Environmental Impact Assessment

Comprehensive Development and Wetland Protection Near Yau Mei San Tsuen (Final Report) (Volume 1 – Text and Figures)

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Environmental Impact Assessment
Comprehensive Development and Wetland Protection
Near Yau Mei San Tsuen
(Final Report)

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1. INTRODUCTION

1.1 Background

The Project Proponent, Asia King Development Limited, is the registered owner of a development site near Yau Mai San Tsuen in Yuen Long.

ENVIRON Hong Kong Limited (ENVIRON) has been commissioned by the Project Proponent to undertake an Environmental Impact Assessment (EIA) for the Project. A project profile (EIA reference: PP345/2008) was submitted to EPD on 20 February 2008. Pursuant to section 5(7)(a) of the Environmental Impact Assessment Ordinance (EIAO), EPD issued a EIA study brief (Ref: ESB-182/2008) on 28 March 2008 for the Project titled "Comprehensive Development and Wetland Protection near Yau Mei San Tsuen".

ENVIRON has conducted this EIA Study in association with consultants of various disciplines including:

- Planning – Kenneth To & Associates Limited
- Architectural – Handi Design Limited
- Ecological – Asia Ecological Consultants Limited
- Landscape and Visual – Urbis Limited
- Engineering – AECOM Asia Company Limited

1.2 The Project Location

The Project Site covers Lot Nos. 3054 BRP and 3055 in DD 104 near Yau Mei San Tsuen, Mai Po, Yuen Long, with a total area of about 8.1 ha. Figure 1-1 shows the site location. Both Lot 3054 S.A RP and 3200 RP in D.D. 104 are fronting directly on Yau Pok Road and under "Recreation" ("REC") zoning. While these lots can be accessed from both east and west through the Project Site (zoned "OU") and the "REC" zone, they will not be landlocked by the proposed development at the Project Site in "OU" zone. The two lots shall be part of the future development in "REC" zone.

The Project Site is primarily farmland abutting the Yau Pok Road near Kam Pok Road. It is located at the periphery of the Deep Bay area and is bounded by a number of existing and planned residential developments adjacent to the Castle Peak Road and the San Tin Highway.

Under the Approved Mai Po and Fairview Park Outline Zoning Plan (OZP) No. S/YL-MP/6, the Project Area is zoned "Other Specified Uses" annotated "Comprehensive Development and Wetland Protection Area" (i.e. "OU(CDWPA)") [1]. The planning intention of the "OU(CDWPA)" zone is to allow the consideration of comprehensive low-density residential development or redevelopment provided that all the existing continuous and contiguous fish

[1] As explained in the Explanatory Statement of the OZP, the objective of the OZP is to indicate a broad land-use zoning and to illustrate the broad principles of development and control only. The OZP is a small-scale plan and the boundaries between land-use zones may be subject to minor adjustments as detailed planning proceeds. In a further objection hearing dated 10 December 1999, the Town Planning Board agreed to rezoned Lot Nos. 3054 BRP and 3055 in DD 104 to "Other Specified Uses" annotated "Comprehensive Development and Wetland Protection Area" (OU(CDWPA)) to meet Objection No. 7 to Draft Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/1. It is therefore the zoning of the Project Area (Lot Nos. 3054 BRP and 3055 in DD104) shall be OU(CDWPA).

ponds within the zone are protected and conserved. The “no-net-loss in wetland’ principle is adopted for any change in use within the zone. Development or redevelopment within this zone should involve no pond filling and no decline in wetland function of the fish ponds. Any new development should be located on the formed land and as far away from the existing fish pond within the development site.

According to the Town Planning Board Guidelines, TPB PG-No. 12C “Application for Developments within Deep Bay Area under Section 16 of the Town Planning Ordinance”, any development in the Deep Bay Area should be based on a “precautionary approach” and a principle of “no-net-loss of wetland” so as to conserve the ecological value of the wetland, while proposals for residential/recreational developments on degraded sites to remove/replace existing open storage or container back-up uses and/or to restore lost wetlands may be given sympathetic consideration by the Town Planning Board subject to satisfactory ecological and other impact assessment (only within the Wetland Buffer Area (WBA)) within the Deep Bay Area.

According to Figure A of the TPB PG-No. 12C, the northern portion of the Project Area falls within the Wetland Conservation Area (WCA) while the remaining portion falls within the Wetland Buffer Area (WBA).

1.3 Project Description

The Project Site occupies a total area of about 8.1 ha. The Project is to transform the Project Site into an area principally made up of wetland protection supported by a sub-urban settlement by the enhancement/ restoration of existing disused ponds within a portion of the Project Site.

The proposed development has been designed such that it can satisfy the “no net loss in wetland” principle as well as “no net increase in pollution loading” requirement in Deep Bay as stipulated in TPB PG-No.12C.

The proposed development is divided into two portions. The northern portion comprises a wetland restoration area (WRA) within the WCA. While, the southern portion comprises a sub-urban settlement in the form of low-rise residential development with a total domestic GFA of not more than 16,200 m^2 , which is entirely within the WBA. The developable area of the proposed houses will be raised from the existing average level of about +2 mPD to a proposed level ranged from +5.5 mPD to +6.5mpD (with an average level of about +5.5mPD). The formation levels of the proposed development along the Ngau Tam Mei Drainage Channel (NTMDC) are designed with reference to the hydraulic model results. Sufficient freeboard under 1 in 50 year scenario is allowed for protection. The banks of the NTMDC around the project site is about +5.1mPD and hence the minimum formation levels of the development is proposed as +5.5mPD.

According to the latest schedule, the Project is intended to be completed for occupation by Year 2018. The proposed development mainly includes construction of 70 nos. of 3-storey houses, club house, swimming pool, site drainage system and ancillary facilities within the developable area, as well as a wetland restoration area of about 3.8 ha within the WCA. An interim sewage treatment plants (STP) is also proposed for temporary use in case connection to the planned public sewerage system is not available at the time of occupation.

The proposed development layout is shown in **Figure 2-10**, while the proposed elements of this Project are also depicted in **Figure 11-22**.

1.4 EIAO and Designated Projects

According to Item P of Part 1, Schedule 2 of the EIAO, the Project is a classified a "Designated Project" since it is a residential development other than New Territories exempted house within the Deep Bay Buffer Zone 2.

1.5 Continuous Public Involvement

Continuous public involvement (CPI) is one of the initiatives incorporated in the EIA process for engaging the public. CPI involves dialogue with local green groups and local residents in parallel with the EIA process in soliciting their views and opinions on the Project.

Two stages of consultations have been held with local green groups in mid-2008 and late 2008/ early 2009. In the first round of consultations, a meeting was held with green group. Some of them have provided their written comments on the Project while others advised that they had no comment on the Project at that stage. The major issues raised by the green groups included the methodology for determining target species for the proposed restored wetland, design, habitat diversity, management and sustainability of the proposed wetland, the design of wetland buffers, and compatibility of proposed low density residential development with the proposed wetland and the wider Deep Bay wetland area.

Continuous efforts were made to conduct CPI exercises with local residents, including those of the Fairview Park, Palm Springs, Royal Palms and the Yau Mei San Tsuen during the course of this EIA. Meetings with representatives of Yau Mei San Tsuen and residents of Royal Palms were held on 29 December 2008 and 6 March 2009 respectively. However, management groups of Fairview Park and Palm Springs advised that they were not ready to provide any comments on the Project at this stage.

All opinions collected during the CPI were taken into account, both in the formulation of development options and selection of the preferred option. Please also refer to Sections 2.5 to 2.7 as well as sections 8.11.1.1 and 11.2 for the layout options that have been considered, enhanced, and evaluated by taking into account the CPI results.

1.6 Scope

The scope of the EIA study covers the Project and its potential environmental impacts. The EIA addresses key issues listed below:

- Noise impacts arising from construction and operation of the Project to nearby village areas;
- Dust impact arising from construction of the Project to nearby air sensitive receivers (ASRs) and odour impact from existing and planned sewage treatment plants to the development and nearby ASRs;
- Landscape and visual impacts during construction and operation of the Project;
- The potential water quality impacts caused by site formation, pond draining, drainage diversion, and any other works activities during construction, the potential water quality impacts caused by operation of the Project;
- Potential impacts on historical buildings/ architectures and monuments;
- Direct and indirect terrestrial and aquatic ecological impacts, in particular the potential impacts of disturbance and fragmentation to the recognized sites of conservation importance in the vicinity including, for example, the Mai Po Nature Reserve, Mai Po Inner Deep Bay Ramsar Site, Mai Po Village Site of Special Scientific Interest (SSSI),

Mai Po Marshes SSSI, Wetland conservation Area (WCA) and Wetland Buffer Area (WBA) and important habitats such as fish ponds, egretries, due to construction and operation of the Project;

- Fisheries impacts during construction and operation of the Project;
- Collection and disposal of potentially contaminated dredged spoil arising from the Project;
- The short-term and long-term maintenance and management of the proposed mitigation wetland within the Project Area.

1.7 Objectives of the EIA Study

The objectives of the EIA study are:

- to describe the Project and associated works together with the requirements for carrying out the Project;
- to identify and describe elements of community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including both the natural and man-made environment;
- to identify and quantify all environmental sensitive receivers, emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
- to identify and quantify any potential losses or damage to flora, fauna and wildlife habitats;
- to identify any negative impacts on sites of cultural heritage and to propose measures to mitigate these impacts;
- to identify and quantify any potential landscape and visual impacts and to propose measures to mitigate these impacts;
- to propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
- to identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;
- to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and reducing them to acceptable levels;
- to investigate the extent of secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA study, as well as the provision of any necessary modification;
- to identity, within the study area, any individual project(s) that fall under Schedule 2 and/or Schedule 3 of the EIA Ordinance; to ascertain whether the findings of this EIA study have adequately addressed the environmental impacts of those projects; and

where necessary, to identify the outstanding issues that need to be addressed in any further detailed EIA study; and

- to design and specify the environmental monitoring and audit requirements, if required, to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted.

1.8 Programme

Appendix 1-1 presents the implementation programme. According to the programme, the construction works are scheduled to commence in the third quarter 2015 and for completion in later 2018. This timeline couples with the current plan of public sewer provision for the area. Major construction works will be scheduled to avoid ecological peak season to minimize disturbance.

1.9 Major Concurrent Projects

A number of development projects are known to be implemented near the Project Site. They include the followings:

- Yuen Long and Kam Tin Sewerage and Sewage Disposal under PWP Item 4235DS (EIA Application No. EIA-094/2004);
- Construction of Cycle Tracks and the associated Supporting Facilities from Sha Po Tsuen to Shek Sheung River (EIA Application No. EIA 159/2008);
- Proposed Residential Development within "Residential (Group D)" zone at various lots in DD 104, Yuen Long, N.T. (Study Brief No. ESB - 204/2009) (hereinafter referred to as the "RD Site");
- Proposed Low-rise and Low-density Residential Development at Various Lots and their Adjoining Government Land in D.D. 104, East of Kam Pok Road, Mai Po, Yuen Long, N.T. (Study Brief No. ESB - 210/2009) (hereinafter referred to as the "Kam Pok Road Site"); and
- Proposed Residential cum Passive Recreational Development within REC Zone and R(C) Zone at Various Lots in DD104, Yuen Long (Study Brief No. ESB -207/2009) (EIA Application No. EIA-220/2014) (hereinafter referred to as the "REC Site").

The locations of the above-mentioned development projects are also shown in **Figure 1-2**, including the alignment of section of proposed public sewerage and the proposed cycle track alignment near the Project Site. The works programme for the Project Site may overlap with that for the above projects.

With regards to the above, the first two projects are government projects which have already obtained approval on their EIA reports under the EIAO process. The public sewerage project near Ngau Tam Mei Channel concerns the construction of a section of gravity trunk sewer underneath Kam Pok Road and Yau Pok Road as well as construction of proposed Ngau Tam Mei Sewage Pumping Station (NTMSPS) near the road junction between Kam Pok Road and Castle Peak Road. According to the approved EIA report of this project, the construction would commence in 2005 for completion by end of 2007. There is currently no fixed construction programme for this public sewerage project.

For the section of proposed cycle track Project, a section of the cycle track will be constructed between Yau Pok Road and the Project Site. According to the approved EIA

report, the construction of the cycle track would commence in mid-2009 for completion by early 2012. Currently, there is no fixed construction programme for this cycle track project.

As the above 2 projects have already obtained EIA approval, overlapping of their works programme with that of this Project cannot be precluded at this stage, and hence they are considered in this EIA study.

For the last three private residential development projects, all of them will need to obtain EIA approval. Development programme in the respective Project profile of these planned projects is outdated and there is no committed development programme available (except the "REC Site", its EIA report has recently been approved"). However, for the "Kam Pok Road Site" and "RD Site" projects planning applications were previously approved for these projects under the Town Planning Ordinance. Based on the current best available information, the construction of the planned "RD Site" will commence in year 2016 for completion in year 2019 (it is also understood from the project proponent of that project that the construction works of that project may be further delayed), while the construction of the planned "Kam Pok Road Site" will commence in 2016 for completion in year 2017.

For the planned "REC" Site, as mentioned above, an EIA report of that project has been approved recently. Construction of that project will be in year 2017 for completion in year 2020. Project works of this Project may potentially overlap in terms of time with the said private residential projects. Thus these projects are considered in the cumulative impact assessment.

1.10 Structure of the EIA Report

The EIA presents the findings of the Study and contains the following sections which demonstrate that the criteria in relevant sections of the Technical Memorandum (TM) on the Environmental Impact Assessment Process of the EIAO are complied with:

- Section 1 (this section) provides an introduction to the Study;
- Section 2 presents the background and the need for this Study. It also describes the consideration of possible development options, construction methods and sequence of works for the Project;
- Section 3 provides information of the air quality impact assessment;
- Section 4 describes the potential noise impact during construction and operation of the Project and recommends the mitigation measures;
- Section 5 presents the water quality impact assessment;
- Section 6 presents the sewerage and sewage treatment implications;
- Section 7 presents the waste management implications;
- Section 8 presents the ecological impact assessment. It contains the findings of the baseline survey and the identification of appropriate mitigation measures to avoid, minimize and compensate for ecological impacts. A wetland restoration plan is also appended;
- Section 9 presents the fisheries impact assessment;
- Section 10 presents considerations of cultural heritage;
- Section 11 presents the landscape and visual impact assessment;

- Section 12 is the summary of environmental outcomes; and
- Section 13 presents the conclusions of the Study

2. CONSIDERATION OF ALTERNATIVES

2.1 Summary

This Chapter explains the need for the Project and documents the evolution and selection of development options. The need for the Project and relevant background information are explained in order to set out the guiding framework for the Project. Later sections of the Chapter describe the evaluation process for the options considered and derivation of the recommended option for further assessment. This Chapter responds directly to Sections 3.3, 3.4, 3.5 & 3.6 of the Study Brief.

2.2 Background

2.2.1 The Project Area

The Project Area covers Lot Nos. 3054 BRP and 3055 in DD 104 near Yau Mei San Tsuen, Mai Po, Yuen Long, and has a total area of about 8.1 ha. It is located to the southeast of the Mai Po Inner Deep Bay Ramsar Site but sandwiched between several suburban residential communities including Palm Springs to the north, Yau Mei San Tsuen and Royal Palms to the east and Fairview Park to the west as shown in Figure 1-1.

A 40m wide open drainage channel and associated roads, including Yau Pok Road and Kam Pok Road, (DSD Contract PWP No. 7100CD: Main drainage channel for Ngau Tam Mei Phase 1 - Yau Mei San Tsuen to Tai Sang Wai section) are located to the immediate south of the Project area. Further south across the drainage channel and the said local roads are residential zones (including “R(D)” and “V” zones) with existing and approved house developments. Major roads, including the San Tin Highway and Castle Peak Road lie further east of the Project area. In general, the locality of the Project area is primarily sub-urban residential in nature. The Project area is well connected with adjacent major roads by local roads along the drainage channel.

2.2.2 History of the Project Area

Back in the 1950s, apart from two ponds to the northeast of the Project area, the majority of which are brackish rice paddies. During the 1970s, when freshwater fish farming prospered in the New Territories, the brackish rice paddies were converted into fish ponds. Subsequently, some of the ponds were turned into farmland. In the late 1980s, the northern part of the Project area was mainly fish ponds with a majority of the southern part was farmland.

Following the improved accessibility of the northwest New Territories, some of the fish ponds, paddy fields and farmland in the area were converted to low density residential development or open storage sites. In order to prevent much of area from turning into open storage ground and hence undergoing further environmental degradation, the Mai Po & Fairview Park Interim Development Permission Area Plan No. IDPA/YL-MP/1 (the IDPA Plan) was Gazetted on 17 August 1990. Under the IDPA Plan, the Project Area was zoned “Unspecified Use”, under which existing uses at that time and “agricultural use” were always permitted.

On 3 June 1994, the Town Planning Board (TPB) gazetted the first Outline Zoning Plan, the Draft Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/1 (the first OZP), for the area and in this first OZP the Project Area was zoned for “Recreation” use. Under the notes for “Recreation” zone, agriculture use was always permitted and development in the zone was restricted to a maximum plot ratio of 0.2, site coverage of 20% and maximum building height of 2-storey (6 m). An objection was lodged against this zoning. During the preliminary consideration of the objection, the TPB considered that the fish ponds in the

northern part of the Project area, which formed part of the contiguous and continuous fish ponds of the Deep Bay wetland ecosystem, should be preserved. In a further objection hearing dated 10 December 1999, the TPB accepted a low density residential development proposal in the Project Area which allowed the long term conservation of the contiguous and continuous fish ponds in the Project area. Therefore the TPB subsequently rezoned the concerned objection lots (the Project area) into "Other Specified Uses" annotated "Comprehensive Development and Wetland Protection Area" (OU(CDWPA)) to meet the objection.

2.2.3 Statutory Planning Intention for the Project Area

Statutory zoning prescribes legitimate use of an area. The Project Area is zoned "Other Specified Uses" annotated "Comprehensive Development and Wetland Protection Area" (OU(CDWPA)) on the Approved Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/6 (the OZP). According to the Statutory Notes of the OZP, the planning intention of the OU(CDWPA) zone is as follows:

"This zone is to allow the consideration of comprehensive low-density residential development or redevelopment provided that all the existing continuous and contiguous fish ponds within the zone are protected and conserved. The "no-net-loss in wetland" principle is adopted for any change in use within the zone. Development or redevelopment within this zone should involve no pond filling and no decline in wetland function of the fish ponds. Any new development should be located on the formed land and as far away from the existing fish pond within the development site."

It is specified in the Statutory Notes that development or redevelopment shall not result in total development intensity in excess of a maximum plot ratio 0.2 and a maximum building height of 3 storeys including car park within the zone.

2.2.4 Conservation Objectives of the Deep Bay Area

The TPB made the first attempt to protect the Inner Deep Bay Area and the Mai Po Marshes Nature Reserve (MPNR) from development by delineating Buffer Zones 1 and 2 in 1992. In September 1995, Mai Po Inner Deep Bay Ramsar site was listed under The Convention on Wetlands of International Importance (commonly known as Ramsar Convention) as a wetland of international importance, especially as a waterfowl habitat. The Study on Ecological Value of Fish ponds in Deep Bay Area (Fish Pond Study) (Aspinwall, 1997) arrived at the conclusion that the fish pond system is fundamentally linked with Mai Po as a wildlife habitat and that a loss of fish pond area would significantly affect the waterfowl, thus the continuous and adjoining fish ponds should be conserved.

The TPB Guidelines for Application for Developments within Deep Bay Area under Section 16 of the Town Planning Ordinance (TPB PG-No. 12C or "the Guidelines" hereafter) has taken on board the recommendations of the Fish Pond Study and set out the precautionary approach to conserve the ecological value of fish ponds and the principle of "no-net-loss in wetland", both targeting the protection and conservation of the existing ecological functions of fish ponds in order to maintain the ecological integrity of the Deep Bay wetland system as a whole. The Guidelines designated the Wetland Conservation Area (WCA) for all existing continuous and adjoining active/abandoned fish ponds and the Wetland Buffer Area (WBA) to protect the ecological integrity of the WCA. Within the WCA, while the primary planning intention is to conserve the ecological value of fish ponds, "limited low-density private residential/recreational development at the landward fringe of the WCA in exchange for committed long-term conservation and management of the remaining ponds within the development site" may be considered by the Town Planning Board under a "private-public partnership approach", "if there are strong planning justifications and positive measures to enhance the ecological functions of the existing fish ponds". For the WBA, "proposals for residential/recreational developments on degraded sites to remove/replace existing open

storage or container back-up uses and/or to restore lost wetlands may be given sympathetic consideration by the Board (Town Planning Board refers) subject to satisfactory ecological and other impact assessments.

2.3 Site Context

2.3.1 Existing Condition of the Project area

The Project area is located amongst various residential uses namely the Fairview Park, Palm Springs, Royal Palms and the Yau Mei San Tsuen. The northern portion of the Project Site (i.e. WRA) is contained within the WCA (roughly sub-areas numbered 8, 9, 17, 18 and A3 as shown in Figure 8-4 while the remaining part of the Project Site (i.e. residential area within the southern portion) falls within the WBA boundary.

Ponds within the WCA portion of the Project area included inactive fish ponds (7, 8 & 18), and ponds which have undergone vegetative succession into marsh (9) as well as drained ponds (A3 and 17) which are being used as farmland. There is also an isolated reedbed (Area 40) within the WBA, many ponds within the Project area have become degraded in function and habitat quality due to their small size, lack of management and remoteness from the main wetland system in the Deep Bay area, and several of the ponds are in a relatively advanced stage of natural ecological succession to non-wetland habitats. The majority of the Project Area is currently used as farmland of low to moderate ecological value.

The Project area supports moderate bird species diversity. Most of these species are common and widespread species of anthropogenic habitats in Hong Kong (Carey *et al*. 2001) but 15 bird species of conservation importance were recorded during field surveys The overall abundance of bird species of conservation importance was low relative to that in the continuous and contiguous pond system in the Deep Bay area. Agricultural land at the Project area also supported a moderate abundance of amphibians, but the species involved are common and widespread in lowlands of Hong Kong.

2.3.2 Existing Condition of the Surrounding Area

The Project area is located to the southwest of the Royal Palms and Palm Springs, and to the east of the Fairview Park. The Mai Po Inner Deep Bay Ramsar Site as well as the contiguous and continuous fish ponds of the Deep Bay Area is linked to the Project area by an area of fish ponds in the northwest.

On the north eastern boundary of the Project area, there is an area of wetland (fish ponds and marsh/reed bed) zoned “Conservation Area” (CA) and “Recreation” (REC) in the Outline Zoning Plan which separates the Project area from the Royal Palms and the Yau Mei San Tsuen. Part of this wetland area is included within the WCA and is connected with the fish ponds and marsh within the Project area and those in the continuous and contiguous Deep Bay wetland system. Abutting the Project area in the southeast is the proposed cycle path and the Ngau Tam Mei Drainage Channel.

Adjacent low-rise residential developments, including the Fairview Park, Palm Springs and Royal Palms, are all gated communities of 0.4 plot ratio, and predominantly two to three storeys high, while the Yau Mei San Tsuen mainly consists of one to two storey simple/ temporary rural structures. These are the nearest sensitive receivers for developments in the Project Area.

2.4 The Need for this Project

The need for the Project is grounded on the TPB’s decision to zone the Project Area as OU(CDWPA) and the **ongoing degraded and deteriorating wetland function of the**

Project Area, in particular the abandoned fish ponds in the WCA. The existing ponds within the WCA have experienced gradual change to habitats with limited or no wetland function (Pond 17 and A3 were drained and changed into farmland, with little or no pond filling), or ecological function has deteriorated (abandoned Pond 9 has been abandoned and colonized largely by exotic invasive species such as *Typha angustifolia* and *Brachiaria mutica*). Restricted by their relatively small size and low economic value, the existing ponds (Ponds 7, 8 and 18) could see change in land use to farmland (as was the case for Pond 17) in the future.

Without active management of the hydrology and vegetation control, the ponds will experience invasion by, mostly exotic and weedy, herbaceous vegetation through natural succession and, ultimately, transition to non-wetland habitats such as grassland and shrubland. The cumulative deterioration of ecological function and habitat quality could indirectly **influence the quality of adjacent wetlands connected with the Deep Bay area**.

The planning intention of the "OU(CDWPA)" zoning is to allow the consideration of comprehensive low-density residential development or redevelopment provided that all the existing continuous and contiguous fish ponds within the zone are protected and conserved. The "no-net-loss in wetland" principle is adopted for any change in use within the zone. This Project adheres to the statutory planning intention, and proposed compatible low density residential development on the formed land in the southern portion of the Project area. This would provide the **incentives and necessary resources to achieve the long term conservation** of continuous and contiguous fish ponds in the northern portion of the Project Area. This restricted development pattern satisfies the conservation objectives in Deep Bay Area and the core Mai Po Nature Reserve in particular and hence the conservation of the wetland habitat for waterfowl of regional and international importance.

While the planning intention for the WCA is the protection of contiguous and continuous fish ponds as an element of the entire Deep Bay Area wetland system, some of the ponds have been lost in the last decade. Positive conservation measures are required to enhance the ecological function of remaining contiguous and continuous fish ponds and to conserve the overall configuration of the adjacent linked Deep Bay wetland system. As stipulated in the statutory planning intention for the Project Area, a compatible, low density development should be considered as the mechanism for the provision of resources for conservation initiatives.

Reference has also been made to the "precautionary approach" and "no-net-loss in wetland" principles outlined in TPB PG-No. 12C in that the ecological impacts of the proposed conservation and development scheme to the Project Area and its surrounding area should be thoroughly assessed under the ecological impact assessment and relevant technical assessments. Ecological considerations have always been given the priority in the evaluation and assessment process of this Project.

2.4.1 Purpose and Objectives of the Project

The purposes and objectives of the Project are derived directly from the planning intention for the Project Area as stated in the statutory notes of the OU(CDWPA) zone on the Outline Zoning Plan quoted above and from TPB PG-No. 12C mentioned above. The specific purposes and objectives for the Project are to:

- Conduct year round ecological survey to establish the existing ecological baseline and to guide the formation of proposed conservation scheme and development plan.
- Provide a wetland conservation scheme aiming to protect and conserve all contiguous and continuous fish ponds in the Project Area and to enhance their ecological value over the existing condition with respect to surrounding habitats.

- Provide an ecologically sensitive residential development to sustain the conservation objectives of the zoning.

- Avoid, minimize and compensate potential environmental impacts brought about by the Project.

2.5 Consideration of Alternatives

2.5.1 Introduction

The EIA Study Brief requires the consideration of alternative layout options with justifications and evaluations for these alternatives. The comparison of environmental merits and demerits of each alternative layout option and the selection process for the preferred option also needs to be documented. The preferred option should avoid and minimize adverse environmental impact to the maximum extent. When considering the alternative layout options, we have taken into account the relevant requirements under the OU(CDWPA) zone in the OZP including locating the development on the formed land and as far away from existing contiguous and continuous fish ponds as possible and the protection and conservation of all the existing contiguous and continuous fish ponds so as to avoid and minimize the potential ecological impacts and human disturbance to the WCA and the surrounding ecologically sensitive areas.

2.5.2 Development Principles for Formulation of Alternatives

Having considered the unique geographical character, history, statutory and non-statutory planning framework of the Project Area and also relevant development and design considerations, a list of development principles have been formulated to guide the derivation and evaluation of alternative layout options. It is important to note that some of the development principles apply to all options, and do not provide differentiation between alternatives layout options.

2.5.2.1 Precautionary Approach

The Precautionary Approach to conserve the ecological value of fish pond was first recommended by the abovementioned Fish Pond Study and then later incorporated into the TPB PG-No. 12C. The Fish Pond Study has established that higher bird usage was observed in contiguous fish ponds and that developments resulting in the loss of fish ponds would reduce the food sources available to waterfowl. In view of the intrinsic high ecological value and importance of continuous and contiguous fish ponds to waterfowl, especially ardeids, the existing ecological functions of fish ponds should be protected and conserved to maintain the ecological integrity and contiguity of the Deep Bay wetland ecosystem as a whole. The Project should undertake Ecological Impact Assessment to demonstrate that there will be no decline of ecological function of existing fish ponds both in the Project Area and the adjacent fish ponds. Furthermore, as fish ponds and marsh within the Project Area are in close proximity to the wetlands in the CA and REC zones to the north-east, conservation of the existing fish ponds, marsh and any former farm land within the WCA is considered in highly beneficial in minimizing any potential decline of ecological function and providing buffering to the wetlands in the CA and REC zones.

2.5.2.2 "No-Net-Loss in Wetland" Principle

The "No-Net-Loss in Wetland" Principle is also documented in TPB PG-No. 12C for guiding development proposals in Deep Bay Area. As stipulated in the Guidelines, the principle can refer to "both loss in 'area' and 'function'". Development proposals should not result in the loss of ecological functions of original ponds and should complement the ecological functions of the wetlands and fish ponds in the Project Area as well as the Deep Bay area. The year-round ecological survey has established a baseline for existing wetland area,

condition and ecological function. The survey has determined that, as of 2008, approximately 3.0 ha is classified as wetland (ponds, marsh and seasonally wet grassland) and has established a baseline in respect of wetland habitats and fauna utilisation which constitutes the minimum ecological function which must be satisfied by the development options.

2.5.2.3 Avoidance, Minimisation and Compensation Principles

In considering potential environmental and ecological impacts to be brought by the Project, according to Technical Memorandum of the Environmental Impact Assessment Ordinance, the avoidance, minimisation and compensation principles should be followed in that order. In particular, potential disturbance to the adjacent recognised sites of conservation importance and important habitats during the construction and operation phases of the Project should be avoided. Where avoidance is not possible, then minimisation and compensation of potential impacts to acceptable levels is required.

2.5.2.4 Protection and Conservation of All Existing Contiguous and Continuous Fish Ponds

The protection and conservation of all existing contiguous and continuous fish ponds is one of the requirements laid down in the OZP No. S/YL-MP/6. The contiguous and continuous fish ponds are part of the Deep Bay Wetland ecosystem extending from the Mai Po Ramsar Site. All existing contiguous and continuous fish ponds in the Project Area should be preserved and covered by a long term wetland management and enhancement plan (**Appendix 8-10** of this EIA refers, which is subject to further discussion and approval from relevant government departments in the detailed design stage).

2.5.2.5 Ecologically Sensitive Low-Density Residential Development in Harmony with Conservation

In accordance with the planning intention of allowing compatible residential development in support of conservation objectives, the Notes for the OU(CDWPA) zone of the OZP No. S/YL-MP/6 allow in the Project Area a residential development with a maximum development intensity of plot ratio of 0.2 and maximum building height of 3-storey including car parking, provided that all the existing contiguous and continuous fish ponds are protected and conserved. The Project Area has an area of about 81,000 m^2, and therefore the total developable gross floor area for the Project Area will be around 16,200 m^2. Such development parameters would form the basis for the generation of the building layout.

2.5.2.6 Residential Development Restricted to Wetland Buffer Area

Part of the Project Area is located within the WCA while part of it is in the WBA as identified in TPB PG-No. 12C. To respect the conservation intention, the WCA portion (around 2.9 ha) of the Project Area would be set aside solely for conservation purposes. Following the intention of WBA of allowing low-density residential development in support of conservation purposes, a low-density (much lower residential density than the surrounding area) residential development would be considered in the WBA portion of the Project Area. The design of the residential development will also be much more ecologically empathetic when compared with the surrounding existing development.

2.5.2.7 The Wetland Conservation and Restoration Design of the Project Area Should Not be a Closed System

While the wetland conservation and restoration plan would, in general, be based on the enhancement of existing wetland habitats to ensure that there are no adverse impacts on species, particularly those of conservation importance, found within or near the Project Area in the ecological baseline survey, the overriding conservation objectives for the whole Deep

Bay wetland area for waterfowl should not be overlooked. The conserved or restored wetland of the Project Area should form an integral part of the Deep Bay wetland ecosystem and be designed as part of the contiguous and continuous wetland of the Deep Bay area for conserving waterfowl of regional and international importance.

2.5.2.8 Offsite Abutting Wetlands in the Adjacent Wetland Conservation Area on the East

The ponds/wetlands immediately adjacent to the eastern boundary of the Project Area fall within the WCA zone and are also part of the contiguous and continuous fish ponds of the Deep Bay area. The wetland conservation and restoration design and the development scheme should observe the ecological functions of these ponds/wetlands and avoid, minimize and mitigate potential impacts of the Project.

2.5.2.9 Ecological Connectivity to Wetlands on the Southwest

During the Continuous Public Involvement Process, a green group recommended that an ecological linkage for mammals and amphibians should be provided to connect the wetlands on the southwest of the Project Area to the Deep Bay wetland system. The ecological linkage could be in the form of a landscaped corridor that also serves a visual buffering function.

2.5.2.10 Buffers between Wetland and Development

Though low density residential use is not, in general, considered an undesirable or disturbing use, buffer would still be required at the interface between the wetlands and the development to minimize potential human disturbance to the wetland and vice versa. The buffer may be in the form of wetland habitats used by relatively disturbance-tolerant fauna, such as reed bed and marsh, or screen planting, landscape strips, building set back etc, so that the environment of the development will be habitat compatible.

2.5.2.11 Development on Formed Land and away from Existing Fish Ponds and No Pond Filling

The statutory zoning of the Project Area specifies the requirement that any new development should be located on formed land and away from existing fish ponds in the Project Area. Existing contiguous and continuous fish ponds within the WCA are found in the north and north-western part of the Project Area whereas a detached pond is found in the south-eastern corner of the Project Area. The planning intention for the statutory zoning plan also states that the development should involve no pond filling.

2.5.2.12 Minimising Alternation to Existing Physical Configuration

Despite the change of use in the past of some parts of the Project Area from paddies to ponds and then to agricultural land, the physical landform, i.e. the configuration of the bunds, mostly remains unchanged. This physical configuration is one of the characters of the Project Area. The future design of the wetland and development scheme should take the existing physical landform into account and minimize alternation to such landform if possible.

2.5.2.13 Minimising Potential Visual Impact to Neighbouring Residential Development

While proposed development on the Project Area is low-rise in nature, residents of Royal Palms raised their concern in the CPI meeting that development on the Project Area may still affect the quality of views of some residents facing directly to the Project Area. The Project should adopt a visually sensitive development layout, as well as façade and boundary

treatment with appropriate mitigation measures to minimize any potential visual impacts to neighbouring residents.

2.5.2.14 Compatible with Future Cycling Track along Yau Pok Road

The Government recently announced a proposed project for cycle tracks connecting North West New Territories with North East New Territories forming a continuous cycling system.

2.6 Alternative Layout Options

The evaluation of Alternative Layout Options starts from the basic. The implications of the two possible scenarios: "Without the Project" and "With the Project" will be discussed at the upfront. Under the "With the Project" scenario, alternative layout options are generated, compared and assessed for recommending a preferred layout option for further refinement and conducting detailed assessment. The process followed for the consideration of alternative layout options is illustrated in Figure 2-2.

2.6.1 Scenario 1: Without the Project

Without the Project Scenario assumes that no development will take place in the Project Area which also implies there will be no resources for positive conservation intervention and the undertaking of any long term management plan. Yet, "no development" does not necessary mean the Project Area will maintain as status quo. Within the Project Area, existing farmland may evolve following market forces for intensification or abandonment while existing wetland will continue to experience natural succession, ultimately to non-wetland habitats. According to the ecological survey, there are around 3.0 ha of wetland habitats (ponds, marsh and seasonally wet grassland) in the Project Area as at 2008.

Though the "Agricultural Use (Fish Pond Culture only)" is the only 'always permitted' use under the prevailing OU(CDWPA) zoning, the zoning provides no control on the uses in the Project Area that existed before its gazettal. In particular before the gazettal of the OU(CDWPA) zoning for the Project Area, agricultural use was always permitted as of right under the then OZPs. This implies that all of the farmlands in operation in the WBA before 6 April 2001 could continue under the terms of the statutory planning controls. In this case, any wet fields (including active or inactive fields) could be drained and converted into active dry agriculture with low ecological wetland value. Potential runoff of chemical fertilizers or pesticides from active agricultural land may also affect the ecology of the Deep Bay wetland area.

As discussed in Section 2.3.1, the Project Site is used as farmland of low to moderate ecological value, while ponds within the WCA portion of the Project Site have undergone vegetative succession and become degraded in function and habitat quality due to lack of management. Based on information by the farmers on-site, water from the existing Ngau Tam Mei Channel has been used as irrigation water by the farmers. However, with the inflatable dam at the downstream end of Ngau Tam Mei Drainage Channel (NTMDC) damaged since year 2009, the water quality at the NTMDC has been affected due to the tidal condition of the channel. The farmers claimed that the fresh/ salty water at the NTMDC is not suitable as irrigation water for commercial farming. According to the baseline water quality survey of this Project conducted between September 2012 and January 2013 (Appendix 5-1 refers), trace of salty water was found with the measured salinity level of water at the NTMDC ranged from 0.2 g/L to 11.4 g/L (as compared to reported depth-average salinity value from 17.5 to 22.5 at marine water in Deep Bay[2]). The salinity level

2 Based on the range of reported depth-averaged salinity values at inner Deep Bay monitoring stations in year 2009, Appendix B-1, Marine Water Quality in Hong Kong 2009, HKSAR Government Environmental

recorded at the NTMDC indicates that the channel is affected by the tidal condition. There may be continuing degradation of farmland due to the lack of water source for farming activities.

The statutory planning control of OU(CDWPA) outlines the conservation intention of the Project Area and prevents further intentional land use changes which may degrade the ecological value of the Project Area. However it does not guarantee positive conservation efforts would be implemented or its prevention from environmental degradation. Within the WCA portion of the Project Area, sub-area no. 9 used to be a fish pond when the TPB PG-No. 12B was drawn up in early 1990s. Yet, fish pond, the most ecologically valuable habitat for the Deep Bay Area, was originally a manmade habitat. Without fish farming and conservation management, it is observed in the habitat survey that sub-area no. 9 has undergone vegetative succession into marsh.

In the long term, natural succession could lead to these becoming terrestrial habitats with reduced ecological value and with little or no benefit to the fauna, especially wetland birds, of the Deep Bay area.

According to information from the TPB records, 11 applications have been submitted to the TPB since 2001 for permission for uses including open storage, parking area, workshops, etc on various OU(CDWRA) zones within Yuen Long; of which 34 applications have been approved (up to 2013). Majority of the approved planning applications were for temporary uses. Under the statutory OZP, submission of a Wetland Restoration Area is not required for applications for temporary uses and therefore will not include any positive conservation effort to the wetland.

Under the statutory OZP, submission of a Wetland Restoration Area is not required for applications for temporary uses. There is no guarantee that the Project Area would be restored to its original condition or that any negative impacts would be mitigated after the interim uses are completed. In theory the potential for such interim uses therefore presents serious environmental risks. If the subject site remains undeveloped, similar kinds of interim uses could be present on site and their associated environmental impacts would reduce the ecological value and further degrade the ecology of the habitats.

In summary, if there were no development, the Project Area may continue to be occupied by farming or other environmental unfriendly interim uses and natural succession of existing wetland habitats may continue. Farming activities within the Project Area may eventually cease due to the unavailability of suitable water source. Since fish pond is in nature a manmade habitat, there is no guarantee that existing continuous and contiguous fish ponds will be protected and conserved without the project under natural succession. With no active management of the site, the ecological value of existing wetland habitats (around 3.0 ha) would also gradually decline and finally lose their wetland ecological function by natural succession. There is no guarantee that existing continuous and contiguous fish ponds will be protected and conserved without the project. Thus the Without the Project Scenario could not guarantee the existing ecological function will be enhanced or maintained and therefore is not favoured from a wetland conservation perspective. Evaluation of this Scenario is compared against other options in Table 2-1. As noted in paragraph 3 of the same section, farming activities is unlikely to be sustainable given the lack of suitable fresh water source, and may eventually cease due to the unavailability of suitable water source.

Protection Department.

2.6.2 Scenario 2: With the Project

Three alternative layout options have been considered to represent different development options. Details of each alternative layout option are presented in paragraphs 2.6.3 to 2.6.5 and these options are evaluated against identified project objectives in section 2.7.

2.6.3 Option A: Sub-urban Layout Option

This layout option considered was to develop the entire Project Area for residential development in a manner similar to the adjacent development at Fairview Park, Palm Springs and Royal Palms to the north and south of the application site. These developments are of a form which could be described as typical suburban development in the North West New Territories. They are typically low-rise houses development with private gardens. Please refer to Figures 2-3 and 2-4 for the master layout plan of this Option.

As per Figure 2-4, 97 2-storey houses will be development in the Project Area attaining the total gross floor area of about 16,200m^2. The residential clubhouse will be located at the northern end of the Project Area while the interim sewage treatment plant is proposed at the south eastern corner.

Despite that the house layout is spacious; most of the open air space will be allocated as private garden or access road. Potential landscaping trees planted along roads and vegetation within the private gardens is usually for ornamental and decorative landscape purposes and are generally of little ecological value.

This form of residential development is fully compatible with the adjacent Fairview Park, Palm Springs and Royal Palms in terms of building height, scale and development character. However, the residential development bisects the elongated CA zone into isolated wetland pockets and fragments the WCA. This is not in line with the current requirements for development in the buffer.

The lack of buffer area between the residential development and the adjacent CA zone was considered undesirable and for not being able to control human disturbance.

As all existing fish ponds and wetland in the Project Area will be filled for development, this sub-urban layout option fails to protect and conserve existing contiguous and continuous fish ponds in the Project Area and it would cause loss in both wetland area and function. This contravenes the planning intention stated in the OZP and relevant guidelines and requirements for development in the Deep Bay Area.

For these reasons a form of typical sub-urban layout similar to the adjacent communities is considered undesirable and this alternative was not recommended. A preliminary evaluation of this alternative layout option is presented in Table 2-1.

2.6.4 Option B: Conformed Layout Option

The statutory OU(CDWPA) zoning in OZP No. S/YL-MP/6 outlines the broad conservation requirement and strategy for the Project Area. The Conformed Layout Option aims to achieve the stated conservation intention, and therefore is developed following the planning intention and development requirements listed under the OU(CDWPA) zone and the TPB Guidelines TPB PG-No. 12C. This Conformed Layout Option is characterised by the following:

- Around 1.8 ha of wetland area would be protected and conserved to achieve the “no-net-loss of wetland” principle.

- Following the intention of WCA, former farm land (around 1.1 ha) falling within the WCA, which have previously been part of the contiguous and continuous fish ponds areas would be restored for conservation management.

- Residential development with ecologically sensitive design would be developed on the remaining ~5.0 ha of formed land within the WBA to provide incentives and resources for long term wetland conservation.

The layout is illustrated in Figures 2-5 and 2-6. The wetland area and development area are clearly differentiated; the northern part of the Project Area would serve as wetland conservation/restoration area while the southern part would be the development area. This layout option involves no pond filling and the proposed low density residential development is located furthest away from Deep Bay Area.

The low density residential developments will have 70 3-storey houses (total gross floor area about 16,200m^2) to be constructed within the development area with vehicular access from Yau Pok Road. The residential clubhouse will be located in the central part. The internal road is designed with an "oval" form to give unique character to the development and row of houses are allocated on both sides of the road. Building footprint is also minimized by having all 3-storey houses which are of a similar height and compatible with the adjacent residential developments. Site level in the development area varies with the central part slight higher to create a varying height profile for the proposed development. There will be no proposed houses fronting directly onto Yau Pok Road to avoid potential visual impacts to the future cycle track and along Yau Pok Road. Based on ecological and environmental considerations, an interim sewerage treatment plant is proposed to be located farthest from the ecologically sensitive wetland of Deep Bay Area at the southwest corner of the Project area to minimize potential adverse impact to the wetland.

This Conformed Layout Option fulfils the conservation intention set by the TPB and the requirements under EIAO by leaving all existing fish ponds intact and restoring WCA portion of the Project Area into wetland. There will be no net loss of wetland area in this layout option. Please refer to Table 2-1 for preliminary evaluation of this alternative layout option.

2.6.5 Option C: Enhanced Layout Option

The Deep Bay Wetland Ecosystem as a whole is protected through both the land use planning framework under the TPO and environmental control mechanism under the EIAO. The Project Area falls within two designated wetland areas namely Wetland Conservation Area (WCA) & Wetland Buffer Area (WBA) and is located inside the Buffer Zone 2.

The planning intention of the WCA is to conserve the ecological value of the fish ponds which form an integral part of the wetland ecosystem in the Deep Bay Area. It comprises the existing and contiguous fish ponds in the Deep Bay Area, which should all be conserved. New development within the WCA would not be allowed unless it is required to support the conservation of the ecological value of the area or the development is an essential infrastructural project with overriding public interest. The intention of the WBA is to protect the ecological integrity of the fish ponds and wetland within the WCA and prevent development that would have a negative off-site disturbance impact on the ecological value of fish ponds.

Under the current land use planning system, preservation of the existing and contiguous fish ponds whether active or abandoned within the WCA is the key planning principle. Implicit from the preservation objectives of wetland conservation is the prevention from fragmentation, degradation and ecological threat within the WCA in order to maintain the ecological integrity of the Deep Bay area wetland ecosystem as a whole. The existing land use planning mechanism of achieving or delivering these long term conservation objectives are through the implementation of 'controlled', "low impact" and "less intrusive" residential or

recreation development with "built-in mitigation measures" in the WBA upon application to the TPB.

The EIAO is a further development control mechanism focusing on the environmental & ecological aspects of impact containment with statutory monitoring power. Residential or recreational uses within Deep Bay Buffer Zones 1 or 2 are the designated projects subject to approval under the EIAO. The proponent of a designated project is required to assess and mitigate all possible adverse environmental impacts arising from the project. In the event of identified ecological impacts following a detailed impact assessment and if avoidance of impact cannot be prevented, mitigation measures will have to be implemented and compensation for loss of ecological functions be provided to ensure that the proposed development will not result in any significant residual impacts.

The Conformed Layout Option mentioned earlier has demonstrated its compliance with the planning intention under the OU(CDWPA) Zone confining development in the formed land and restoring the fish ponds within the WCA. The TPB PG-No. 12C principle of "no net loss of wetland area & function" has also been convincingly achieved through wetland restoration and enhancement. Furthermore, the Conformed Layout Option's wetland mitigation measures accord with the EIAO Study Brief requirements for impact assessment, impact mitigations with no significant residual impacts in relation to the ecological baseline conditions. The Conformed Layout Option despite its zoning and environmental compliance in returning wetland in WCA within the Project Area to functional condition with no less in area, however, does not sufficiently insure or "protect" the adjoining off-site WCA with a suitable condition that can foster better ecological integrity or higher ecological value.

Unlike other wetland development zonings focusing on the compensatory mitigation measures to avoid and minimize adverse environmental effects including restoration such as in the OU(CDWRA) Zone and enhancement such as in the OU(CDWEA) Zone, the unique OU(CDWPA) Zone covering the Project Area though not explicitly stated in the statutory plan and in TPB PG-No. 12C, subtly asks for positive mitigation measures to go beyond the typical “self-sustaining” wetland compensatory mitigation concept and the conventional moderate efforts to meet the minimum regulatory requirements mitigating the adverse impacts only. This Enhanced Layout Option is therefore generated as a result of the above conceptual development. It embraces all conservation objectives of safeguarding the existing continuous and contiguous fish ponds within the development site and proactively establishes a friendlier environment protecting the adjoining off-site WCA ecosystem.

The Enhanced Layout Option, which is developed to satisfy the planning intention of OU(CDWPA) zoning, places emphasis on "Protecting" the WCA as an additional ecological gain through a sustainable land use planning approach. Besides restraining the development to the formed land portion, it proposes the area adjoining the WCA (at area A1 and A2) as design solution space to enlarge the WCA buffer, strengthen the WCA protection capability and to further minimize the potential human disturbance (illustrated in Figure 2-7).

The architectural layout of the Enhanced Layout Option is illustrated in Figure 2-8. There will be 70 3-storey houses attaining total gross floor area of 16,200m^2. The layout of the development is organised in such a way as to maximise greening and to minimize the hard paved area by minimising the internal access road. The proposed houses are allocated on both sides of the road and are situated away from the periphery of the development area to allow extra buffer from the adjacent development and Yau Pok Road. Specific buffer area along the edge of Area 40 is dedicated for embankment planting. The building footprint is minimized by adopted all 3-storey houses and there will be slight variation of site levels (+6.5mPD at the central inland part and +5.5mPD at the periphery) to increase visual interest. With a view to minimize potential visual impacts on the neighbouring Fairview Park residents, the proposed 2-storey club house is placed adjacent to the nearest houses of Fairview Park near the vehicular access road. The interim sewerage treatment plant is

located farthest away from Deep Bay Area in the south eastern corner. A preliminary evaluation of this alternative layout option is summarised in Table 2-1 in the following section.

2.7 Evaluation of Layout Options

The abovementioned alternative layout options, together with the "Without the Project" Scenario are compared and evaluated in Table 2-1 below. The evaluation compares the relative strengths and weaknesses of each option in ecological, planning, visual and landscape, environmental and engineering respects in the context of specific project objectives. As this Project is primarily a conservation project grounded in the statutory planning framework, the emphasis of evaluation is focused on ecological and planning objectives while these are supported by the associated broad-brush impact evaluations in respect of visual and landscape, environmental and engineering aspects.

Table 2-1 Evaluation of Layout Options

	Objectives	**Scenario 1: Without the Project**	**Scenario 2: With the Project**		
			Option A Sub-urban Layout Option	**Option B** Conformed Layout Option	**Option C** Enhanced Layout Option
Ecological	Protect and Conserve Contiguous and Continuous Fish ponds	No positive ecological protection and conservation measures; inactive fish ponds will progressively deteriorate in ecological value and will eventually revert to terrestrial habitats.	All wetland areas, including inactive fish ponds, marsh and seasonally wet grassland, will be filled for development. No ecological protection and conservation measures for the existing wetland areas, and may cause deterioration of the surrounding fish ponds.	1.9 ha of inactive fish ponds, and marsh and seasonally wet grassland will be retained and 1.0 ha of former farm land within the WCA will be restored; ecological protection and conservation measures will be implemented on proposed 2.9 ha of continuous and contiguous fish ponds (Figure 2-5 refers).	1.9 ha of inactive fish ponds, and marsh and seasonally wet grassland will be retained and a total of 1.5 ha of former farm land within and adjoining the WCA will be restored; ecological protection and conservation measures will be implemented on 3.4 ha of continuous and contiguous fish ponds and a 0.2 ha isolated fish pond abutting Yau Pok Road (Figure 2-7 refers).
	No-net-loss of Wetland Function & Area	Net loss of area because nature succession.	Total loss of area and function of the wetland areas because of the full development involve pond filing.	Minor reduction in wetland compared to the existing baseline condition (3.0ha), but increase in wetland function anticipated due to active management for wildlife on 2.9 ha.	Net increase of wetland compared to the existing baseline condition (3.0ha). Increase in wetland function, together with continuous and contiguous fish ponds on 3.6 ha.
	Enhance Ecological Functions of Wetland within the Project Area	Gradually deterioration.	No enhancement and cause deterioration of the wetlands within the Site.	Enhancement of proposed 2.9 ha.	Enhancement of proposed 3.6 ha.
	Maintain Ecological	Marginal negative due to fringe.	No benefit and fragment further the	Pond restoration will have positive	Pond restoration will have positive

	Objectives	**Scenario 1: Without the Project**	**Scenario 2: With the Project**		
			Option A Sub-urban Layout Option	**Option B** Conformed Layout Option	**Option C** Enhanced Layout Option
	Integrity of the Deep Bay Wetland System		Deep Bay Wetland System from the wetlands to the east of the Site.	effect on integrity by increasing wetland area and function.	effect on integrity by increasing wetland area and function connected with the continuous and contiguous Deep Bay wetland system.
Ecological	Enhance diversity of wetland habitat types	No effect.	No benefit.	Limited effect as little scope to do other than restore pond habitat.	Scope to enhance wetland habitat diversity and overall ecological function by forming freshwater marsh and other wetland habitats.
	Enhance abundance and diversity of wetland fauna and flora	Market driven; monoculture vegetation for human consumption.	No benefit; will even reduce the abundance and diversity of some wetland fauna and flora that exist in the wetlands within the Project area.	Limited effect as little scope to do other than restore pond habitat.	Scope to enhance wetland habitat diversity and wetland fauna diversity by forming freshwater marsh and other wetland habitats.
Planning	Development on Formed Land Only	No proposed physical development.	Development not only on formed land.	Entire development area is on formed land.	Entire development area is on formed land.
	No Pond Filling	No protection against natural succession, or illegal filling may occur.	All ponds are filled. Development on entire site.	All existing ponds are preserved.	All existing ponds are preserved.
	Development Located Far Away from Existing Fish Ponds	No proposed development within the Project Area.	All ponds are filled. Development on entire site.	Entire development area falls within WBA.	Entire development area falls within WBA; restored wetland as a buffer between development area and contiguous and continuous wetland in the northwest and northeast;
Landscape and Visual	Minimize Potential Landscape Impact	No impact.	Land formation of the entire site, thus completely removing all existing landscape resources.	This Option will result in fewer trees being affected than Option A through better layout.	This Option will result in fewer trees being affected than Option B through better layout.

	Objectives	**Scenario 1: Without the Project**	**Scenario 2: With the Project**		
			Option A Sub-urban Layout Option	**Option B** Conformed Layout Option	**Option C** Enhanced Layout Option
	Avoid Potential Visual Impact to Sensitive Receivers	No impact	Development over the entire site and up to the site boundary would have substantial visual impact on adjacent VSRs. This scenario would leave only minimal buffer areas between the proposed and existing developments, and a relatively high retaining wall along the site boundary.	This option will have greater impact on VSRs in the adjoining areas of Fairview Park, Palm Springs and Royal Palms. Enhancing Area 40 as amenity wetland will reduce visual impacts for VSRs to the east of the Project Area.	The increased ecological and amenity wetland buffer area will reduce impacts on VSRs to the north and east of the Project Area due the greater distance between the developments.
Environmental	Minimize Site Formation Works and Retaining Works Required and Associated Environmental Impacts	No site formation works is required and hence no temporary construction noise and construction dust impact.	The entire site will be filled. Major construction will be required and will likely cause construction noise and dust impact.	~ 4.9 ha area will be filled and ~ 1.2km long landscaped retaining wall/slope will be constructed. Mitigation measures would be required to minimize the potential temporary construction noise and dust impact.	~ 4.5 ha area will be filled and ~ 1.0km long landscaped retaining wall/slope will be constructed. Mitigation measures would be required to minimize the potential temporary construction noise and dust impact.
	Operational Phase Environmental Impact	Run-off of herbicides and pesticides from agricultural land will continue to enter Deep Bay wetland system.	No impact.	No impact.	No impact.
Engineering	Practical and Feasible Hydrological System	No drainage works is required.	Extensive drainage works is required as the entire site is developed.	Drainage works in the developable area is practical and feasible but more extensive due to larger area.	Drainage works in the developable area is practical and feasible but less extensive due to smaller area.

As detailed in Table 2-1 above, the Enhanced Layout Option (Option C) is preferable to other options, including the Without the Project Scenario, in both ecological and planning aspects. It does not only achieve the ecological objectives, it also provides extra protection and enhancement to the wetland habitat. It would achieve restoration or construction of extra wetland on former farm land within the WCA or farmland within the WBA over and above the existing condition, and therefore provide scope for provision of more diverse wetland habitat for wildlife. The additional restored wetland areas in the Enhanced Layout Option would further buffer existing continuous and contiguous wetland areas from the proposed development. The additional buffer area would increase the separation of the proposed residential development from ponds in the WCA to the east of the Project Area.

For the impacts-related evaluation covering landscape and visual, environmental and engineering aspects, the Without the Project Scenario ranked highest as no proposed development implies no development associated impacts. Yet, there will be potential pollution due to continuing pesticide and herbicide run-off and deterioration in Deep Bay water quality will occur, assuming that agricultural use continues and illegal pond filling or other activities resulting in habitat degradation do not occur. Among the three alternative layout options (Options A, B and C) under the With the Project Scenario, the associated environmental and engineering impacts decreased as the site formation area reduced. The Enhanced Layout Option, which set aside additional buffer area, will have a smaller site formation area and hence lesser impacts. The Enhanced Layout Option is preferred in terms of impacts on landscape resources as it provides increased ecological and amenity wetland buffer.

Overall, it is concluded that the Enhanced Layout Option is a better performing option in achieving the conservation objectives of the Project while equally respecting the statutory intention. The extent of associated visual, landscape, environmental and engineering impact will be minimized and acceptable.

2.8 Refinement of the Enhanced Layout Option

While the Enhanced Layout Option is considered to be a better performing option, greater sensitive effort has been made to refine the Enhanced Layout Option to further mitigate potential impacts based on preliminary result of technical assessments and the public opinions obtained during the Continuous Public Involvement (CPI) process.

Despite the fact that the existing Area 40 has limited ecological value, the flight path surveys for birds have identified a minor flight line along the existing wetland to the east of the Project Area and some of the birds flied over Area 40. Area 40 formed part of the wetland linkage between wetlands in the WCA and the drainage channel. Strengthening the ecological corridor of Area 40 to the abutting wetlands to the east and enhancing its ecological function will be necessary.

When reviewing visual impact of the proposed residential development in the Project Area, visual relation to Kai Kung Leng, which is a major visual element in the area, and potential impacts to neighbouring residential development are critical considerations. It will be preferable if there is a buffer distance between the proposed house development and Fairview Park, and a visual corridor orientating towards Kai Kung Leng will be maintained in the development scheme.

In order to minimize the edge effect of the proposed residential development on the surrounding area, suitable treatments are required for the edges of the development area including the interfacing edge with the future cycle track and the boundary facing future development of the REC zone in the southwest.

During the Continuous Public Involvement process, green groups have raised the point that the proposed layout design should also pay respect to the wetland in the REC zone to the southwest of the Project Area. In particular, they considered it preferable to have an ecological corridor for amphibian/ herpetofauna to connect the wetlands in the REC zone to the contiguous and continuous wetland system in Deep Bay Area. However, in view of the latest proposed development at the adjacent REC zone, such a corridor is no longer considered necessary.

In view of the above, different mitigation strategies are comprehensively considered and incorporated into the alternative layout development. As a refinement of the Enhanced Layout Option, the Recommended Layout Option (Option D) was evolved for detailed assessments.

2.9 Option D: Recommended Layout Option

The Recommended Layout Option contains all ecological and planning merits of the Enhanced Layout Option presented in Table 2-1 and it incorporates additional environmentally empathetic development layout design to enhance the ecological values and offer greater ecological protection. It is a well balanced option with concerted efforts from both the Project Proponent and relevant stakeholders who have participated in the CPI process. In this Option, the proposed residential development sets back about 9 m to 19m from the north eastern boundary adjoining area 20 for an ecological corridor connecting Area 40 and the restored wetland at A1. This ecological corridor will function together with the abutting area 20 outside the Project Area as a whole to form an extension of wetland from the WCA to the drainage channel. Area 40 will then become part of the functional wetland system in Deep Bay Area.

In response to the recommendations from green groups during the CPI process, an additional 5m wide buffer is also proposed along the northern and eastern edge of the residential development area between the WCA (i.e. the proposed WRA) and residential area (i.e. the WBA). This area will form part of the wetland as the Wetland and Visual Buffer under the TPB PG No.12C. Please refer to Figure 2-10 and 11-18 for details.

The additional ecological corridor and proposed reedbed strip serves a strategic function to connect restored or existing wetlands in WBA forming a continuous strip of wetland buffering the WCA to its immediate north. The layout and master layout plan of the Recommended Layout Option are presented in Figures 2-9 and 2-10 respectively. The major features of the Recommended Layout Option are summarised the bullets below and the key development parameters are summarised in Table 2-2 below. The first four features comprise the proposed WRA in this option which add up to 3.8ha, accounting to approximately 47% of the total area of Project Site. Both the percentage and actual area of the proposed wetland are deemed sufficient in view of (a) its satisfaction of the “no net loss in wetland” principle as stipulated in TPB PG-No.12C, and (b) this being a sensible balance between providing habitat for a number of target specie and maximising the land availability to alleviate the acute shortage of housing sites in Hong Kong.

- Around 1.8 ha of wetland area (at area 7, 8, 9, 18, and an area of seasonal wet grassland adjacent to area 9) would be protected and conserved to achieve the “no-net-loss of wetland” principle.

- Following the intention of WCA, former farm land (around 1.1 ha at area 17 and A3) falling within the WCA, which have previously been part of the contiguous and continuous fish ponds areas would be restored for conservation management.

- About 0.5ha of former farm land in WBA adjoining WCA (at area A1 and A2) will be restored into wetland to further protect the integrity of WCA.

- On top of existing wetlands to the east of the Project Area, an additional 5m wide wetland and visual buffer along the northern and eastern edge of the residential development area between the WCA and residential area (i.e. the WBA) as well as an ecological corridor about 9 m to 19m wide (a total about 0.2 ha) would be provided to strengthen the connection between the Area 40 and the contiguous and continuous fish ponds in Deep Bay Area. Area 40 (about 0.2 ha) would then become part of the contiguous and continuous fish ponds in Deep Bay Area.

- Residential development with ecologically sensitive design would be developed on the remaining ~4.3 ha of formed land within the WBA to provide incentives and resources for long term wetland conservation.

Table 2-2 Key Development Parameters of Recommended Layout Option

Project Area	About 8.1 ha
Plot Ratio	0.2
Gross Floor Area	About 16,200m^2 (not include residential club house)
Total Wetland Area	About 3.8 ha (include all existing, restored wetland)
Development Area	About 4.3ha
No. of Houses	70
No. of Storeys	3

In this Recommended Layout Option, the wetland area and development area are clearly differentiated. The northern part of the Project Area would serve as wetland conservation/ restoration area while the southern part would be the development area. No pond filling will be required and proposed low density residential development is located furthest away from Deep Bay Area.

Based on the allowable development parameters under the prevailing OU(CDWPA) zoning, the low density residential development will have a maximum developable gross floor area of 16,200 m^2 and a maximum building height of 3 storeys. There will be 70 nos. of 3-storey houses to be constructed within the developable area (the ~4.3 ha formed land within the WBA) with vehicular access from Yau Pok Road and the retaining wall. Based on ecological and environmental considerations, an interim sewerage treatment plant is proposed to be located farthest from the ecologically sensitive wetland of Deep Bay Area at the southwest corner of the Project area to minimize potential impacts to the wetland.

Similar to the Enhanced Layout Option, hard paved area is minimized in the Recommended Layout Option by arranging the internal access road as a loop with a row of houses on both sides. Site level in the development area varies with the central part slight higher to create a varying height profile for the proposed development. To minimize potential visual impacts to neighbouring residential developments including the Fairview Park, Royal Palms, Palm Springs and the Yau Mei San Tsuen, proposed houses are setback away from the periphery of the development area to maximize building distances. The club house is proposed to be a two-storey building with a view to minimize potential visual disturbance to the adjacent houses at Fairview Park. There will also be no proposed houses fronting directly onto Yau Pok Road to avoid potential visual impacts to the future users of the cycling track and those along Yau Pok Road.

In the Recommended Layout Option, the number of houses fronting onto north western boundary of the development is reduced so as to minimize potential impact to visual sensitive receivers from that direction. The distance to houses north of Fairview Park is maximised and a view corridor between the fish pond area and the eastern ridgelines of Kai Kung Leng is introduced.

The proposed development has been designed such that it can satisfy the “no net loss in wetland” principle as well as “no net increase in pollution loading” requirement in Deep Bay as stipulated in TPB PG-No.12C.

2.10 Construction Methods and Sequences of Works

2.10.1 Site Characteristics

Based on the existing ground investigation records readily available from Geotechnical Information Unit of Civil Engineering and Development Department, the solid geology underlying the Project Area is volcanic/ tuff. The superficial layers comprise Fill of approximately 1 m to 3 m thick underlain by marine/ pond deposit which are mainly clay in nature and then followed by alluvial clay/sand. The current topographical survey records indicate that the existing ground level is +2.2 mPD approximately.

2.10.2 Construction Activities

Major Construction Activities Involved

Similar to other general building project, the sequence of works at the residential portion of this Project will generally involve site formation works, foundation (piling) works, superstructure works, underground services and utilities, roadworks, etc.

For the construction works involved in Wetland Restoration Area (WRA), re-profiling of the bunds is major works to be carried out, such that there will be some deep water area within the WRA and gentle slope along the bunds which is currently 90 degree straight. The re-profiling works will be conducted on one pair of pond at a time to minimize disturbance to the rest of the Area, i.e. no site formation work would be required. In addition, the design of the wetland restoration area will follow the existing topography, for example, the existing bunds in the wetland restoration area will be retained as much as possible. Therefore, there will be limited construction activities and minimum no. of construction plants would be required. The works to be carried out at the WRA will be similar to the regular maintenance work carried out by the fish pond owner as well as the works for compensatory wetland for the Spurline. An overlay of the existing configuration and the proposed WRA is shown in Figure 2-11. The time periods, start and completion dates for these actions will be carried out first by only re-profiling the bunds and provision of bunds within some designated area as presented in Appendix 1-1.

During the construction of the WRA, an area to the west of the Project Area (part of the farmland) will be used as a temporary wetland enhancement area (Section 8.11.1.4 refers). No major construction work would be required for this temporary wetland enhancement area as existing configuration will be used. The temporary wetland enhancement area will also be used as the refugee site for amphibian during the enhancement work of the WRA.

Site Formation Work

The whole Project Area is about 8.1 ha, therefore the construction work is planned to be undertaken in phases. The earth work of the WRA (Phase A) will be conducted first. Subsequently, the site formation work for the residential portion of the Project Area will be conducted. For the residential portion of the Project Site which is over 4 ha, the site formation work is planned to be undertaken into 3 phases, namely Phases B, C and D.

For the Wetland Restoration Area (WRA), no major site formation work would be required as its design will basically follow the existing topography as much as possible. For example, the existing bunds within the WRA will be retained as much as possible, i.e. similar to the design of the wetland under the Spurline Project which mainly involved re-profiling the pond bunds. The existing earth bund of these ponds will be re-profiled to provide as shallow a slope as feasible according to the properties of the bund material to provide various habitats. Minimum no. of small powered mechanical equipment such as mini excavator and dump trucks would be used in the re-profiling of the pond bund for re-distributing the soil to create

gentle slope and deep water area. As a result, the site formation work required for the WRA is minimal.

For the residential portion of the Project Site, 70 nos. of 3-storey houses, club house, site drainage system and ancillary facilities are proposed. Site formation works will be carried out by filling up to an average of about +5.5mPD (varying from 5.5mPD to 6.5mPD) in order to prevent flooding. Settlement due to consolidation of the compressible marine/ pond and alluvial clay and creep settlement of fill is anticipated, and engineering solution would be required to tackle the problem. Pre-loading in combination with vertical drains may be adopted to increase the rate of consolidation of the clay layer and settlement of fill.

A series of slope or retaining walls will be built along the boundary of the developable zone for separation from the WRA and adjacent lots. Retaining wall/ supporting may also be constructed for the proposed STP which involves underground part and the drainage systems within the developable area.

In the presence of the superficial marine and alluvial clay, retaining wall simply resting on top of the existing compressible layer may cause problems of wall instability and excessive long-term settlement to the future ground/ structures behind the wall. Pile foundation to support the retaining wall would be one feasible option to resolve the problem. Another option would be to carry out ground improvement works to the founding soil stratum prior to construction of the retaining wall.

The extent of pre-loading and vertical band drain installation required and engineering option to be selected for resolving the problems related to retaining wall construction will be subject to further engineering appraisals during detailed design.

It is envisaged that not much excavation works will be required during the site formation works in the developable zone. Excavated material will be reused on-site where possible for wetland restoration, pre-loading, landscaping or eventually disposal to a suitable facility. Environmental testing of the excavated material will be conducted to confirm if they are inert and suitable for reuse.

2.10.3 Alternative Construction Sequence

Ecological considerations have been a top priority in planning the construction works. Major construction works will be scheduled to avoid the ecologically sensitive season such that ecological disturbance is minimized. Erection of the site hoarding will be carried out around middle of 2015; and the WRA enhancement work will only be commenced after that. Construction of the residential portion of the Project Area will be carried out after the construction of the wetland, which will serve as a buffer for the existing ecologically sensitive area outside the Project Area during the construction of the residential portion of the development.

Since the proposed development can be divided into the wetland restoration area (WRA) and the residential portion and the works involved within each of these areas are different (as discussed above), construction works can be arranged to be carried out at these two portions of area individually.

A preliminary construction programme was established based on the shortest possible construction period (about 2.5 years) (see Appendix 1-2), and the construction programme for WRA and the residential portion is considered separately. This programme has been developed merely based on construction sequence at each respective site area without considering potential cumulative impacts due to concurrent works. However, based on this construction programe there will be many overlapping of construction works between the WRA and the residential portion of the Project Site as depicted in the construction programe shown in Appendix 1-2. For instance, the construction of the WRA would be carried in

parallel to that of the residential portion. Thus, significant impacts on construction noise would arise due to the extensive construction area and concurrent works. Significant construction dust impact may also arise due to concurrent site formation works undertaken at both the northern portion and southern portion of the Project Site.

As such, the above-mentioned construction programe has been revised, and a new programme is developed with due consideration on sequence of works with a view to minimize concurrent construction at the WRA and the residential portion of the Project Site (See Appendix 1-1). This programe has provided due consideration to the potential cumulative construction impacts and concurrent works are avoided as much as possible. According to this construction programe, the construction works of the WRA within the northern part of the Project Area will be carried out prior to the commencement of construction of the residential development commences in order to minimize concurrent works as much as possible. This arrangement would minimize potential impacts on construction noise and construction dust due to concurrent site formation works at the two portions of the Project Site. In addition, the construction programme has been extended to about 3 years so that overlapping of construction activities during different stages of construction has been minimized as far as possible. Further extension of construction period will cause significant delay in construction programme and is not cost effective. With this arrangement, potential impacts due to construction activities can be further reduced to a minimal as both the number and type of construction equipment to be used during each construction phase is minimized (by avoiding concurrent works) when compared to the original construction programme.

Asides from avoiding concurrent works and extending the construction period to avoid concurrent works, due consideration has also been given to the sequence of works when developing the construction programe. In order to avoid unnecessary excavation between different phases of construction, construction of underground services and utilities will be constructed before the roadworks so that excavation of road surface to install underground services and utilities can be avoided. This arrangement will also avoid generation of unnecessary construction waste due to excavation.

In addition, instead of carrying site formation works for the whole residential portion at the same time, which would trigger adverse construction impacts such as construction noise and construction dust due to the large extent of works areas and the large number of construction plants working within the Site, the site formation works of the residential portion will be carried out in phases with each construction area representing only a portion of the residential portion of development. Also some machinery/plant could be mobilized from phase to phase in order to minimize the total number of plants operating on-site. As such, the construction impacts could be minimized.

Given to the above, the construction programme and sequence of works presented in Appendix 1-1 is more preferable than the original construction programe shown in Appendix 1-2.

2.10.4 Alternative Construction Method

As discussed earlier, the Project is for restoration of wetland and associated low-rise residential development, thus the extend of building structures construction will be minimum. Subject to the site condition, piling works may be required for the proposed development. Piling works may be undertaken by percussive piling method. This construction method will generate higher level of construction noise. This method will require a Construction Noise Permit to be issued by EPD in advance.

An alternative piling method is by Continuous Flight Auger. The drilling method allows excavating in a wide variety of soils, dry or water-logged, loose or cohesive. This piling method is relatively quiet than the percussive piling method as no shocks or vibrations are induced when the system is performed. In addition, no bentonite mud is needed for the excavation, thus handling of bentonite slurries will not be required.

The proposed development will require excavation and filling works, thus excavated materials and filling materials will need to be handled carefully in order to minimize waste generation. One way to handle excavated materials is by off-site disposal to public fill facility and/or landfill site subject to the quality of excavated materials. However, this would increase the amount of waste generated by this Project. Instead, due consideration has been given to reduce waste generation and disposal, and the excavated material will be utilized on site where possible as fill materials and for the landscaping area. The Contractor will be required to reuse materials on site as far as practicable and to minimize waste from arising. This construction method would reduce the amount of waste to be generated which requires off-site disposal. As excavated materials are re-used on-site, the amount of fill materials required would be minimized as well.

3. AIR QUALITY

3.1 Summary

This air quality impact assessment has been carried out in accordance with Section 3.9.1 of the EIA Study Brief to qualify and quantify the potential air quality impacts associated with the construction and operation of the Project. The Chapter follows the criteria and guidelines for evaluating and assessing air quality impacts as stated in section 1 of Annex 4 and Annex 12 of the EIAO-TM.

This Chapter addresses the potential air quality impacts during construction phase and operational phase of the Project. The Assessment Area for air quality impact assessment is defined by a distance of 500 m from the boundary of the Project Site as per the Study Brief requirements.

3.2 Proposed Development

The proposed Project is for comprehensive development and wetland protection near Yau Mei San Tsuen. Detailed elements of the proposed development are described in Sections 1.3 and 2.9, and the MLP is shown in Figure 2-10.

3.3 Legislation, Standards, Guidelines and Criteria

The principal legislation regulating air quality in Hong Kong is the Air Pollution Control Ordinance (APCO) (Cap. 311). Air Quality Objectives (AQOs) are set for the whole of Hong Kong, which specify the statutory limits for various criteria pollutants and the maximum number of exceedance allowed over a specified period of time. The prevailing AQOs specified under the Air Pollution Control (Amendment) Ordinance 2013, have been adopted in this air quality assessment.

The AQOs for Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2), Respirable Suspended Particulates (RSP), and Fine Suspended Particulates (FSP), which are relevant to this assessment, are summarized in Table 3-1 below.

Table 3-1 Hong Kong Air Quality Objectives

Pollutants	Averaging Period *	Pollutants Concentration ($\mu g/m^3$) *	No. of Exceedances Allowed Per Calendar Year *
CO	1 hour	30,000	0
	8 hours	10,000	0
NO_2	1 hour	200	18
	Annual	40	N.A.
SO_2	10-min.	500	3
	Daily (24 hours)	125	3
RSP (PM_{10})	Daily (24-hours)	100	9
	Annual	50	N.A.
FSP ($PM_{2.5}$)	Daily (24-hours)	75	9
	Annual	35	N.A.

Remark:

* Based on the Air Quality Objectives under the Air Pollution Control (Amendment) Ordinance 2013.

N.B. Concentrations of gaseous air pollutants are measured at 293 K and 101.325 kPa (one atmospheric pressure).

N.A. Not applicable.

FSP means suspended particles in air with a nominal aerodynamic diameter of 2.5 μm or less.

RSP means suspended particles in air with a nominal aerodynamic diameter of 10 μm or less.

In addition to the AQOs, an hourly Total Suspended Particulates (TSP) limit of 500 $\mu g/m^3$ measured at 298K(25^oC) and 101.325 kPa (one atmosphere) for construction dust impact assessment and 5 odour units based on an averaging time of 5 seconds for the odour prediction assessment is required under Annex 4 in the Technical Memorandum on EIA Process of the EIA Ordinance.

Construction dust is controlled under the Air Pollution Control (Construction Dust) Regulation. Works such as site formation, construction of the foundation and superstructure of buildings, road construction works are classified as “notifiable work” under the Regulation. Any works which involve stockpiling of dusty materials, loading, unloading or transfer of dusty materials, transfer of dusty materials using a belt conveyor system, use of vehicles, debris handling, excavation or earth moving, site clearance, etc. are regarded as “regulatory work”.

A Schedule specifying the dust control requirements for a variety of construction activities is included in the Regulation. Contractors responsible for a construction site where a notifiable work and/or regulatory work is involved have to ensure that the work is carried out in accordance with the Schedule with regard to dust control.

3.4 Ambient Air Quality

Existing Ambient Air Quality Levels

The Project Site is located in rural area. CLP Power Hong Kong Ltd. has a monitoring station at Lau Fau Chan, which is also located in rural area. Thus, the recorded air pollutants concentrations between year 2009 and 2013 at that station was used to provide an indication on ambient air pollutants level at the Project area. As CLP’s monitoring station only covers NO_2 and SO_2 levels, data recorded at EPD’s Yuen Long air quality monitoring station was used to provide an indication of ambient air pollutants concentrations for CO, TSP, RSP, and FSP.

The above calculated air pollutants concentrations are presented below, which are based on best available information. Based on the recorded air pollutants concentrations, the ambient air pollutants level at the project area was generally within the air quality criteria/ AQOs except some exceedances of RSP and FSP recorded in the past few years at EPD’s Yuen Long monitoring station. It is noted that EPD’s Yuen Long monitoring station is located at downtown area surrounded by existing road networks, which may not fully represent the ambient air quality level at rural area where the Project Site is located. It is selected since it is the best available information.

Table 3-1A Air Quality Levels Recorded Between Year 2009 and Year 2013

				Pollutants Concentrations (µg/m^3)					
Pollutants	**Averaging Period ***	**Air Quality Criteria/ Standard (µg/m^3) ***	**No. of Exceedances Allowed Per Calendar Year ***	**2009**	**2010**	**2011**	**2012**	**2013**	**Remark**
Data from EPD Yuen Long Monitoring Station									
CO @	1-hr	30,000	0	2,540	2,730	3,210	2,200	2,690	
	8 hours	10,000	0	2,181	2,318	2,610	1,945	1,950	
RSP (PM_{10}) ## & ###	Daily (24-hours)	100	9	**107**	**115**	**111**	100	**142**	Based on 10th highest conc.
	Annual	50	N.A.	**51**	49	**54**	44	**56**	
FSP ($PM_{2.5}$) ## & ###	Daily (24-hours)	75	9	73	73	**76**	65	**106**	Based on 10th highest conc.
	Annual	35	N.A.	33	32	**36**	29	**37**	
TSP ** & ##	1-hr	500	N.A.	-	-	-	-	-	
	Annual	Nil	N.A.	77	78	86	68	73	
Data from CLP Lau Fau Shan Monitoring Station									
NO_2 # & ##	1-hr	200	18	-	164	171	136	155	Based on 19th highest conc.
	Annual	40	N.A.	23	29	36	30	30	
SO_2 #	10-min.	500	3	-	-	-	-	-	
	Daily (24 hours)	125	3	-	25	33	27	23	Based on 4th highest conc.

Note:

Bold numbers indicate exceedance of the relevant air quality criteria/ standard.

* Based on the prevailing Air Quality Objectives (please refer to Table 3-1 above).

** Parameter specified in the EIAO-TM only.

- denotes data is not available.

Based on recorded levels at CLP's Lau Fau Shan Monitoring Station. (available at: https://www.clpgroup.com/poweru/eng/air_quality/airQuality_monitoring_detail.aspx).

Based on annual average concentrations reported in EPD's Air Quality In Hong Kong Annual report (various years) for monitoring station at Yuen Long as well as CLP's Lau Fau Shan monitoring station.

Based on EPD's daily average monitoring data at Yuen Long Station available at: http://epic.epd.gov.hk/EPICDI/air/station/?lang=en

@ Based on the highest hourly CO and highest 8-hours CO reported in EPD's Air Quality In Hong Kong Annual report (various years) for monitoring station at Yuen Long.

Ambient Air Quality Levels for Evaluation of Construction and Operational Air Quality Impacts

The above ambient air pollutants levels provide air quality levels recorded in the past. The Environment Bureau released a report namely "A Clean Air Plan for Hong Kong" in 2013, which documents planned reduction in air pollution in Hong Kong. It is anticipated that the future background air quality would be improved.

For the purpose of evaluating the construction and operational phase air quality impacts, background contributions are based on EPD's PATH concentration output. According to "Guidelines on Assessing the 'TOTAL' Air Quality Impacts" published in EPD's website, hour-by-hour background contribution is estimated using output of PATH model.

Background contribution of FSP is not directly available from PATH model. According to "Guidelines on the Estimation of FSP for Air Quality Assessment in Hong Kong", background contribution of FSP is deduced based on the following conservative formula.

Daily($\mu g/m^3$): FSP = 0.75 x RSP

Annual($\mu g/m^3$): FSP = 0.71 x RSP

For TSP background contribution, the RSP contribution in PATH's concentration output is adopted instead.

Regarding the proposed development which falls within grid(20,40) in PATH system, the background contributions of RSP is based on concentration of each hour in PATH's concentration output for grid(20,40). For background contribution of FSP and TSP, these are calculated based on the RSP values as discussed above. As construction of the proposed development is to be commenced in year 2015, PATH's concentration output for Year 2015 is adopted as a conservative approach.

Appendix 3-1B shows details of background contribution from the PATH output for grid (20,40).

3.5 Air Sensitive Receivers

3.5.1 Construction Phase

3.5.1.1 Existing ASRs

Representative existing ASRs within 500 m of the site boundary have been identified according to the criteria listed in the EIAO-TM through site visits and a review of land use plans. ASRs and their horizontal distance to the nearest emission source are summarized in Table 3-2 below. The locations of these ASRs are also shown in **Figure 3-1**. The representative ASRs that are worst affected, are selected for construction phase air quality impact assessment as shown in **Figure 3-2**.

Table 3-2 Locations of Representative Air Sensitive Receiver

Description	Usage	No. of Storeys	Distance to the nearest Emission Sources (Approx.) **	Ground Level, mPD *
Fairview Park @	Residential	2-3	~ 25m (Boundary of Construction Site of Proposed Residential Area) ~ 55 m (Interim STP)	3.9-4.6
Royal Palms (A25)	Residential	2	~ 20m (Boundary of Construction Site of Proposed Wetland Restoration Area) ~ 330 m (Interim STP)	4.9
Palm Springs (A17, A34, A35)	Residential	2-3	~85m (Boundary of Construction Site of Proposed Wetland Restoration Area) ~ 390 m (Interim STP)	5.7
Yau Mei San Tsuen village house (A18, A36, A07, A23)	Residential	2	~ 5m to 65m (Boundary of Construction Site of Proposed Wetland Restoration Area) ~ 315 m to 330 m (Interim STP)	3.1-3.6
Hong Chi Morninglight School Yuen Long (A26)	School	3	~330m (Boundary of Construction Site of Proposed Wetland Restoration Area) ~518 (Interim STP)	4.4
Christian Ministry Institute (A24)	School	2	~141m (Boundary of Construction Site of Proposed Wetland Restoration Area) ~450m (Interim STP)	3.5
Hang Fook Garden (A20)	Residential	3	~422m (Boundary of Construction Site of Proposed Residential Development) ~472m	4.2
Chuk Yuen Tsuen (A19, A08, A09)	Residential	2-3	~223m (Boundary of Construction Site of Proposed Residential Development) ~294m (Interim STP)	2.3-3.5
Bethel High School (A10, A10A) ***	School	3	~495m (Boundary of Construction Site of Proposed Residential Area and Interim STP)	4.4
Fairview Park (near Fairview Park Boulevard) (A01, A01A, A02, A02A, A13) ***	Residential	2-3	>500 m	4.4 – 4.6
Helene Terrace and Villa Camellia (A11) ***	Residential	2	>500 m	4.5
Villa Camilla (A12) ***	Residential	2	>500 m	6.5
Wong Chan Sook Ying Memorial School (A14) ***	School	4	>500 m	4.4
Man Yuen Tsuen village house (A15) ***	Residential	3	>500 m	4.1
Ha San Wai village house (A21, A22) ***	Residential	3	>500 m	3.5 -4.2
Existing building (near Ha San Wai Road) (A27) ***	Residential	3	>500 m	4.5
Restaurant nearby Helene Terrace (A32) ***	Commercial	2	>500m	4.5

Remark: * Existing ground level of representative ASRs

** Shortest horizontal distance between the ASRs and the nearest Project Site boundary.
*** ASRs outside 500 m radius selected for the cumulative impact assessment.

@ Representative ASRs at Fairview Park A03, A04, A05, A05A, A05B, A06, A06A, A16, A16A, A28, A29, A30, A31, A33 as shown in Figure 3-2.

An assessment area of 500m envelope as well as individual representative ASRs locations selected for construction phase air quality assessment are shown in Figure 3-2. Since there are also planned development projects nearby (as discussed in Section 3.5.1.2), representative ASRs outside the 500m radius of this Project (which may be affected by the planned development projects), are also selected for cumulative impact assessment.

3.5.1.2 Planned ASRs

Identification of potential planned/ committed ASRs has been based on best available information such as relevant plans[3] , current Outline Zoning Plan (OZP No. S/YL-MP/6), and Town Planning Board (TPB) records, which have been reviewed. The registry of EIAO projects was also reviewed for identifying EIA projects. Based on information reviewed, there are a few planned residential development projects in the vicinity of the proposed development site. These planned residential developments are also classified as designated project under the EIAO; as such they have to go through the EIAO process. These potential future development cases are listed in Table 3-3 below, and their geographical locations are also shown in **Figure 3-2**.

Table 3-3 Planned Air Sensitive Receivers

Planned Site	ASR ID	Relevant Town Planning Board / EIAO Application Number	Description	Approval from TPB	Approval of EIAO	Ground mPD Level, (Approx.) *	No. of storey *	Distance , m **
Planned residential development proposals								
REC Site	A3Pa, A4Pa	ESB-207/2009	Proposed Recreational and Ancillary Residential Development (Including the Relaxation of Maximum Building Height) at DD 104 Lots 3054ARP(Part), 3200ARP, 3201RP, 3202, 3203RP, 3204RP, 3205RP, 3211RP, 3212RP, 3213RP, 3215-3217, 3218RP and 3250B33RP(Part) and Adjoining Government Land.	No	Yes	3	2	~10-402 m
Kam Pok Road Site	A5Pa	ESB-210/2009. A/YL-MP/136; Also in A/YL-MP/170 & A/YL-MP/202	Proposed Residential Development at R(D) zone	Yes	No	7	2	~412m
RD Site	A1Pa, A2Pa	ESB-204/2009. Different scales of development and site areas were also under A/YL-MP/132, and A/YL-MP/146, and A/YL-MP/193	Proposed Residential Development within R(D) Zone at Various Lots in DD 104.	Yes	No	3	2	~110m

3 According to information available on Planning Department's website (available at: http://www.pland.gov.hk/pland_en/info_serv/tp_plan/index.html), the Project Site is not covered by existing Development Permission Area Plans. Instead, it is currently covered by the Outline Zoning Plan (OZP) No. S/YL-MP/6. Records of both the adopted and draft departmental plans in the area were obtained from Planning Department. According to the records obtained, relevant plans were reviewed such as the "L/YL-FP/1C Residential Layout - Fairview Park Access Road, Yuen Long" adopted in year 1982; as well as the draft departmental plan "DP/NWNT/1C North West New Territories - Development Plan" approved in year 1984. As all of these plans were prepared in 1980s', planned uses indicated in these plans are outdated and are superseded by the exsiting OZP. As advised by Planning Department, the existing OZP is the latest version regarding planned land uses in the area.

Planned Site	ASR ID	Relevant Town Planning Board / EIAO Application Number	Description	Approval from TPB	Approval of EIAO	Ground mPD Level, (Approx.) *	No. of storey *	Distance, m **
"V" zone in OZP	V01	A/YL-MP/172-3 and A/YL-MP/183-1	Proposed new territory exempted village house development	Yes	N/A	3	3	~425m
	V02, V03/ V04	Nil	Village zone /"R(D)" zone in OZP, respectively	-	-	2.4/ 4.8	3	~185m - ~553m

Remark:

* Existing ground mPD level. According to the OZP, the allowed building height of the planned development sites is 6m high, it is therefore assumed the planned developments are 2 storeys buildings.

The proposed new territories exempted village houses are expected to be typical 3 storeys buildings.

** Shortest horizontal distance between the nearest Project site boundary and the ASR locations shown in Figure 3-2.

N/A stands for not applicable.

None of the above residential development proposals have obtained approval from both the Town Planning Board (TPB) and provisions under the EIAO. Although these development sites have no committed development programme (except for "REC Site" which has been approved), best available information regarding their construction programmes have been obtained from the project proponents of these projects and considered in the cumulative construction phase air quality impact assessment. Details of the assessment and assumptions adopted have been provided in the following sections.

In addition to the above planned development projects, there are also approved new territories exempted house development sites on the opposite side of Ngau Tam Mei Drainage Channel (e.g. case number A/YL-MP/172-3 and A/YL-MP/183-1) within the Village Development ("V") zone under the Outline Zoning Plan No. S/YL-MP/6 (V01 in **Figure 3-2** refers). Asides from the above, the existing "V" zone and "R(D)" zone in the Outline Zoning Plan No. S/YL-MP/6 are also selected for assessment (V02, V03, and V04 in **Figure 3-2** refer). It is expected that development within these areas will be typical 3 storeys buildings. Although there is no committed development programe for these development sites, the concerned development sites are also taken into account in the air quality assessment.

3.5.2 Operational Phase

During the operation, representative ASRs of this Project are the proposed residential houses within the Project Site. **Figure 2-10** shows the layout of proposal residential development.

3.6 Air Quality Impact Assessment

3.6.1 Construction Phase

3.6.1.1 Identification of Potential Impacts

According to the current MLP (**Figure 2-10** refers), the entire Project Area will be divided into 2 portions, i.e. the wetland restoration portion and the residential portion. Construction works will be carried out in phases to minimize cumulative construction impacts (a phasing plan is shown in **Figure 4-4**). An indicative construction programme is shown in **Appendix 3-1A**. For the construction works involved in Wetland Restoration Area (WRA), the WRA area is currently water ponds and marshes, which will be maintained as wetland in the proposed development. The design of the WRA will follow the existing topography so that

only re-profiling of the bunds at existing ponds will be the major works to be carried out within the WRA (i.e. no filling works will be required). As the WRA area is located at low lying area and currently comprises water ponds and marsh, the materials involved will be wet and no significant construction air quality impact will be expected. An overlay of the existing configuration and the proposed WRA is shown in **Figure 2-11**. As the proposed WRA is to maintain the existing topography of existing water ponds and marshes over there, only minor works will be required, it is expected that there will be no significant construction air quality impact. As such, further assessment is not necessary.

The potential odour nuisance due to pond sediment is further discussed in Sections 3.6.1.2 and 3.9.1.

For the residential development area (about 4.3ha), the Project works comprise construction of 70 nos. of 3-storeys residential buildings, club house, site drainage system and ancillary facilities as discussed in **Sections 1.3** and **2.10.2**. Since only 3-storey high buildings will be constructed, significant air quality impacts due to construction of foundation, building structures and the finishing works are not anticipated. As "ready-mixed" concrete will be used during construction, significant air quality impact is not expected. As such, major sources of air quality impact during the construction phase would be fugitive dust emissions during the site formation stage of the concerned residential area (Phases B to D) as well as the buffer planting area along its edge in adjacent to the WRA area, as a result of earth movement activities and transportation of excavated/ fill materials. As suspended particles will be the main air quality parameter concerned for construction works which involve handling of excavated/ fill materials, TSP, RSP and FSP have been identified as the parameters for further air quality impact assessment for dust emission impact.

Emissions of other air pollutants such as carbon monoxide and dioxide, nitrogen oxides and sulphur dioxide generated by powered mechanical equipment and vehicle exhausts on-site should not be significant since only limited amount of construction plants will be used on-site. Therefore, unacceptable impacts from the criteria pollutants (such as NOx, SO_2, and CO) are unlikely to occur as significant emissions of pollutants are not anticipated, and further assessment is considered not necessary.

Given the Project Site area is relatively flat, no rock crushing will be necessary. It is expected that no concrete batching plant will be used on-site. Concrete will be brought to the site in "ready-mixed" state or in pre-cast sections. Similarly, construction of pile caps for the residential buildings will use "ready-mixed" concrete. Thus emissions due to operation of cement works or rock crushing activities are not anticipated.

There are fixed temporary noise barriers (with a barrier height of 3m to 6 m, proposed to be erected near the site boundary during the construction phase (**Figure 4-6** refers). Since the Project construction site is in an open area, the proposed vertical noise barriers along a portion of the Site boundary will not affect the dispersion of air pollutants from the construction site or affect the ASRs. Thus, no further assessment is considered necessary.

3.6.1.2 Evaluation of Impacts

According to the construction programme, the construction of the Project is envisaged to commence in third quarter 2015 for completion in later 2018. An indicative construction programme is shown in Appendix 3-1A.

As discussed earlier, the identified major sources of air quality impact during the construction phase will be fugitive dust emissions during site formation of the residential area as well as the buffer planting area along its edge in adjacent to the WRA area. Earth movement activities and transportation of excavated/ fill materials will be involved, which would attribute to dust emissions. Activities that would attribute to dust emissions are:

- Removal and unloading of soil materials by excavators;
- Earth loading/ unloading, and stockpiling;
- Bulldozing and surface compaction;
- Wind erosion on exposed ground; and
- Vehicle movements on haul roads;

According to the construction programme in Appendix 3-1A, the concerned site formation works will involve filling and excavation works. After which, the surcharge will be removed at the end of site formation works. As the nature of construction works involved will be similar (i.e. mainly earth movement activities), it is expected that the type of activities identified above which would attribute to dust emission, will be applicable to both the filling/ excavation works and the surcharge removal works.

During construction, the Contractor(s) will be required to transport only the adequate amount of fill materials to the Project Site in order to avoid cumulating filling materials on-site and the filled area shall be compacted as soon as possible (relevant requirement has been stated in Section 3.9.1). In addition, excavated materials will be reused as fill materials within the Project Site so as to minimize dust emission due to transportation of fill materials. In case temporary stockpiling of small amount of materials is required, the stockpiling location will be covered by tarpaulin sheets and backfilled as soon as possible.

The potential air quality impact is anticipated to be short-term and can be effectively controlled through appropriate design and good site practice stipulated in the Air Pollution Control (Construction Dust) Regulation. Notwithstanding the above, an EM&A programme will be implemented to monitor the construction process to facilitate the enforcement of dust controls and modification of work methods in order to reduce the dust emission to an acceptable level.

An assessment on impact of TSP, RSP and FSP emissions have been undertaken for the Project works, and the results are depicted in the following sections.

As discussed earlier, part of the Wetland Restoration Area will comprise existing ponds, where pond sediments could be found. Pond sediments are usually rich in organic matters, and therefore may potentially give rise to odour nuisance to the surrounding area when a large amount of such materials are exposed. Since any exposed surface will be covered by impervious sheet or immediately backfilled during the construction phase, the potential odour nuisance from exposed pond sediments, if any, should be minimal.

In order to minimize potential odour nuisance, the following control measures are recommended:

- Exposed surface shall be immediately filled by filling materials;
- Malodorous excavated materials, if any, will be placed as far as possible from any ASRs;
- Excavated malodorous materials will be removed away from the Project Site within 24 hours or as soon as possible; and
- Malodorous materials, if stockpiled on-site, will be covered entirely by plastic tarpaulin sheets.

With proper mitigation measures, potential odour impact is considered to be short-term and controllable. In addition, an odour patrol will be carried out during the re-profiling works for the WRA to ensure the effectiveness of the control measures implemented (also refer to section 3.9.1). Should disposal of any excavated sediment be required, it shall follow the requirements stated in Buildings Department's PNAP ADV-21[18] for "Management Framework for Disposal of Dredged/ Excavated Sediment".

3.6.1.3 Concurrent Construction Due to Adjacent Approved Designated Government Projects

According to the approved EIA report for the "EIA and TIA Studies for the Stage 2 of PWP Item No. 215DS - Yuen Long and Kam Tin Sewerage and Sewage Disposal [4]", a sewage pumping station (SPS) (Ngau Tam Mei SPS) has been proposed at about 206m south east of the Project Site boundary. The approximate location of the proposed SPS is shown in **Figure 1-2** as well as **Figure 3-1** based on the above EIA report.

Under the same project (current PWP Item No. 4235DS), a gravity trunk sewer will be constructed along the Castle Peak Road between Ngau Tam Mei and San Tin, and a section of the trunk sewer alignment will be constructed along the Ngau Tam Mei Channel. The construction of the above sewerage project has been assessed in the above-mentioned EIA report.

Currently, there is no committed construction programme for the said sewage pumping station and the public sewers. The EIA report has stated that all works will be carried out in small sections with each section lasting only a short period of time. These activities should not generate significant amounts of construction dust, and will therefore unlikely cause cumulative dust impacts. It has also recommended in the same report that the construction works should be carried out in 50m segments. The contractor is also obliged to follow the procedures and requirements given in the Air Pollution Control (Construction Dust) Regulation. Therefore, the active works areas should be small. In addition, an EM&A programme will be implemented for this project to ensure implementation of and review of the effectiveness of the mitigation measures.

Similarly, based on the information in a separate EIA report for "Construction of Cycle Tracks and the Associated Supporting Facilities from Sha Po Tsuen to Shek Sheung River" (EIA Application No. EIA-159/2008), a cycle track will be provided along the Castle Peak Road and Yau Pok Road as part of the cycle track project between Tuen Mun and Sheung Shui under PWP Item No. 7259RS.

According to the EIA report, the concerned construction of cycle track project will involve construction of a narrow strip of cycle track, which will be constructed in sections. Typically, the active works area will be 40 m long by 4 m wide and no adjacent sections (200m between two neighbouring sections) will be constructed simultaneously. The EIA report concluded that the construction dust can be controlled at source to acceptable levels with the implementation of dust control measures stipulated under the *Air Pollution Control (Construction Dust) Regulation*. The approved EIA report has also recommended a series of measures for suppressing dust on site, including spraying the works area for site clearance with water before, during and after the operation so as to maintain the entire surface wet.

With the wetting of the whole construction site and keeping the construction area small, the potential dust impacts arising from the cycle track construction are expected to be minimal.

4 Agreement No. CE 66/2001(EP), EIA and TIA Studies for the Stage 2 of PWP Item No. 215DS - Yuen Long and Kam Tin Sewerage and Sewage Disposal (YLKTSSD), Environmental Impact Assessment (Final), Mar 2004.

Hence, no unacceptable impacts are anticipated. In addition, an EM&A programme will be implemented for that Project during the construction phase, to check effectiveness of the recommended mitigation measures and compliance with relevant statutory criteria.

Given that the concerned construction works for the above two approved EIA projects are relatively small in scale (i.e. laying sewers along an existing road, and construction of a cycle track), and that the construction will only be carried out in small sections (less than 50m for the public sewers, and 40m for the cycle track), adverse dust impacts are not expected from the construction works of these projects with the implementation of mitigation measures recommended in the corresponding approved EIA reports.

EM&A programme will also be implemented to monitor the effectiveness of the mitigation measures during construction of these projects, and the contractors will be required to follow the procedures and requirements as stipulated in the Air Pollution Control (Construction Dust) Regulation to control dust emission. As all of these approved projects will also be subject to control under the EIAO, cumulative air quality impact from this Project will be controlled through implementation measures described in this report and those committed for the other projects. According to the above-mentioned EIA reports, with the recommended mitigation measures, adverse dust impacts are not expected to arise from these projects and the residual construction air quality impacts are expected to be acceptable. As such, air quality impacts due to the above-mentioned adjacent projects are not considered further in this Study.

3.6.1.4 Concurrent Construction Due to Nearby Planned Development Projects

As discussed in Section 3.5.1 and Section 1.9, there are a few planned development projects adjacent to the Project Site. According to the EIA Study Brief of these planned development projects, the proposed developments of these projects are also for low-rise and low-density residential developments (i.e. similar to this Project). Since all these projects are located in relatively flat area, it is expected that the construction scale of these project sites will be similar to this Project and major sources of air quality impact during the construction of these planned development sites would be fugitive dust emissions during the site formation stage.

As discussed above (Section 3.6.1.1 refers), site formation works of the proposed residential area as well as buffer planting area in adjacent to WRA has been identified as the major sources of air quality impact during the construction phase of this Project, which will commence in December 2015 for completion by April 2017 (**Appendix 3-1A** refers).

For the planned “Kam Pok Road Site”, it is an EIA project under the EIAO and has previously obtained an approval from TPB. Thus, reference was made to the published information as well as construction programe obtained from the project proponent of that project. Based on best available information, site formation works of that project will be undertaken between April 2016 and first half of November 2016, thus it may potentially overlap with the site formation of this Project (see **Appendix 3-1B** for its construction programe).

For the planned “RD Site”, it is also an EIA project under the EIAO and has previously obtained approval from the TPB. Thus, reference was made to the published information as well as construction programe obtained from the project proponent of that project. Based on information obtained previously, site formation works for the planned “RD Site” will be undertaken between May 2017 and October 2017 (i.e. after the completion of site formation of this Project) (see **Appendix 3-1B**). It is also understood from the Project Proponent of that project that the construction works of that project may be further delayed (i.e. no concurrent works).

For the planned "REC Site", an EIA report for that development project has recently been approved, thus reference is made to the published construction programme of that Project. According to the published information, the site formation works of that project has been arranged so that the southern portion of that project will be constructed first. Given the separation distance that the southern portion is over 350m away from this Project Site, potential impact due to construction activities has been minimised. In addition, the site formation work of the planned "REC Site" is to commence in November 2017 (after the completion of site formation of this Project).

Since construction works of this Project will unlikely overlap with the adjacent planned "RD Site" as well as planned "REC Site", cumulative air quality impacts are very unlikely, and are not considered further in this assessment.

For the planned "Kam Pok Road Site", given to the fact that the concerned "Kam Pok Road Site" project is distant away from this Project with a shortest separation distance over 360m between the site boundary of this Project and the planned "Kam Pok Road Site" project boundary. There are currently no existing ASRs immediately adjacent to these two project sites that may be worst affected due to the concurrent construction activities of the two project sites. As such, construction of that project is unlikely to result in any adverse impacts on ASRs. Air quality impact of that Project will be controlled through the implementation of mitigation measures committed for that project under its EIA study.

Nevertheless, a sensitivity test has been undertaken to evaluate potential cumulative impacts due to concurrent construction with the planned "Kam Pok Road Site" project, which is presented in Section 3.10.2.

3.6.2 Operational Phase

3.6.2.1 Identification of Potential Impacts

According to Para 3.9.1.4 (iv) of the EIA Study Brief, a quantitative impact evaluation following the methodology in para. 3.9.1.4(v) shall be carried out if the assessment indicates likely exceedance of the recommended limits set forth in the TM on the Project Area and at nearby air sensitive receivers (ASRs). Given the scale of this Project (for small houses development), vehicular emissions due to traffic generated/ attracted by this Project is unlikely to be significant. It is expected that the Project itself will unlikely give rise to any adverse air quality impact during its operation (see Section 3.6.2.2).

Vehicular emissions from off-site sources are identified as the potential source of air pollution during the operational phase of the Project. However, since sufficient setback distance has already been provided between the development and the road networks, its potential impacts are anticipated to be insignificant.

A review of chimney locations based on EPD's register previously obtained, were carried out. No chimney was identified within the Assessment Area. Additional chimney surveys were also conducted on 30 Mar 2009, 10 July 2009, and 29 Oct 2010. There was no change to the site condition observed during the subsequent visits on 10 December 2010, 28 July 2011, 12 October 2011, 07 February 2013, and 24 February 2014. As no chimney was identified within the Assessment Area in the verification surveys, no air quality impact related to chimney emissions is expected and therefore not considered further in this assessment.

In addition, odour impact from nearby sewage treatment plants (STPs) may also be of concern. Given the long buffer distance (more than 500 m) between the existing STPs (private STPs serving the Palm Springs, Royal Palms and the Fairview Parks) and the Project, the potential odour impacts are considered insignificant. The future Ngau Tam Mei Sewage Pumping Station (SPS) is planned to be located at the junction of the Kam Pok

Road and the Castle Peak Road (about 206m from the Subject Site) (**Figure 3-1** refers). With the careful design of the SPS, installation of odour removal system, and the substantial separation between the future SPS and the proposed development, such odour impact due to the SPS would be insignificant.

Regarding the interim STP within the Project Site, it is currently envisaged that the interim on-site STP for the proposed development will be a combination of membrane bioreactor (MBR) system and reverse osmosis (RO) system downstream. RO system is a totally enclosed system; while the MBR will be a semi-enclosed system. However, the interim STP will be located within a totally enclosed building of which the MBR and RO system will be located underground. Details of the proposed STP system are provided in Chapter 6 of this report.

The interim STP will only be operated if the future public sewerage system is not in place by the time the residential portion of the Project is occupied. Eventually, the proposed development will connect to the public sewerage system when it becomes available. The enclosed interim STP will be located at the south western end of the Project Site.

The layout of the facilities for the development will be carefully planned such that the refuse collection point (RCP) of the residential development (a potential odour generator) will be away from the residential area but will be close to the main access area connecting the main road. During the detailed design stage, the minimisation of odour at the RCP will be considered further to reduce any localized impact.

3.6.2.2 Evaluation of Impacts

Vehicular Emissions

Adverse vehicular emissions impact from the major roads (e.g. San Tin Highway (an Expressway) and Castle Peak Road (a Rural Road)) is not expected as the sensitive receivers of this Project are distant away from the concerned major roads (**Figure 3-1** refers). The concerned separation distance between the sensitive uses of this Project and the road edge of above-mentioned major roads (> 254 m) can already satisfy the buffer distance requirement for Trunk Road (i.e. >20m) for active and passive recreation uses according to Chapter 9, Environment of the Hong Kong Planning Standard and Guidelines (HKPSG).

As for nearby local access roads (e.g. Yau Pok Road and Kam Pok Road), the Project Site is also setback from these roads by existing roadside slopes surrounding the Project Site. The separation distance measured between the nearest sensitive uses of the Project Site and the road edge was shown in **Figure 3-1**. The separation distance (>= 24m) can already satisfy the buffer distance requirement for Local Distributor (i.e. >5m) for active and passive recreation uses according to Chapter 9 of the HKPSG.

During operation of the proposed development, there will be additional traffic generated as a result, which may potentially affect other nearby existing/ planned ASRs. However, it is not expected that there will be any adverse air quality impact given the scale of this Project (for small house development). A sensitivity test on vehicular emissions upon nearby roads due to the additional traffic generated/ attracted by this Project (up to 27 vehicles/ hour), has been undertaken based on a worst case scenario (see **Appendix 3-12**). According to the sensitivity test results, the contribution of vehicular emissions by this Project is insignificant and negligible as such this Project will not attribute to any deterioration on air quality. Furthermore, existing ASRs nearby such as Fairview Park and Yau Mei San Tsuen are further setback from Yau Pok Road and with adequate separation distance, thus they are unlikely be impacted by vehicular emission from nearby road networks as well.

Since the buffer distance provided by this Project can already satisfy the HKPSG requirement, and no significant vehicular emission is expected due to this Project, there will

be no adverse air quality impact due to vehicular emissions on nearby road networks. As such, it is not assessed further in this assessment.

Industrial Emissions

As discussed in Section 3.6.2.1, no industrial chimney was identified within the Assessment Area. Thus, potential air quality impacts due to emissions from chimneys are not anticipated for this Project. Thus, it is not assessed further.

Odour from STPs and Proposed SPS

The three existing private STPs serving the Palm Springs, Royal Palms and the Fairview Parks are all located at more than 500 m from the residential portion of the proposed development. Therefore, it is anticipated that no sewage related odour impacts from these existing STPs are expected at the Project Site.

Based on the information provided by DSD and EPD, planned Ngau Tam Mei SPS will be provided at the junction of the Kam Pok Road and the Castle Peak Road under PWP Item 4235DS. The Ngau Tam Mei SPS is about 206 m southeast of the Project Site. According to the EIA report for the Stage 2 of PWP Item No. 215DS – Yuen Long and Kam Tin Sewerage and Sewage Disposal (EIA-094/2004), odour removal filtering system will be installed in the Ngau Tam Mei SPS and the predicted odour concentration at existing ASR at Yau Mei San Tsuen (adjacent to Project Site) would be reduced to 0.030 OU[5] which is 0.6% of 5 OU criteria. With the odour removal filtering system and long buffer distance from the future SPS, adverse odour impact on the Project Site is considered unlikely.

An odour patrol has been undertaken in May 2014. The odour patrol was conducted by qualified odour panellist using their olfactory sensors to sniff odour at different locations during the atmospheric temperature of 30°C or above. The patrol has identified existing odour sources and included a ground truthing along existing drainage channels surrounding the Project boundary, which may affect the Project Site. Further odour intensity checking was also carried out at key locations at the channels as well as adjacent to the Project Site boundary. According to the odour patrol results, no odour emission sources which may adversely affect the Project Site were found to be in adjacent to the Project Site, and that the odour intensity along the nearby drainage channels was found to be very minimal or negligible. Thus, the Project Site is not adversely affected by any existing odour emission sources during the operational phase (see **Appendix 3-11B**).

As for the interim STP of this Project Site, according to the sewerage impact assessment of this Project (Section 6.7 refers), the design of interim sewage treatment plant will handle about 148 m^3/day sewage (under ADWF). The interim STP for the Project Site will be located within a totally enclosed building of which the MBR and RO system will be located underground. It is expected that the exhaust will be directed away from nearby ASRs as well as proposed buildings of this Project. Detailed design of the interim STP has yet to be carried out. An odour impact assessment has been carried out for the proposed STP based on worst case scenario, details of which are provided in **Appendix 3-11A**. It was found that with environmental conscious design of an effective odour removal system (with an odour

5 Agreement No. CE 66/2001(EP), EIA and TIA Studies for the Stage 2 of PWP Item No. 215DS - Yuen Long and Kam Tin Sewerage and Sewage Disposal (YLKTSSD), Environmental Impact Assessment (Final), Mar 2004. The existing village houses at Yau Mei San Tsuen are 2-3 storeys high. According to Appendix 7.4 of the above EIA report, the mitigated odour level at ASR (AN07 and AN09) at Yau Mei San Tsuen would be 0.027 OU and 0.030 OU, respectively, at a level of 10m above ground level.

removal efficiency of not less than 99.5%), the odour concentration at the exhaust would be significantly reduced to below the specified odour criteria and no odour impacts are expected to arise from the operation of the interim on-site STP.

Given that the Project Site is not subject to any odour impact from existing or planned odour sources, and that no adverse odour impact would arise from the proposed interim STP of this Project, it is therefore expected there will be no significant odour impact upon the development site or its surroundings.

3.7 Assessment Methodology

3.7.1 Emission during Construction Phase

3.7.1.1 Introduction

As discussed above (Section 3.6.1.1), site formation of the residential area as well as the buffer planting area along its edge in adjacent to the WRA area, has been identified as for construction air quality assessment and fugitive dust could be generated during the site formation phase. TSP, RSP and FSP have been identified as the parameters for air quality impact assessment.

The following paragraphs describe the air quality assessment methodology. For the purpose of this air quality impact assessment, information such as boundaries of sub-zones and works programme have been based on construction activities and information provided by the Engineer. During the detailed design stage, there may be minor amendment according to the site condition (e.g. the boundaries of sub-zones). However, it is expected that such minor amendments will not affect the outcome of assessment results given that current divided each sub-zone would only represent a small percentage of the works area in any one time (an average of about 5% as shown in **Appendix 3-9**).

3.7.1.2 Emission Sources

In order to minimize potential dust impacts, the construction programme for the Project Site (see Appendix 3-1A) has been designed so as to minimize overlapping in construction programme as far as possible. According to the construction programme, the concerned site formation will be carried out between December 2015 and April 2017.

In addition, the site formation works of the Project Site will not overlap with the adjacent planned “REC Site” and “RD Site” so that cumulative impacts can be avoided (Section 3.6.1.4 refers). For planned “Kam Pok Road Site” project, as discussed in Section 3.6.1.4 above, a sensitivity test has been undertaken in order to assess the cumulative impacts due to concurrent works. Please refer to Section 3.10.2 for details.

According to Section 3.6.1.2, the following activities during site formation stage that would attribute to dust emissions have been taken into account in the assessment:

- Removal and unloading of soil materials by excavators;
- Earth loading/ unloading, and stockpiling;
- Bulldozing and surface compaction;
- Wind erosion on exposed ground; and
- Vehicle movements on haul roads

3.7.1.3 Emission Strength

Unmitigated Scenario

Emission rates of the dusty activities given above were based on typical values and emission factors documented in Compilation of Air Pollutant Emission Factors (AP-42) 5th Edition published by USEPA. In order to represent the worst case scenario, the upper bound or the lower bound of the range of typical values provided in the AP-42 document has been used in deriving the emission rates (i.e. higher emission rate is adopted) (also refer to Appendices 3-2 and 3-3 for details). The unmitigated scenario refers to the calculated emission rates based on AP-42 without any mitigation measures. The works area will refer to the corresponding site boundary of the Project Site.

The concerned site formation of the residential area as well as the buffer planting area along its edge in adjacent to the WRA area has been identified as the dust emission sources to be modelled as area sources. Detailed calculation of emission rates corresponding to each of the activities described in Section 3.7.1.2, are also given in **Appendices 3-2 and 3-3.**

In the assessment, it has been assumed that the concerned whole works area will be constructed at the same time and soil surface is exposed to atmosphere. Since the calculated emission factors for filling/excavation works are higher than that due to removal of surcharge, to be conservative, the emission factors calculated for filling/ excavation works are adopted in the unmitigated scenario.

Mitigated Scenario

Based on the above worst case emission rates calculated according to the AP-42 document, the mitigated scenario refers to mitigated emission rates after the implementation of proposed mitigation measures of this Project and measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* (Section 3.9.1 of this report refers). Detailed calculation of mitigated emission rates corresponding to each of the activities described in Section 3.7.1.2, are also given in **Appendices 3-2 and 3-3.**

Currently, the Project Site is a green field site and is covered by grass. During the construction phase, construction works will be carried out in phases and the grass land at the unaffected area will be maintained so that the soil underneath is not exposed to the atmosphere (i.e. there will be no wind erosion).

In order to minimize dust emission during site formation, it is expected that the concerned works area (i.e. residential area as well as the buffer planting area along its edge in adjacent to the WRA) will be divided into 7 sub-zones (i.e. a total of 21 sub-zones as shown in **Appendix 3-8**) based on information provided by the Project Proponent and the Engineer. Within each Phase, only one sub-zone will be under construction in any one time in order to avoid cumulative impacts. The corresponding % active area of each sub-zone in respect to the total residential developement area is given in **Appendix 3-9** with an average value of about 5%.

As mentioned above, the Project Site is currently a green field site, as such, the construction works within the active sub-zone will be the only emission source since the remaining areas of the Project Site is covered by grass and will not be affected (i.e. no dust emission for the remaining areas). Once construction for a sub-zone is completed, the works area will be compacted, covered by tarpaulin sheet and hydroseeded before construction of another zone. Watering will also be applied on regular basis. Thus, there will be no cumulative construction impacts.

According to the construction programme in **Appendix 3-1A**, the concerned site formation works would basically involve “filling/ excavation” and “removal of surcharge”. Concerned works will be carried out in phases (Phases B, C, and D), and the concerned whole construction period will commence in December 2015 until April 2017.

Phase B site formation works will be carried out before the commencement of works at Phases C and D (i.e. only one sub-zone within Phase B will be constructed in any one time). The filling/ excavation of Phase B will be carried out between December 2015 and middle of May 2016. While the "filling/ excavation" works of Phases C and D may more or less overlap with each other. As such, in assessing the air quality impact, to be conservative, it has been assumed that the "filling/ excavation" works of Phases C and D will be constructed at the same time (i.e. one sub-zone in Phase C and one sub-zone in Phase D will be constructed simultaneously) for a period between middle of May 2016 and October 2016 in order to represent a worst case scenario.

During site formation of each Phase, the excavation/ filling works will require a construction period of about 5 months, while the removal of surcharge will take another 1.5 months. Accordingly, it is estimated that construction of each construction sub-zone will take an average of about 24 calendar days during excavation/ filling works, and 6 calendar days during removal of surcharge. These have been adopted in the air quality assessment for assessing the short-term (hourly and daily) impacts.

For the long-term impact (annual), it has been based on the peak site formation period between December 2015 and November 2016 (i.e. 12 months) where most of the filling and excavation materials involved (source of emission) during site formation stage are taken into account (i.e. worst case).

Due to the phased construction area, only limited space and construction plants will be available for construction in any one time. Thus, the construction activities that would contribute to dust emissions as identified in Section 3.7.1.2, particularly the removal and unloading of soil materials by excavators; earth loading/ unloading, stockpiling; and bulldozing and surface compaction, will unlikely to operate at the same time. In fact, only one of the above activities will operate in any one time. However, to be conservative, air quality impacts due to simultaneous construction of these activities have been taken into account in this assessment.

3.7.1.4 Modelling Approach

Use of ISCST Model for Dispersion Modelling

The TSP, RSP and FSP parameters were modelled using the software "Industrial Source Complex Short Term (ISCST)" developed by Trinity Consultants Incorporated. The ISCST model is based on the principle of Gaussian dispersion and is widely accepted by authorities worldwide including the Hong Kong Environmental Protection Department (EPD) and the United States Environmental Protection Agency (USEPA). The model has used the following input data/ parameters in the simulation:

- Hourly mixing height data from MM5 was adopted;
- Hourly Pasquill stability classes generated by PCRAMMET;
- Wind direction and speed, temperature, raw from MM5;
- Pre-processed wind speeds capped at 1 m/s;
- Anemometer height taken at 10mAG which is half of the thickness of Layer 0 (ground layer) of the MM5 model;
- "Rural" dispersion option was used;
- No wet and dry deposition assumed;

Since the representative ASRs are mainly low-rise (2- to 3-storey high) buildings, the assessment height for the ASRs is taken from the ground level including 1.5m breathing zone up to 7.5m for the upper floor at the ASRs.

Processing of the MM5 Meteorological Data

Meteorological data derived using MM5 model has been adopted for the assessment. To enable the use of MM5 meteorological data in a format that can readily be accepted by the Gaussian models ISCST3, raw MM5 data were extracted, converted and pre-processing by PCRAMMET. PCRAMMET combines the twice-daily mixing heights data record measured at the King's Park weather station (2010) to produce the following additional data:

- Hourly Pasquill stability classes;
- Interpolated hourly values from daily morning and maximum mixing heights measured at King's Park in 2010;
- Converted meteorological data in a format acceptable to the ISCST3/ CALINE4.

Background Air Pollutants Concentrations

For the purpose of evaluating the construction and operational phase air quality impacts, background contributions are based on EPD's PATH concentration output. According to "Guidelines on Assessing the 'TOTAL' Air Quality Impacts" published in EPD's website, hour-by-hour background contribution is estimated using output of PATH model.

The background hourly air quality data at the same grid covering the ASRs are extracted from PATH model output file to calculate the overall air pollutants concentrations for each hour. Grids (20,40) of the PATH domain are considered relevant as they coincide with the locations of the ASRs mentioned in Section 3.5.

For a conservative assessment, the PATH simulated background air quality data of Year 2015 has been adopted.

Background contributions of RSP is based on concentration of each hour in PATH's concentration output. As background contribution of FSP is not directly available from PATH model. According to "Guidelines on the Estimation of FSP for Air Quality Assessment in Hong Kong", background contribution of FSP is deduced based on the following conservative formula.

Daily($\mu g/m^3$): FSP = 0.75 x RSP

Annual($\mu g/m^3$): FSP = 0.71 x RSP

For TSP background contribution, the RSP contribution in PATH's concentration output is adopted instead.

Post-Processing of Model Output Data

Maximum 1-hour average TSP concentrations, as well as 24-hour average, and annual average RSP and FSP concentrations were predicted at the representative ASRs. The outputs were then combined and post-processed on an hour-by-hour basis, and then superimposed with the derived from the PATH output (see Section 3.4) (background level) for comparison with the air quality objectives specified in Table 3-1 and the 1-hour TSP limit of 500$\mu g/m^3$ specified in EIAO-TM.

Contour plots of the above parameters are prepared based on the worst hit level. Contour plots of the maximum 1-hour average TSP concentrations and the annual average RSP and

FSP concentrations, are based on the maximum predicted level. Contour plots of the 24-hour average RSP and FSP concentrations are based on the 10th highest predicted level in accordance with the relevant AQOs.

Assumptions Adopted in Modelling

The following assumptions have been adopted in this modelling exercise for both the unmitigated and mitigated scenarios:

- The construction works will be undertaken from 0800 to 1800 hours during general weekdays (i.e. day-time) and 25 working days per month;
- It is expected that there will be no construction works during restricted hours (i.e. 1900 to 0700 hours of the next day, and any time on a general holidays, including Sunday). Construction works within restricted hours would require advance application for a Construction Noise Permit from EPD;
- Since there will be no construction activities during restricted hours, and on Sundays and general holidays, the calculated emission rates in Section 3.7.1.3 have been applied to day-time hours during general weekdays only (i.e. 0800 to 1800 hours) only. While the hours from 1800 to 0800 are adopted for impact assessment of wind erosion on the site; and
- The estimated maximum no. of trucks during site formation is 10 trucks per hour according to the Engineer;

As discussed above (Section 3.6.1.1), site formation of the residential area as well as the buffer planting area along its edge in adjacent to the WRA area has been identified for construction air quality assessment. For the unmitigated scenario, it is assumed that the construction activities will be carried out within the concerned whole construction area at the same time, i.e. no phasing of the construction activities.

For the mitigated scenario, the following assumptions have been adopted in the modeling exercise:

- The construction programe and duration of site formation works has been based on the construction programme in **Appendix 3-1A** and the phased construction method described in **Appendix 3-8.** As shown in **Appendix 3-8**, the construction is divided into 21 sub-zones; and the construction period of each sub-zone is about 24 calendar days (for filling and excavation) and 6 calendar days (for removal of surcharge). Within each of Phase B, C and D, only one sub-zone will be under construction in any one time. Therefore, in assessing the air quality impact (both short-term and long-term), only one sub-zone is considered in the assessment.
- As the construction will be carried out in phases, the duration of construction works of each sub-zone that will affect the ASR will be relatively short. After the construction of one sub-zone, construction works will be shifted to another sub-zone which is relatively far away from the ASR (i.e. less affected by construction works). In order to simulate the phased construction approach, the above-mentioned duration of works is set for each sub-zone and the model is driven by the obtained hourly meteorological data (i.e. 8,760 hours/ year) in order to obtain the hourly emission levels. Based on which, the maximum hourly level, daily average level, and annual average level have been derived accordingly.
- For Phases C and D, since their construction programe is more or less overlapped, it has been assumed that Phases C and D will be constructed at the same time to represent a worst case scenario;
- During construction of each sub-zone, construction activities within that sub-zone will be the only dust emission source, while the remaining area of the Project Site is

currently covered by grass and will not contribute to any dust emission (i.e. zero contribution);

- The designated haul road should be hard paved (this requirement has been stated in Section 3.9.1, and will be followed by the Contractor(s) of this Project);
- Dust suppression measures in terms of frequent watering are proposed. Water will be sprayed frequently during day-time (e.g. eight times a day) with water browser or manually. The calculated dust suppression efficiency taken into account the dust suppression measures, is also provided in **Appendix 3-9**, i.e. 90% efficiency. The concerned dust suppression efficiency has been applied to both the short-term impacts (e.g. hourly and daily) and long-term impacts (e.g. annual); and
- Relevant requirement of the above has also been stated in Section 3.9.1 and will be included in the Project EM&A Manual for implementation.

3.7.2 Operational Phase

3.7.2.1 Vehicular Emissions Due to the Project

As discussed in Section 3.6.2.2, the proposed development can satisfy the HKPSG requirements in terms of buffer distance from nearby roads and there is no industrial chimney identified within the Assessment Area.

In addition, as discussed in Section 3.6.2.2, a sensitivity test on vehicular emissions due to the additional traffic generated/ attracted by this Project, has been undertaken. Details of the assessment methodology and assumptions are already listed in **Appendix 3-12**, which is not repeated here. The following paragraphs briefly describe the assessment methodology, while details should refer to **Appendix 3-12**.

RSP, FSP and NO_2 have been determined to be focued in the assessment. Peak hour traffic flow data was obtained from the traffic consultant, and emission model EMFAC-HK was adopted to calculate the vehicle emission factors. Year 2018 (Project completion year) is chosen as the Calendar Year in EMFAC-HK Model to represent the worst case scenario emissions.

In order to represent a worst case scenario, it has also been assumed that the AM peak hour traffic flow and traffic composition would persist for 24 hours of a day and throughout the whole year. Typical worst-case meteorological conditions were assumed :

- Wind direction: worst-case angle selected by model
- Wind speed: 1 m/s
- Directional Variability: 6°
- Stability Class: F
- Mixing Height: 500 m
- Temperature: 20 ℃

Vehicular emissions were calculated by the dispersion model “CALINE4”. The modelled hourly concentrations have been converted to daily average concentration and the annual average level was also calculated.

According to the sensitivity results, vehicular emissions due to the additional traffic generated/ attracted by this Project are found to be insignificant and negligible, thus no adverse air quality impacts due to vehicular emissions are anticipated and are not assessed further. During the operational stage, no adverse impact is anticipated as the proposed residential development itself will not have any emission generating activities during the operational phase.

3.7.2.2 Odour Emission Due to Proposed STP

The interim sewage treatment plant (comprising MBR system and RO system) will be within a totally enclosed building of which the MBR and RO system will be located underground. The exhaust will be directed away from nearby ASRs. With environmental conscious design of an effective odour removal system at the exhaust of the STP (with an odour removal efficiency of not less than 99.5%), the odour concentration at the exhaust would be significantly reduced to below the specified odour criteria.

An odour impact assessment has been undertaken for the proposed STP based on a worst case scenario. The following paragraphs briefly describe the assessment methodology, while details of which and the assessment results are provided in **Appendix 3-11A**.

Odour Sources and Emission Strength

Potential locations of odour sources of the proposed STP have been obtained from the Engineer, which include sources from the preliminininary treatment unit; MRB treatment unit; and Slude treatment unit. As the proposed STP is to serve the proposed residential development, reference has ben made to the published odour emission strength from other similar facilities (e.g. sewage treatment plants managed by the Drainage Services Department (DSD) of Hong Kong SAR Government). Information of odour emission sources and odour strength has been collected for STPs using MBR system, which is comparable to this Project. It is considered that the reported odour emission strength would represent a worst case scenario of this Project given that this Project only concerns domestic sewage from proposed 70 houses and club house, and that the concerned odour strength is unlikely to be in the same magnitude as DSD's STPs, which are designed for a much larger treatment capacity.

The concerned odour emission strength is assumed to last 24 hours a day and 365 days a year in order to represent a worst case scenario.

Modelling Approach

The modelling was based on the software "Industrial Source Complex Short Term (ISCST)" developed by Trinity Consultants Incorporated. The ISCST model is based on the principle of Gaussian dispersion and is widely accepted by authorities worldwide including the Hong Kong Environmental Protection Department (EPD) and the United States Environmental Protection Agency (USEPA). The odour emission sources were modelled as point source. Anemometer height was taken at 10mAG, and "rural" dispersion option was used.

The proposed development falls within grid(20,40) in PATH system, thus meteorological data derived using MM5 model (grid(20,40)) has been adopted for the assessment with the same methodology described in Section 3.7.1.4 above.

The ISCST3 model output for 1-hour average concentration was then converted into 5-second average by taking into account the stability classes in order to enable a direct comparison with the relevant odour criteria (i.e. 5 odour unit under the EIA-TM).

As there are no other odour emission sources which may adversely affect the Project Site were found in adjacent to the Project Site as per the odour patrol results (Section 3.6.2.2 and **Appendix 3-11B** refer), the predicted odour concentration due to the proposed STP would represent the overall odour level at the sensitive receviers.

Assessment Results

It was found that with environmental conscious design of an effective odour removal system at the exhaust of the STP (with an odour removal efficiency of not less than 99.5%), the

odour concentration at the exhaust would be significantly reduced to below the specified odour criteria and no odour impact is expected to arise from the operation of the interim on-site STP.

3.8 Construction Phase Air Quality Impact Assessment Results (Unmitigated Scenario)

3.8.1 Short-term and Long-term Impacts

The predicted unmitigated hourly average TSP concentrations, as well as daily average and annual average RSP and FSP concentrations due to construction of this Project have been assessed according to the methodology described in Section 3.7.1, and the results are presented in Table 3-4 to Table 3-8. Location map of representative ASRs selected for fugitive dust assessment is shown in **Figure 3-2**.

Details of the calculated emission rates are also provided in **Appendices 3-2 and 3-3**. Details of calculation results are also presented in **Appendices 3-4** and **3-5**. Contour plots based on the worst hit level are also provided in **Figures 3-3 to 3-7**.

Table 3-4 Predicted Maximum Hourly TSP Concentrations Due to This Project (Unmitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	TSP Concentration (µg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	1300 / 1286 / 1258	1136 / 1122 / 1094
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	1344 / 1330 / 1303	1180 / 1166 / 1139
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	1221 / 1206 / 1177	1057 / 1042 / 1013
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	1257 / 1239 / 1205	1093 / 1075 / 1041
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	1784 / 1751 / 1688	1620 / 1587 / 1524
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	2060 / 2011 / 1915	1896 / 1847 / 1751
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	2587 / 2357 / 1968	2423 / 2193 / 1804
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	2142 / 1976 / 1719	1978 / 1812 / 1555
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	2860 / 2706 / 2429	2696 / 2542 / 2265
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	4078 / 3324 / 2680	3914 / 3160 / 2516
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	3308 / 2981 / 2444	3144 / 2817 / 2280
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	11363 / 5962 / 3352	11199 / 5798 / 3188
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	2012 / 1972 / 1895	1848 / 1808 / 1731
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	1893 / 1862 / 1800	1729 / 1698 / 1636
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	1702 / 1674 / 1620	1538 / 1510 / 1456
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	1588 / 1564 / 1518	1424 / 1400 / 1354
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	1211 / 1200 / 1177	1047 / 1036 / 1013
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	1048 / 1038 / 1019	884 / 874 / 855
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	1044 / 1035 / 1016	880 / 871 / 852
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	785 / 772 / 747	621 / 608 / 583
A15	Man Yuen Tsuen village house	4.1	1.5 / 4.5 / 7.5	603 / 595 / 580	439 / 431 / 416
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	8653 / 4475 / 2817	8489 / 4311 / 2653
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	7868 / 3959 / 3051	7704 / 3795 / 2887
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	3585 / 3164 / 2502	3421 / 3000 / 2338
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	4441 / 3375 / 2435	4277 / 3211 / 2271
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	1412 / 1371 / 1294	1248 / 1207 / 1130
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	1163 / 1140 / 1097	999 / 976 / 933
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	1272 / 1229 / 1147	1108 / 1065 / 983
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	1008 / 998 / 978	844 / 834 / 814

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	TSP Concentration (μg/m^3)	
				With Background **	Without Background *
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	6146 / 5318 / 4034	5982 / 5154 / 3870
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	6019 / 5241 / 4020	5855 / 5077 / 3856
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	2126 / 2059 / 1940	1962 / 1895 / 1776
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	2800 / 2695 / 2498	2636 / 2531 / 2334
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	1367 / 1352 / 1322	1203 / 1188 / 1158
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	2394 / 2160 / 1929	2230 / 1996 / 1765
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	2700 / 2424 / 2032	2536 / 2260 / 1868
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	2220 / 2148 / 2013	2056 / 1984 / 1849
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	5244 / 4409 / 3171	5080 / 4245 / 3007
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	1047 / 1037 / 1017	883 / 873 / 853
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	6326 / 4737 / 2847	6162 / 4573 / 2683
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	5309 / 4800 / 3967	5145 / 4636 / 3803
A35	Palm Springs	5	1.5 / 4.5 / 7.5	3457 / 3186 / 2720	3293 / 3022 / 2556
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	5189 / 3754 / 2854	5025 / 3590 / 2690
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	6327 / 5203 / 3716	6163 / 5039 / 3552
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	2117 / 2055 / 1937	1953 / 1891 / 1773
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	7535 / 4895 / 3274	7371 / 4731 / 3110
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	1930 / 1887 / 1804	1766 / 1723 / 1640
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	2030 / 1981 / 1889	1866 / 1817 / 1725
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	1617 / 1580 / 1509	1453 / 1416 / 1345
V02	Planned “V” zone	2.4	1.5 / 4.5 / 7.5	4777 / 4020 / 3040	4613 / 3856 / 2876
V03	Planned “V”zone	3	1.5 / 4.5 / 7.5	1504 / 1480 / 1434	1340 / 1316 / 1270
V04	Planned “RD” zone	4.8	1.5 / 4.5 / 7.5	1258 / 1244 / 1216	1094 / 1080 / 1052
Max. Conc. (with bkg.)	**-**		**-**	**11,363**	**11,199**
Criteria	**-**		**-**	**500**	**500**

Remark: * Concentration due to contribution of Project Site.

** Total concentration due to contribution of the Project Site as well as background concentration in the PATH output. The predicted TSP level due to this Project has already exceeded the relevant air quality criteria regardless the background level (i.e. mitigation measures will be required regardless the background level), thus in calculating the total concentration of TSP (i.e. background + Project contribution), the maximum hourly RSP level from the PATH output file (i.e. 164 μg/m^3 according to Appendix 3-1C) is used as a conservative approach.

Table 3-5 Predicted Daily Average RSP Concentrations Due to This Project (Unmitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	RSP Concentration (μg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	164 / 163 / 161	42 / 41 / 39
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	168 / 167 / 166	46 / 45 / 44
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	167 / 167 / 165	45 / 45 / 43
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	172 / 171 / 169	50 / 49 / 47
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	194 / 193 / 190	72 / 71 / 68
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	196 / 194 / 190	74 / 72 / 68
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	234 / 227 / 215	112 / 105 / 93
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	221 / 215 / 206	99 / 93 / 84
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	254 / 243 / 225	132 / 121 / 103
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	395 / 348 / 286	273 / 226 / 164
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	341 / 315 / 276	219 / 193 / 154
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	570 / 423 / 313	448 / 301 / 191
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	204 / 199 / 190	82 / 77 / 68
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	188 / 184 / 177	66 / 62 / 55
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	186 / 184 / 182	64 / 62 / 60
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	174 / 173 / 171	52 / 51 / 49
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	153 / 153 / 152	31 / 31 / 30
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	151 / 150 / 150	29 / 28 / 28
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	171 / 170 / 169	49 / 48 / 47
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	162 / 161 / 161	40 / 39 / 39
A15	Man Yuen Tsuen village house	4.1	1.5 / 4.5 / 7.5	152 / 151 / 151	30 / 29 / 29
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	553 / 402 / 296	431 / 280 / 174
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	562 / 409 / 301	440 / 287 / 179
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	304 / 290 / 267	182 / 168 / 145
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	294 / 271 / 243	172 / 149 / 121
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	168 / 166 / 163	46 / 44 / 41
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	163 / 162 / 160	41 / 40 / 38
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	161 / 160 / 158	39 / 38 / 36
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	143 / 143 / 142	21 / 21 / 20
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	280 / 270 / 253	158 / 148 / 131

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	RSP Concentration (μg/m^3)	
				With Background **	Without Background *
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	257 / 249 / 234	135 / 127 / 112
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	226 / 220 / 209	104 / 98 / 87
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	187 / 185 / 182	65 / 63 / 60
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	157 / 157 / 156	35 / 35 / 34
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	270 / 258 / 239	148 / 136 / 117
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	286 / 275 / 255	164 / 153 / 133
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	214 / 211 / 205	92 / 89 / 83
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	409 / 363 / 303	287 / 241 / 181
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	157 / 157 / 156	35 / 35 / 34
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	442 / 376 / 300	320 / 254 / 178
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	281 / 270 / 253	159 / 148 / 131
A35	Palm Springs	5	1.5 / 4.5 / 7.5	269 / 256 / 236	147 / 134 / 114
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	434 / 363 / 285	312 / 241 / 163
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	284 / 260 / 229	162 / 138 / 107
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	182 / 181 / 177	60 / 59 / 55
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	526 / 353 / 267	404 / 231 / 145
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	206 / 204 / 200	84 / 82 / 78
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	188 / 186 / 182	66 / 64 / 60
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	169 / 168 / 166	47 / 46 / 44
V02	Planned "V" zone	2.4	1.5 / 4.5 / 7.5	225 / 215 / 200	103 / 93 / 78
V03	Planned "V"zone	3	1.5 / 4.5 / 7.5	164 / 163 / 162	42 / 41 / 40
V04	Planned "RD" zone	4.8	1.5 / 4.5 / 7.5	160 / 160 / 159	38 / 38 / 37
Max. Conc.	**-**		**-**	**570**	**448**
No. of exceedance @				**>9**	**>9**
Criteria			**-**	**100 (no. of exceedance allowed <= 9)**	

Remark: The above results are based on the 1st highest daily average concentrations

@ According to Appendix 3-5, the no. of exceedance would exceed the relevant air quality criteria/ AQOs as the 10th highest value would also exceed the relevant air quality criteria/ AQOs.

* Concentration due to contribution of Project Site

** Total concentration due to contribution of the Project Site as well as background concentration in the PATH output. The predicted RSP level due to this Project at some of the ASRs nearby has already exceeded the relevant air quality criteria/ AQOs regardless the background level, thus in calculating the total concentration of

RSP (i.e. background + Project contribution), the maximum daily average RSP level from the PATH output file (i.e. 122 µg/m^3 according to Appendix 3-1C) is used as a conservative approach.

Table 3-6 Predicted Daily Average FSP Concentrations Due to This Project (Unmitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	FSP Concentration (µg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	103 / 103 / 103	12 / 12 / 12
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	105 / 104 / 104	14 / 13 / 13
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	105 / 104 / 104	14 / 13 / 13
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	106 / 106 / 105	15 / 15 / 14
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	113 / 112 / 111	22 / 21 / 20
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	113 / 113 / 111	22 / 22 / 20
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	125 / 123 / 119	34 / 32 / 28
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	121 / 119 / 116	30 / 28 / 25
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	131 / 127 / 122	40 / 36 / 31
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	173 / 159 / 140	82 / 68 / 49
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	157 / 149 / 137	66 / 58 / 46
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	225 / 181 / 148	134 / 90 / 57
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	116 / 114 / 111	25 / 23 / 20
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	111 / 110 / 108	20 / 19 / 17
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	110 / 110 / 109	19 / 19 / 18
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	107 / 106 / 106	16 / 15 / 15
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	100 / 100 / 100	9 / 9 / 9
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	100 / 99 / 99	9 / 8 / 8
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	106 / 105 / 105	15 / 14 / 14
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	103 / 103 / 103	12 / 12 / 12
A15	Man Yuen Tsuen village	4.1	1.5 / 4.5 / 7.5	100 / 100 / 100	9 / 9 / 9
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	220 / 175 / 143	129 / 84 / 52
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	223 / 177 / 145	132 / 86 / 54
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	146 / 141 / 135	55 / 50 / 44
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	142 / 136 / 127	51 / 45 / 36
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	105 / 104 / 103	14 / 13 / 12
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	103 / 103 / 102	12 / 12 / 11
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	103 / 102 / 102	12 / 11 / 11

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	FSP Concentration (μg/m^3)	
				With Background **	Without Background *
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	97 / 97 / 97	6 / 6 / 6
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	138 / 135 / 130	47 / 44 / 39
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	131 / 129 / 125	40 / 38 / 34
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	122 / 120 / 117	31 / 29 / 26
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	110 / 110 / 109	19 / 19 / 18
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	101 / 101 / 101	10 / 10 / 10
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	135 / 132 / 126	44 / 41 / 35
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	140 / 137 / 131	49 / 46 / 40
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	119 / 118 / 116	28 / 27 / 25
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	177 / 163 / 145	86 / 72 / 54
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	101 / 101 / 101	10 / 10 / 10
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	187 / 167 / 144	96 / 76 / 53
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	139 / 135 / 130	48 / 44 / 39
A35	Palm Springs	5	1.5 / 4.5 / 7.5	135 / 131 / 125	44 / 40 / 34
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	185 / 163 / 140	94 / 72 / 49
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	140 / 132 / 123	49 / 41 / 32
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	109 / 109 / 108	18 / 18 / 17
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	212 / 160 / 134	121 / 69 / 43
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	116 / 116 / 114	25 / 25 / 23
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	111 / 110 / 109	20 / 19 / 18
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	105 / 105 / 104	14 / 14 / 13
V02	Planned "V" zone	2.4	1.5 / 4.5 / 7.5	122 / 119 / 114	31 / 28 / 23
V03	Planned "V"zone	3	1.5 / 4.5 / 7.5	103 / 103 / 103	12 / 12 / 12
V04	Planned "RD" zone	4.8	1.5 / 4.5 / 7.5	102 / 102 / 102	11 / 11 / 11
Max. Conc.			**-**	**225**	**134**
No. of exceedance @				**>9**	**>9**
Criteria			**-**	**75 (no. of exceedance allowed <= 9)**	

Remark: The above results are based on the 1st highest daily average concentrations

@ According to Appendix 3-5, the no. of exceedance would exceed the relevant air quality criteria/ AQOs as the 10th highest value would also exceed the relevant air quality criteria/ AQOs.

* Concentration due to contribution of Project Site.

** Total concentration due to contribution of the Project Site as well as background concentration in the PATH output. The predicted FSP level due to this Project at some of the ASRs nearby has already exceeded the relevant air quality criteria/ AQOs regardless the background level, thus in calculating the total concentration of FSP (i.e. background + Project contribution), the maximum daily average FSP level from the PATH output file (i.e. 91 µg/m^3 according to Appendix 3-1C) is used as a conservative approach.

Table 3-7 Predicted Annual Average RSP Concentrations Due to This Project (Unmitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	RSP Concentration (µg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	49 / 49 / 49	6 / 6 / 6
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	48 / 48 / 48	5 / 5 / 5
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	50 / 49 / 49	7 / 6 / 6
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	50 / 50 / 50	7 / 7 / 7
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	52 / 52 / 51	9 / 9 / 8
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	55 / 55 / 54	12 / 12 / 11
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	63 / 62 / 60	20 / 19 / 17
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	61 / 60 / 58	18 / 17 / 15
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	67 / 65 / 63	24 / 22 / 20
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	106 / 95 / 82	63 / 52 / 39
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	86 / 81 / 73	43 / 38 / 30
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	91 / 77 / 66	48 / 34 / 23
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	48 / 47 / 47	5 / 4 / 4
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	46 / 46 / 46	3 / 3 / 3
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	51 / 51 / 51	8 / 8 / 8
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	51 / 50 / 50	8 / 7 / 7
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	45 / 45 / 45	2 / 2 / 2
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	44 / 44 / 44	1 / 1 / 1
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	47 / 47 / 47	4 / 4 / 4
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	46 / 46 / 46	3 / 3 / 3
A15	Man Yuen Tsuen village house	4.1	1.5 / 4.5 / 7.5	45 / 45 / 45	2 / 2 / 2
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	189 / 132 / 92	146 / 89 / 49
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	157 / 122 / 93	114 / 79 / 50
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	61 / 58 / 55	18 / 15 / 12
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	88 / 82 / 73	45 / 39 / 30
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	45 / 45 / 45	2 / 2 / 2
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	44 / 44 / 44	1 / 1 / 1

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	RSP Concentration (μg/m^3)	
				With Background **	Without Background *
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	44 / 44 / 44	1 / 1 / 1
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	44 / 44 / 44	1 / 1 / 1
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	55 / 54 / 53	12 / 11 / 10
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	54 / 53 / 52	11 / 10 / 9
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	67 / 65 / 62	24 / 22 / 19
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	48 / 48 / 48	5 / 5 / 5
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	45 / 45 / 45	2 / 2 / 2
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	68 / 66 / 63	25 / 23 / 20
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	67 / 65 / 62	24 / 22 / 19
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	59 / 58 / 57	16 / 15 / 14
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	91 / 81 / 71	48 / 38 / 28
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	46 / 46 / 46	3 / 3 / 3
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	133 / 106 / 83	90 / 63 / 40
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	52 / 51 / 50	9 / 8 / 7
A35	Palm Springs	5	1.5 / 4.5 / 7.5	69 / 67 / 63	26 / 24 / 20
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	123 / 100 / 80	80 / 57 / 37
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	61 / 59 / 55	18 / 16 / 12
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	48 / 48 / 48	5 / 5 / 5
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	156 / 113 / 89	113 / 70 / 46
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	54 / 54 / 53	11 / 11 / 10
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	49 / 49 / 48	6 / 6 / 5
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	46 / 46 / 46	3 / 3 / 3
V02	Planned “V” zone	2.4	1.5 / 4.5 / 7.5	52 / 51 / 50	9 / 8 / 7
V03	Planned “V”zone	3	1.5 / 4.5 / 7.5	46 / 45 / 45	3 / 2 / 2
V04	Planned “RD” zone	4.8	1.5 / 4.5 / 7.5	46 / 46 / 46	3 / 3 / 3
Max. Conc.	-		-	**189**	**146**
Criteria	-		-	**50**	**50**

Remark: * Concentration due to contribution of Project Site.

** Total concentration due to contribution of the Project Site as well as background concentration in the PATH output. The predicted RSP level due to this Project at some of the ASRs nearby has already exceeded the relevant air quality criteria/ AQOs regardless the background level, thus in calculating the total concentration of

RSP (i.e. background + Project contribution), the maximum annual average RSP level from the PATH output file (i.e. 43 μg/m^3 according to Appendix 3-1C) is used as a conservative approach.

Table 3-8 Predicted Annual Average FSP Concentrations Due to This Project (Unmitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	FSP Concentration (μg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	33 / 33 / 33	2 / 2 / 2
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	33 / 33 / 33	2 / 2 / 2
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	33 / 33 / 33	2 / 2 / 2
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	33 / 33 / 33	2 / 2 / 2
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	34 / 34 / 34	3 / 3 / 3
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	35 / 34 / 34	4 / 3 / 3
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	37 / 37 / 36	6 / 6 / 5
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	36 / 36 / 36	5 / 5 / 5
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	38 / 38 / 37	7 / 7 / 6
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	50 / 47 / 43	19 / 16 / 12
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	44 / 42 / 40	13 / 11 / 9
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	45 / 41 / 38	14 / 10 / 7
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	33 / 33 / 33	2 / 2 / 2
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	33 / 33 / 33	2 / 2 / 2
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	31 / 31 / 31	0 / 0 / 0
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
A15	Man Yuen Tsuen village	4.1	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	75 / 58 / 46	44 / 27 / 15
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	65 / 55 / 46	34 / 24 / 15
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	36 / 36 / 35	5 / 5 / 4
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	45 / 43 / 40	14 / 12 / 9
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	32 / 32 / 31	1 / 1 / 0
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	31 / 31 / 31	0 / 0 / 0
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	31 / 31 / 31	0 / 0 / 0

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	FSP Concentration (μg/m^3)	
				With Background **	Without Background *
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	31 / 31 / 31	0 / 0 / 0
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	35 / 34 / 34	4 / 3 / 3
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	34 / 34 / 34	3 / 3 / 3
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	38 / 38 / 37	7 / 7 / 6
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	33 / 33 / 32	2 / 2 / 1
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	38 / 38 / 37	7 / 7 / 6
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	38 / 38 / 37	7 / 7 / 6
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	36 / 36 / 35	5 / 5 / 4
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	45 / 42 / 39	14 / 11 / 8
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	58 / 50 / 43	27 / 19 / 12
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	34 / 33 / 33	3 / 2 / 2
A35	Palm Springs	5	1.5 / 4.5 / 7.5	39 / 38 / 37	8 / 7 / 6
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	55 / 48 / 42	24 / 17 / 11
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	37 / 36 / 35	6 / 5 / 4
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	33 / 32 / 32	2 / 1 / 1
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	65 / 52 / 45	34 / 21 / 14
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	34 / 34 / 34	3 / 3 / 3
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	33 / 33 / 33	2 / 2 / 2
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
V02	Planned “V” zone	2.4	1.5 / 4.5 / 7.5	34 / 34 / 33	3 / 3 / 2
V03	Planned “V”zone	3	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
V04	Planned “RD” zone	4.8	1.5 / 4.5 / 7.5	32 / 32 / 32	1 / 1 / 1
Max. Conc.			**-**	**75**	**44**
Criteria		**-**		**35**	**35**

Remark: * Concentration due to contribution of Project Site

** Total concentration due to contribution of the Project Site as well as background concentration in the PATH output. The predicted daily level of FSP due to this Project at some of the ASRs nearby has already exceeded the relevant air quality criteria/ AQOs regardless the background level (i.e. mitigation measures would be required), thus in calculating the total concentration of annual FSP (i.e. background + Project contribution), the maximum annual average FSP level from the PATH output file (i.e. 31 μg/m^3 according to Appendix 3-1C) is used as a conservative approach.

Based on the above results, the unmitigated TSP, RSP and FSP concentrations due to construction of the Project site would exceed the relevant air quality criteria/ AQOs as well as the no. of exceedance allowed under the AQO, regardless the background level. Thus, mitigation measures as stipulated in Section 3.9.1 will be required to be implemented in order to alleviate adverse impacts.

3.9 Mitigation of Impacts

3.9.1 During Construction

To ensure compliance with the AQOs at the ASRs at all times, it is recommended to include mitigation measures and good site practice in the contract clauses to minimize cumulative dust impact and to implement a dust monitoring and audit programme to ensure proper implementation of the identified mitigation measures. The Contractor shall follow the requirements stipulated in the Air Pollution Control (Construction Dust) Regulation to ensure constructional dust impacts are controlled within the relevant standards.

Good site management practices are important in reducing potential air quality impacts. As a general guidance, the contractor shall maintain high standard of housekeeping to prevent fugitive dust emission. Loading, unloading, handling and storage of fuel, raw materials, products, wastes or by-products should be carried out in a manner so as to minimize the release of visible dust emission. For example, dusty materials should be covered to prevent wind erosion and dust could be suppressed by regular site watering. Site watering twice a day could reduce dust contribution from exposed area by 50%. Increasing the watering frequency would achieve higher dust suppression efficiency. Based on the assessment in **Appendix 3-9**, it is recommended that the active works areas within the construction site should be watered eight times a day during day time from 0800 to 1800 hours (for a dust suppression efficiency of 90%).

The speed of the trucks travelling on haul roads within the Project Site will be controlled at 10 kph or below in order to reduce dust impact and for safe movement around the Project Site. Any piles of materials accumulated on or around the work areas shall be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas shall be carried out in a manner without generating fugitive dust emissions. The material shall be handled properly to prevent fugitive dust emission before cleaning.

It is expected that no concrete batching will be required for the Project works, and concrete will be brought to the site in “ready-mixed” state or in pre-cast elements instead. However, if concrete batching is required at the site, the plant should be cleaned and watered regularly as a good practice. Cement and other fine grained materials delivered in bulk should be stored in enclosed silos fitted with high level alarm indicator. Wet mix batching process is preferred over dry mix batching. In addition, concrete batching plant shall comply with the specified process (SP) licence requirements including specified emission limits and dust control measures.

<u>General Mitigation Measures</u>

All the relevant dust control measures stipulated in the Air Pollution Control (Construction Dust) Regulation would be fully implemented. Mitigation measures include:

- The designated haul road should be hard paved to minimize fugitive dust emission;
- During the site formation works, the active works areas should be water sprayed with water browser or manually eight times during day-time from 0800 to 1800 hours. The

Contractor(s) should ensure that the amount of water spraying is just enough to dampen the exposed surfaces without over-watering which could result in surface water runoff;

- Dump trucks for transporting dusty materials should be totally enclosed using impervious sheeting;
- Any excavated dusty materials or stockpile of dusty materials should be covered entirely by impervious sheeting or sprayed with water so as to maintain the entire surface wet, and recovered or backfilled or reinstated as soon as possible;
- Dusty materials remaining after a stockpile is removed should be wetted with water;
- The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with e.g. concrete, bituminous materials or hardcore or similar;
- The Contractor(s) shall only transport adequate amount of fill materials to the Project Site to minimize stockpiling of fill materials on-site, thus reducing fugitive dust emission due to wind erosion;
- Should temporary stockpiling of dusty materials be required, it shall be either covered entirely by impervious sheeting, placed in an area sheltered on the top and the 3 sides; or sprayed with water so as to maintain the entire surface wet;
- All dusty materials shall be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty material wet;
- Vehicle speed to be limited to 10 kph except on completed access roads;
- The portion of road leading only to a construction site that is within 30 m of a designated vehicle entrance or exit should be kept clear of dusty materials;
- Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites;
- The load of dusty materials carried by vehicle leaving a construction site should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle;
- The working area of excavation should be sprayed with water immediately before, during and immediately after (as necessary) the operations so as to maintain the entire surface wet; and
- Use of effective dust screens, sheeting or netting to be provided to enclose dry scaffolding which may be provided from the ground floor level of the building or if a canopy is provided at the first floor level, from the first floor level, up to the highest level (maximum four floors for this Project) of the scaffolding where scaffolding is erected around the perimeter of a building under construction.

Site-specific Mitigation Measures

In order to minimize potential cumulative dust impacts, the Contractor(s) shall carry out site formation works in phases (i.e. different sub-zones) (a total of 21 sub-zones as shown in **Appendix 3-8**, and with an average % active works area of 5% for each sub-zone as shown in **Appendix 3-9)**. Within each of Phases B to D, there will be only one sub-zone under construction in any one time. Once construction for a sub-zone is completed, the works area will be compacted, covered by tarpaulin sheet and hydroseeded before construction of another zone. Watering will also be applied on regular basis (eight times a day during day time from 0800 to 1800 hours for a dust suppression efficiency of 90%). Thus, there will be no cumulative construction dust impact. Works area shall be properly covered at the end of working day to minimize wind erosion.

Precautionary Measures for Odour Impact

In order to minimize potential odour nuisance, the following control measures are recommended during the construction of proposed Wetland Restoration Area:

- Exposed surface shall be immediately filled by filling materials;
- Malodorous excavated materials, if any, should be placed as far as possible from any ASRs;
- Excavated malodorous materials will be removed away from the Project Site as soon as possible within 24 hours;
- Malodorous materials, if stockpiled on site, should be covered entirely by plastic tarpaulin sheets;
- Odour patrol will be carried out when excavation of pond sediment is being carried out in the construction stage of the project. The required odour patrol has been detailed in the EM&A Manual; and
- Should disposal of pond sediment be required, if any, it shall follow the requirements stated in Buildings Department's PNAP ADV-21 for "Management Framework for Disposal of Dredged/ Excavated Sediment".

With proper measures, potential odour impact will be short-term and controllable.

Therefore, with appropriate dust control measures and good housekeeping practice, adverse dust impact is not anticipated. EM&A will also be carried out for this Project during the Project construction phase in order to monitor the air quality impacts and to verify the effectiveness of the mitigation measures implemented. It is expected that there will be no adverse construction dust impacts on the ASRs given proper control measures and EM&A programme are in place. With the continual monitoring and review of dust impact in the area, air quality impact is not anticipated.

3.9.2 During Operation

Air quality aspect has been taken into account during the Project planning by providing adequate buffer distance between the Project Site and the nearby roads (Section 3.6.2.2 refers). Thus, the potential impacts in terms of air quality during the operational phase are insignificant and no specific mitigation measure is required.

The interim STP for the Project Site will be located within a totally enclosed building of which the MBR and RO system will be located underground. The exhaust will be directed away from nearby ASRs as well as proposed buildings of this Project. An effective odour removal system at the exhaust of the STP (with an odour removal efficiency of not less than 99.5%) is proposed during operation of the interim on-site STP. Brine disposal during maintenance will be away from residential area as much as possible and close to the vehicular access connecting the nearby road.

During operation, RCP will be provided for the residential development. A licensed waste collector shall be employed to collect domestic waste on daily basis. Localized impact and minimization of odour nuisance will be considered during detailed design.

3.10 Construction Phase Air Quality Impact Assessment Results (Mitigated Scenario)

3.10.1 Short-term and Long-term Impacts

The predicted mitigated hourly average TSP concentrations, as well as daily average and annual average RSP and FSP concentrations due to construction of this Project (taking into account mitigation measures in Section 3.9.1) have been assessed according to the methodology described in Section 3.7.1, and the results are presented in Table 3-9 to Table

3-13 Location map of representative ASRs selected for fugitive dust assessment is shown in **Figure 3-2**.

Details of the calculated emission rates are also provided in **Appendices 3-2 and 3-3**. Details of calculation results are also presented in **Appendices 3-6** and **3-7**. Contour plots based on the worst hit level are also provided in **Figures 3-8 to 3-12**.

Table 3-9 Predicted Maximum Hourly TSP Concentrations Due to This Project (Mitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	TSP Concentration (μg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	164 / 164 / 164	15 / 14 / 14
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	164 / 164 / 164	17 / 17 / 16
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	164 / 164 / 164	15 / 14 / 14
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	164 / 164 / 164	16 / 15 / 14
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	164 / 164 / 164	26 / 25 / 24
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	164 / 164 / 164	30 / 30 / 28
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	164 / 164 / 164	29 / 28 / 26
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	164 / 164 / 164	31 / 28 / 25
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	164 / 164 / 164	39 / 36 / 32
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	164 / 164 / 164	66 / 55 / 45
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	164 / 164 / 164	56 / 49 / 37
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	295 / 215 / 164	212 / 132 / 84
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	164 / 164 / 164	47 / 44 / 38
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	165 / 165 / 165	42 / 40 / 35
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	164 / 164 / 164	24 / 24 / 23
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	164 / 164 / 164	21 / 21 / 20
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	164 / 164 / 164	10 / 10 / 10
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	164 / 164 / 164	17 / 17 / 16
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	164 / 164 / 164	15 / 15 / 14
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	164 / 164 / 164	13 / 13 / 12
A15	Man Yuen Tsuen village house	4.1	1.5 / 4.5 / 7.5	164 / 164 / 164	9 / 9 / 9
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	218 / 164 / 164	184 / 107 / 55
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	185 / 175 / 164	134 / 100 / 58
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	164 / 164 / 164	50 / 44 / 33
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	219 / 208 / 192	114 / 90 / 58
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	164 / 164 / 164	31 / 30 / 28
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	164 / 164 / 164	18 / 18 / 17
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	164 / 164 / 164	16 / 16 / 16
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	164 / 164 / 164	16 / 16 / 16
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	164 / 164 / 164	48 / 43 / 37

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	TSP Concentration (μg/m^3)	
				With Background **	Without Background *
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	164 / 164 / 164	44 / 43 / 39
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	200 / 196 / 188	69 / 61 / 49
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	164 / 164 / 164	55 / 53 / 49
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	164 / 164 / 164	17 / 17 / 17
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	164 / 164 / 164	33 / 31 / 28
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	164 / 164 / 164	37 / 35 / 30
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	164 / 164 / 164	28 / 26 / 24
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	181 / 164 / 164	123 / 103 / 73
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	164 / 164 / 164	10 / 10 / 10
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	177 / 164 / 164	132 / 101 / 61
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	164 / 164 / 164	43 / 42 / 40
A35	Palm Springs	5	1.5 / 4.5 / 7.5	177 / 173 / 167	89 / 79 / 62
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	208 / 190 / 178	153 / 94 / 67
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	179 / 169 / 165	77 / 67 / 56
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	164 / 164 / 164	40 / 39 / 36
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	164 / 164 / 164	121 / 72 / 60
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	164 / 164 / 164	29 / 28 / 27
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	164 / 164 / 164	29 / 28 / 27
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	164 / 164 / 164	35 / 34 / 32
V02	Planned “V” zone	2.4	1.5 / 4.5 / 7.5	169 / 168 / 168	90 / 77 / 58
V03	Planned “V”zone	3	1.5 / 4.5 / 7.5	164 / 164 / 164	27 / 27 / 26
V04	Planned “RD” zone	4.8	1.5 / 4.5 / 7.5	164 / 164 / 164	10 / 10 / 10
Max. Conc.	**-**		**-**	**295**	**212**
Criteria	**-**		**-**	**500**	**500**

Remark: * Concentration due to contribution of Project Site

** The above results have included the background level extracted from the PATH Output (year 2015). The hour-by-hour background contribution is estimated using output of PATH model, and added hour-by-hour to the Project contribution.

Table 3-10 Predicted Daily Average RSP Concentrations Due to This Project (Mitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	RSP Concentration (μg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	122 / 122 / 122	2 / 2 / 1
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	122 / 122 / 122	2 / 1 / 1
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	122 / 122 / 122	2 / 2 / 1
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	122 / 122 / 122	4 / 3 / 3
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	122 / 122 / 122	4 / 3 / 2
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	125 / 124 / 124	6 / 5 / 3
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A15	Man Yuen Tsuen village house	4.1	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	122 / 122 / 122	9 / 6 / 3
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	122 / 122 / 122	10 / 5 / 3
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	122 / 122 / 122	3 / 3 / 2
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	124 / 123 / 123	4 / 3 / 2
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 0 / 0
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	123 / 123 / 123	2 / 2 / 2

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	RSP Concentration (μg/m^3)	
				With Background **	Without Background *
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	123 / 123 / 123	1 / 1 / 1
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	123 / 123 / 123	2 / 2 / 1
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	122 / 122 / 122	2 / 2 / 2
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	122 / 122 / 122	3 / 2 / 2
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	122 / 122 / 122	7 / 4 / 3
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	122 / 122 / 122	9 / 5 / 4
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	122 / 122 / 122	2 / 2 / 1
A35	Palm Springs	5	1.5 / 4.5 / 7.5	122 / 122 / 122	4 / 3 / 3
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	125 / 124 / 123	6 / 4 / 3
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	122 / 122 / 122	4 / 3 / 2
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	122 / 122 / 122	10 / 4 / 3
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
V02	Planned “V” zone	2.4	1.5 / 4.5 / 7.5	122 / 122 / 122	2 / 2 / 1
V03	Planned “V”zone	3	1.5 / 4.5 / 7.5	122 / 122 / 122	1 / 1 / 1
V04	Planned “RD” zone	4.8	1.5 / 4.5 / 7.5	122 / 122 / 122	0 / 0 / 0
Max. Conc.			**-**	**125**	**10**
No. of exceedance @				**3**	**-**
Criteria			**-**	**100 (no. of exceedance allowed <= 9)**	

Remark: The above results are based on the 1st highest daily average concentrations.

* Concentration due to contribution of Project Site

** The above results have included the background level extracted from the PATH Output (year 2015). The hour-by-hour background contribution is estimated using output of PATH model, and added hour-by-hour to the Project contribution.

@ Total no. of exceedance based on the calculated cumulative concentration.

Table 3-11 Predicted Daily Average FSP Concentrations Due to This Project (Mitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	FSP Concentration (µg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 0 / 0
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 1 / 0
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 1 / 1
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 1 / 1
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	92 / 92 / 92	2 / 1 / 1
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A15	Man Yuen Tsuen village	4.1	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	91 / 91 / 91	3 / 2 / 1
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	91 / 91 / 91	3 / 2 / 1
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 1 / 1
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	92 / 92 / 92	1 / 1 / 1
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	FSP Concentration (μg/m^3)	
				With Background **	Without Background *
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	92 / 92 / 92	1 / 1 / 0
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	92 / 92 / 92	0 / 0 / 0
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	92 / 92 / 92	1 / 1 / 0
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 0 / 0
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 1 / 1
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	91 / 91 / 91	2 / 1 / 1
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	91 / 91 / 91	3 / 1 / 1
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 0 / 0
A35	Palm Springs	5	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 1 / 1
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	92 / 92 / 92	2 / 1 / 1
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 1 / 1
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	91 / 91 / 91	3 / 1 / 1
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
V02	Planned “V” zone	2.4	1.5 / 4.5 / 7.5	91 / 91 / 91	1 / 1 / 0
V03	Planned “V”zone	3	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
V04	Planned “RD” zone	4.8	1.5 / 4.5 / 7.5	91 / 91 / 91	0 / 0 / 0
Max. Conc.			**-**	**92**	**3**
No. of exceedance @				**2**	**-**
Criteria			**-**	**75 (no. of exceedance allowed <= 9)**	

Remark: The above results are based on the 1st highest daily average concentrations

* Concentration due to contribution of Project Site.

** The above results have included the background level extracted from the PATH Output (year 2015). The hour-by-hour background contribution is estimated using output of PATH model, and added hour-by-hour to the Project contribution.

@ Total no. of exceedance based on the calculated cumulative concentration.

Table 3-12 Predicted Annual Average RSP Concentrations Due to This Project (Mitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	RSP Concentration (µg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	43.4 / 43.4 / 43.3	0.1 / 0.1 / 0.1
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	43.4 / 43.4 / 43.4	0.2 / 0.2 / 0.1
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	43.4 / 43.4 / 43.4	0.2 / 0.1 / 0.1
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	43.5 / 43.4 / 43.4	0.2 / 0.2 / 0.2
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	43.7 / 43.6 / 43.5	0.5 / 0.4 / 0.3
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	43.6 / 43.6 / 43.5	0.4 / 0.3 / 0.2
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	43.6 / 43.5 / 43.4	0.4 / 0.3 / 0.2
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0 / 0
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A15	Man Yuen Tsuen village house	4.1	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	44.3 / 43.9 / 43.6	1.1 / 0.6 / 0.4
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	44.2 / 43.8 / 43.6	1 / 0.6 / 0.4
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	43.5 / 43.4 / 43.4	0.2 / 0.2 / 0.1
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	43.7 / 43.6 / 43.5	0.5 / 0.4 / 0.3
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	RSP Concentration (µg/m^3)	
				With Background **	Without Background *
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	43.4 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	43.5 / 43.5 / 43.4	0.3 / 0.2 / 0.2
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	43.5 / 43.4 / 43.4	0.2 / 0.2 / 0.2
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	43.5 / 43.4 / 43.4	0.2 / 0.2 / 0.2
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	43.4 / 43.4 / 43.4	0.1 / 0.1 / 0.1
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	43.6 / 43.6 / 43.5	0.4 / 0.3 / 0.2
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	43.9 / 43.7 / 43.5	0.6 / 0.4 / 0.3
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	43.4 / 43.4 / 43.3	0.1 / 0.1 / 0.1
A35	Palm Springs	5	1.5 / 4.5 / 7.5	43.6 / 43.5 / 43.5	0.3 / 0.3 / 0.2
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	44 / 43.8 / 43.6	0.8 / 0.6 / 0.4
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	43.5 / 43.4 / 43.4	0.2 / 0.2 / 0.1
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	43.9 / 43.7 / 43.6	0.7 / 0.5 / 0.3
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
V02	Planned “V” zone	2.4	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0.1 / 0.1 / 0.1
V03	Planned “V”zone	3	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
V04	Planned “RD” zone	4.8	1.5 / 4.5 / 7.5	43.3 / 43.3 / 43.3	0 / 0 / 0
Max. Conc.			**-**	**44.3**	**1.1**
Criteria		**-**		**50**	**50**

Remark: * Concentration due to contribution of Project Site.

** The above results have included the background level extracted from the PATH Output (year 2015). The hour-by-hour background contribution is estimated using output of PATH model, and added hour-by-hour to the Project contribution.

Table 3-13 Predicted Annual Average FSP Concentrations Due to This Project (Mitigated Scenario)

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	FSP Concentration (μg/m^3)	
				With Background **	Without Background *
A01	Fairview Park	4.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A01A	Fairview Park	4.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A02	Fairview Park	4.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A02A	Fairview Park	4.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A03	Fairview Park	4.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A04	Fairview Park	4.3	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A05	Fairview Park	4.2	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.7	0.1 / 0 / 0
A05A	Fairview Park	4.2	1.5 / 4.5 / 7.5	30.8 / 30.7 / 30.7	0 / 0 / 0
A05B	Fairview Park	4.2	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.8	0.1 / 0.1 / 0
A06	Fairview Park	4.2	1.5 / 4.5 / 7.5	30.9 / 30.8 / 30.8	0.2 / 0.1 / 0.1
A06A	Fairview Park	4.2	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.8	0.1 / 0.1 / 0.1
A07	Yau Mei San Tsuen village house	3.1	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.8	0.1 / 0.1 / 0.1
A08	Chuk Yuen Tsuen village house	2.3	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A09	Chuk Yuen Tsuen village house	3.5	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A10	Bethel High School	4.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A10A	Bethel High School	4.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A11	Helene Terrace	4.5	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A12	Villa Camilla	6.5	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A13	Fairview Park	4.6	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A14	Wong Chan Sook Ying Memorial School	4.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A15	Man Yuen Tsuen village	4.1	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A16	Fairview Park	4.2	1.5 / 4.5 / 7.5	31 / 30.9 / 30.8	0.3 / 0.2 / 0.1
A16A	Fairview Park	4.2	1.5 / 4.5 / 7.5	31 / 30.9 / 30.8	0.3 / 0.2 / 0.1
A17	Palm Springs	5.7	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.7	0.1 / 0.1 / 0
A18	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.8	0.1 / 0.1 / 0.1
A19	Chuk Yuen Tsuen village house	3.3	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A20	Hang Fook Garden	4.2	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A21	Ha San Wai village house	4.2	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A22	Ha San Wai village house	3.5	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0

ASR No.	Description	Ground Level, mPD	Height Above Ground, m	FSP Concentration (μg/m^3)	
				With Background **	Without Background *
A23	Yau Mei San Tsuen village house	3.6	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A24	Christian Ministry Institute	3.5	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A25	Royal Palms	4.9	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.8	0.1 / 0.1 / 0.1
A26	Hong Chi Morninglight School Yuen Long	4.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A27	Existing village house	4.5	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A28	Fairview Park	4.3	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.8	0.1 / 0.1 / 0
A29	Fairview Park	4.3	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.8	0.1 / 0.1 / 0
A30	Fairview Park	4.5	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A31	Fairview Park	3.9	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.8	0.1 / 0.1 / 0.1
A32	A Restaurant near Helene Terrace	4.5	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A33	Fairview Park	3.9	1.5 / 4.5 / 7.5	30.9 / 30.8 / 30.8	0.2 / 0.1 / 0.1
A34	Palm Springs	5.2	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A35	Palm Springs	5	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.8	0.1 / 0.1 / 0.1
A36	Yau Mei San Tsuen village house	3.5	1.5 / 4.5 / 7.5	30.9 / 30.9 / 30.8	0.2 / 0.2 / 0.1
A1Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	30.8 / 30.8 / 30.7	0.1 / 0.1 / 0
A2Pa	Planned RD Site	3	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A3Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	30.9 / 30.8 / 30.8	0.2 / 0.1 / 0.1
A4Pa	Planned REC Site	4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
A5Pa	Planned Kam Pok Road Site	6.5	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
V01	Planned NT exempted houses	3	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
V02	Planned “V” zone	2.4	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
V03	Planned “V”zone	3	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
V04	Planned “RD” zone	4.8	1.5 / 4.5 / 7.5	30.7 / 30.7 / 30.7	0 / 0 / 0
Max. Conc.			**-**	**31.0**	**0.3**
Criteria		**-**		**35**	**35**

Remark: * Concentration due to contribution of Project Site.

** The above results have included the background level extracted from the PATH Output (year 2015). The hour-by-hour background contribution is estimated using output of PATH model, and added hour-by-hour to the Project contribution.

It is found that with the implementation of general mitigation measures listed out in **Section 3.9.1**; and the proposed site-specific measures, the dust level can be significantly reduced and can comply with the relevant air quality criteria/ AQOs for TSP, RSP and FSP, respectively. Thus, no further mitigation measures will be necessary.

As the dust level can comply with the relevant air quality criteria/ AQOs, no residual impact is anticipated.

With regard to the above, the air quality impact of construction activities has been assessed using a conservative emission rate (Section 3.7.1.3 and Appendices 3-2 and 3-3 refer), in order to represent a worst case scenario. To be conservative, simultaneous construction of construction activities as identified in Section 3.7.1.2 (i.e. removal and unloading of soil materials by excavators; earth loading/ unloading, stockpiling; and bulldozing and surface compaction), has also been assumed. Thus, the predicted air quality impact upon ASRs as shown above is based on a conservative approach. However, the concerned activities are considered unlikely to operate at the same time due to the phased construction method, where there are only limited space and construction plants available for construction in any one time. Thus, it is expected that the actual air quality impact due to construction works would be less significant.

In addition, due to the adoption of phased construction method, the construction duration of each sub-zone will only last for about 24 calendar days (for excavation and filling) and 6 calendar days (for removal of surcharge), after that the construction activities will be moved to another sub-zone and so on. As a result, the air quality impact upon ASRs will be relatively short-term and temporary as the nearest dust emission sources of individual ASR will not last for the whole period of site formation stage and will discontinue after a short period of time.

It should also note that practical mitigation measures have already been proposed in Section 3.9.1 that the works area will be constructed in phases. With the phased construction method, each sub-zone shown in Appendix 3-8 only represents an average of about 5% of the Site area in Phases B to D (see Appendix 3-9), which cannot be practically reduced further; frequent watering will be applied; exposed surfaces will be compacted, covered by tarpaulin sheets and hydroseeded after works. Thus, the air quality impact due to construction of this Project has already been reduced to a minimal and practical mitigation measures have been exhausted.

3.10.2 Concurrent Construction with Planned "Kam Pok Road Site" Project

As discussed in Sections 3.6.1.3 and 3.6.1.4, there are planned development projects nearby. Potential impact due to concurrent construction with these planned projects has been evaluated in the said sections of this report. It is found that site formation works of the planned "Kam Pok Road Site" may potentially overlap with this Project, thus it is investigated further.

Given the concerned "Kam Pok Road Site" project is distant away from this Project (over 360m apart) and there are currently no existing ASRs immediately adjacent to the two project sites that may be worst affected by the concurrent works of the two projects, it is expected that concurrent construction is unlikely to result in any adverse impacts on ASRs. Nevertheless, a sensitivity test has been undertaken to evaluate potential cumulative impacts due to concurrent construction with the planned "Kam Pok Road Site" project.

Since the nature of the planned "Kam Pok Road Site" project is similar to this Project (i.e. land based project involving small houses development), it is expected that the construction scale of that project will be similar to this Project and the major sources of air quality impact during the construction would be fugitive dust emissions during the site formation stage. As

such, TSP, RSP and FSP have been identified as the parameters for air quality assessment. Construction information such as construction programe and construction sequence of the planned "Kam Pok Road Site" project has been obtained from the project proponent of that project. Based on the best available information, short-term and long-term impacts due to construction of that project have been assessed (please refer to **Appendix 3-13**).

According to the sensitivity test results presented in **Appendix 3-13**, the cumulative dust emissions due to concurrent construction of the two project sites would not adversely impact on ASRs as the contribution due to the planned "Kam Pok Road Site" Project is very small and insignificant. The cumulative dust levels can comply with the relevant air quality objectives/ criteria. As such, there will be no adverse cumulative impact anticipated during construction stage.

3.11 Environmental Monitoring and Audit

Given the mitigated TSP, RSP and FSP levels (with implementation of recommended mitigation measures) can comply with the relevant air quality criteria/ AQOs, no adverse impact will be anticipated due to the Project works, and no environmental monitoring and audit (EM&A) will be necessary.

Nevertheless, in order to ensure the effectiveness of implementation of mitigation measures, it is proposed that an environmental monitoring and audit (EM&A) program is carried out during construction to monitoring the short-term impacts. The Environmental Team (ET) shall check the contractor(s)' practice and ensure the above recommendations are properly implemented. Should adverse dust impacts be identified, the source of fugitive dust emission should be identified. Additional mitigation measures shall be proposed by the Contractor(s) before concerned construction works is continued. Details of the EM&A requirements are provided in **Chapter 13** of this report.

3.12 Conclusion

Through implementation of dust control measures required under the Air Pollution Control (Construction Dust) Regulation, and recommended specific measures in the EIA report, and good housekeeping practice by the works contractors, short-term construction dust impacts can be controlled to acceptable levels. Practical mitigation measures have already been proposed for this Project to alleviate potential impacts. The concerned site formation works will only be short-term and have been reduced to a minimal through recommended mitigation measures and can comply with the relevant air quality criteria/ AQOs. Thus, no adverse construction dust impact is anticipated.

Appropriate precautionary measures (e.g. peripheral setback from the site boundaries) have been incorporated in the Site plan that can satisfy the buffer distance requirements stated in the HKPSG, thus no unacceptable air quality impact upon the development is expected due to vehicular emission. No unacceptable air quality impact due to industrial emissions is expected as no industrial emission source has been identified within 500m from the Project boundary.

Given the scale of the Project (for small houses development), there is no major planned dust generating or air pollutant emission source from the proposed development that would contribute to any adverse impact on air quality. Thus, the Project Site itself is unlikely to generate any air pollution nuisance. Vehicular emissions due to additional traffic generated/ attracted by this Project is found to be insignificant and negligible, thus this Project will not attribute to any deterioration on air quality. During the operational phase, a licensed waste collector will be employed to collect domestic waste on daily basis and Refuse Collection Points (RCPs) will be provided for the residential development. Thus, no adverse odour impact is anticipated.

During the operational stage, an interim sewage treatment plant is proposed within the Project Site before connection to the public sewerage system becomes available. The interim sewage treatment plant comprising a combination of membrane bioreactor system and reverse osmosis system will be located underground within a totally enclosed building. The exhaust will be directed away from nearby ASRs. Environmental conscious design of an effective odour removal system at the exhaust of the STP (with an odour removal efficiency of not less than 99.5%), is proposed. With these measures in place, the odour impact assessment has found that there will be no adverse odour impact as a result of the STP.

4. NOISE

4.1 Introduction

This section has been completed based on the criteria and guidelines for evaluation and assessment of noise impact as stated in Annexes 5 and 13 of the EIAO-TM and has covered the scope outlined in Clause 3.9.2 of the EIA Study Brief.

4.2 Relevant Legislation, Standards & Guidelines

4.2.1 Construction Noise

4.2.1.1 General Construction Activities during Non-Restricted Hours

Noise impacts arising from general construction activities other than percussive piling during the daytime period (07:00-19:00 hours of any day not being a Sunday or general holiday) have been assessed against the noise standards given in Table 4-1 below.

Table 4-1 Noise Standards for Daytime Construction Activities

NSR	0700 to 1900 hours on any day not being a Sunday or general holiday L_{eq} (30 min.) dB (A)
All domestic premises including temporary housing accommodation, Hotels and hostels	75
Educational institutions including kindergarten, nurseries and all others where unaided voice communication is required	70 65 (during examination)

Source: EIAO-TM, Annex 5, Table 1B - Noise Standards for Daytime construction Activities

Note:

(i) The above noise standards apply to uses, which rely on opened windows for ventilation

(ii) The above standards shall be viewed as the maximum permissible noise levels assessed at 1m from the external facade

(iii) The above standards shall be met as far as possible. All practicable mitigation measures shall be exhausted and the residual impacts are minimized

4.2.1.2 General Construction Activities during Restricted Hours

Noise impacts arising from general construction activities (excluding percussive piling) conducted during the restricted hours (19:00-07:00 hours on any day and anytime on Sunday or general holiday) and percussive piling during anytime are governed by the Noise Control Ordinance (“NCO”).

For carrying out of any general construction activities involving the use of any Powered Mechanical Equipment (“PME”) within restricted hours, a Construction Noise Permit (CNP) is required from the Authority under the NCO.

The noise criteria and the assessment procedures for issuing a CNP are specified in Technical Memorandum on Noise from Construction Work Other Than Percussive Piling (GW-TM) under the NCO.

The use of Specified PME (“SPME”) and/or the carrying out of Prescribed Construction Work (“PCW”) within a Designated Area (“DA”) under the NCO during the restricted hours are also prohibited without a CNP. The relevant technical details can be referred to Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM) under NCO.

Designated areas, in which the control of SPME and PCW shall apply, are established through the Noise Control (Construction Work Designated Areas) Notice made under Section 8A(1) of the NCO.

According to the latest Designated Area defined under the NCO [Plan No.: EPD/AN/NT-01 by the Environment Bureau], the Project Area is within Designated Areas.

During the construction phase, the Contractor has the responsibility to check the latest status and coverage of the Designated Areas at time of construction of the project.

4.2.1.3 Percussive Piling at Anytime

Percussive piling is only permitted when the Authority has granted a CNP. Technical Memorandum on Noise from Percussive Piling (PP-TM) under the NCO sets out the permitted hours of operation of percussive piling and Acceptable Noise Level ("ANL") requirements, which are dependent on the level of exceedance of the Acceptable Noise Level ("ANL"). For this project, percussive piling is not considered necessary at this stage.

Regardless of any description or assessment made in this chapter, in assessing a filed application for a CNP the Authority will be guided by the relevant Technical Memorandum. The Authority will consider all the factors affecting their decision taking contemporary situations/ conditions into account. Nothing in this report shall pre-empt the Authority in making their decisions, and there is no guarantee that a CNP will be issued. If a CNP were issued, the Authority may include any conditions they consider appropriate and such conditions are to be followed while the works covered by the CNP are being carried out. Failing to do so may lead to cancellation of the permit and prosecution action under the NCO.

4.2.2 Operational Noise

4.2.2.1 Road Traffic

Environmental Impact Assessment Ordinance (EIAO)

Noise criteria for the assessment of road traffic noise impact on the Project are provided in Table 1A of Annex 5 of EIAO-TM and are summarised below. According to the guidelines, the maximum allowed road traffic noise level, measured in terms of L_{10}(1-hr), at typical facades of new dwellings of the proposed Project is to be 70 dB(A).

Table 4-2 EIAO-TM Road Traffic Noise Planning Criteria

Common Uses	Road Traffic Noise L10 (1 hour), dB(A)
All domestic premises including temporary housing accommodation	70
Hotel and hostels	70
Offices	70
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	65
Places of public worship and courts of law	65
Hospital, clinics, convalescences and homes for the aged, diagnostic rooms, wards	55

Note:

(i) The above standards apply to uses which reply on opened windows for ventilation;

(ii) The above standards shall be viewed as the maximum permissible noise levels assessed at 1m from the external facade.

4.2.2.2 Fixed Plant Noise

Noise Control Ordinance (NCO)

The Noise Control Ordinance (NCO) provides the statutory framework for the control of fixed plant. It defines statutory limits applicable to the fixed plants used during the operational phase of the Project. The Technical Memorandum for the Assessment of Noise from Places

other than Domestic Premises, Public Places or Construction Sites (IND-TM) sets the criteria - Acceptable Noise Level (ANL) for governing fixed plant noise.

Environmental Impact Assessment Ordinance (EIAO)

According to the Table 1A of EIAO-TM, the noise impact due to fixed noise sources shall comply with the following criteria:

- 5 dB(A) below the appropriate Acceptable Noise Levels (ANLs) given in Table 2 of the IND-TM; or
- The prevailing background noise levels where it is 5 dB(A) below the ANL.

Noise sensitive receivers (NSR) are classified according to the Area Sensitivity Rating (ASR). Any NSR shall be assigned an ASR of "C" if it is within 100 m of a zone designated as "Industrial" or "Industrial Estate" on a statutory Outline Zoning Plan, or an ASR of "B" if it is between 100 m and 250 m from such a zone, except for cases which indicate an ASR of "C". Table 4-3 presents the ASRs in different areas.

Table 4-3 Area Sensitivity Ratings (ASRs)

Type of Area Containing NSR	Degree to which NSR is affected by Influencing Factor		
	Not Affected	Indirectly Affected	Directly Affected
Rural area, including country parks or village type developments	A	B	B
Low density residential area consisting of low-rise or isolated high-rise developments	A	B	C
Urban area	B	C	C
Area other than those above	B	B	C

Being 5dB(A) more stringent than the ANL, the noise criteria specified in the EIAO-TM have been used for this EIA for the evaluation of operational noise impact for different ASRs summarised in Table 4-4 below.

Table 4-4 Operational Noise Criteria for Fixed Plants, dB(A)

Area Sensitivity Ratings in relevant Time Periods	ASR		
	A	B	C
Day (0700 to 1900 hours)	55	60	65
Evening (1900 to 2300 hours			
Night (2300 to 0700 hours)	45	50	55

The free field background noise level (i.e. no façade correction considered) at 1.2m above ground has been measured at the southern boundary of the Site along Yau Pok Road. The noise level was 56 dB(A) during the daytime period (1300 to 1800 on Jan 09, Mar 10, Jul 10) while 47 dB(A) to 52 dB(A) during the night-time period (2400 to 0100 on Jan 09, Mar 10 and Jul 10).

The weather condition during the noise measurement was good. With the +3 dB(A) façade correction, the background noise level (façade level) at the residential house will be about 59 dB(A) during the daytime period and 50 dB(A) to 55 dB(A) during the night-time period. Additional background noise measurement was also undertaken on 06 February 2013. The recorded background noise level (facade level) was 58 dB(A) during day-time and 52 dB(A) during night-time.

Figure 4-7 shows the location of the background noise measurement; and graphical presentation of the measured background noise level is shown in Appendix 4-1. The land uses surrounding the Project Area include residential developments, drainage, fish ponds, agriculture use, village development and roads. During the measurement the dominant noise sources are from the nearby domestic premises and the road traffic from local roads and there was no operation from the identified industrial site. Since the measured background noise level is higher that of the "ANL-5" criteria, the "ANL-5" noise criteria is used for the noise assessment accordingly.

As the Project Site is located in rural area with village type developments and is not affected by any influencing factors, the Area Sensitive Rating (ASR) is "A" and the noise criteria for fixed plant shall be those given in Table 4-4 which are 55 dB(A) for daytime and evening periods, and 45 dB(A) for night time.

It should be noted that fixed plant noise is controlled under Section 13 of the NCO during operation of the plant. In exercising the control, the Noise Control Authority shall determine the noise impact from concerned fixed noise sources on the basis of prevailing legislation and practices in force, and taking into account the prevailing conditions/ situations of adjoining land uses. The Area Sensitivity Ratings (ASRs) proposed in this EIA are intended for assessment only. Nothing in the EIA shall bind the Noise Control Authority in the context of enforcement against any of the fixed noise sources identified and assessed in the future.

4.3 Identification of Potential Noise Impacts

The potential noise impacts associated with the construction and operational phases of the proposed development are identified and described in this section.

4.3.1 Construction Noise

Noise impacts arising from construction of the proposed development are mainly due to the use of powered mechanical equipment ("PME") for various construction activities. Construction activities of this Project are described in Section 2.10.2. The construction work for the proposed development is generally divided into four phases:

Phase A – Establishment of Wetland Restoration Area

Phases B, C and D – Site formation and houses construction

Phase A mainly involve site formation and landscaping works of the Wetland Restoration Area; while Phases B, C and D involve site formation, foundation, infrastructure and superstructure works, as well as landscaping works for the residential portion at the Developable Area.

Piling activities will be required for the foundation works of the proposed development. Non-percussive piling was assessed based on proposed construction plants and construction activities. The construction activities that are likely to cause noise impacts include excavation, piling, materials loading and unloading and concreting. No noisy operations are expected during the landscaping works and the "finishing" activities of each phase. The landscaping works would involve planting of various plantations; while the "finishing" activities would be carried out within the buildings. The potential noise impact during the construction phase of the development was assessed quantitatively in later sections. While potential cumulative construction noise impacts due to other nearby approved designated projects are also provided in Section 4.8.

4.3.2 Operational Noise

4.3.2.1 On-site interim STP

There will be an interim on-site sewage treatment plant ("STP") which is a potential fixed noise source within the Project. There is no detailed design of the interim STP yet. However, the interim STP will be totally enclosed and equipped with sufficient noise insulation measures such as acoustic louvre.

As the interim STP may be operated at night, the nighttime noise criteria specified in Table 4-4 (i.e. 45 dB(A) for Area Sensitive Rating of "A") has been adopted.

According to the approved EIA study for Main Drainage Channels for Ngau Tam Mei, the reverberant sound pressure level (SPL) inside typical plant room is Leq 85 dB(A) [6] by applying a combination of acoustic treatment inside the plant room (e.g mineral wools) and acoustic treatment at source (e.g. acoustic shrouds or enclosure at pump). It is recommended that acoustic louvre and silencer with a minimum noise reduction of 11 dB(A) are also provided at the exhaust louvre in order to alleviate the noise impacts (i.e. the maximum noise level at louvre would be 85 – 11 = 74dB(A)). .The required noise mitigation measures are included in the implementation schedule in Table 14-1 as well as the EM&A Manual for implementation during the detailed design stage.

Taking into account the reverberant noise level inside the plant room and noise reduction by the acoustic louvre and silencer, residual noise level at the nearest NSR is calculated and shown in Table 4-5 (NSR location is also shown in Figure 4-7). According to the results, the calculated noise level at NSR is found to be well below the noise criteria.

Table 4-5 Calculated Noise Level Due to the Proposed Interim STP

Reverberant SPL inside plant room, dB(A)	Noise Reduction by Acoustic Louvre, dB(A) ##	Shortest horizontal distance to nearby NSRs, m #	Distance Correction, dB(A) *	Façade Correction, dB(A)	Calculated Noise Level at NSR, dB(A)^
85	-11	15	-32	+3	45

Remark:

Shortest horizontal distance between the proposed interim STP and the nearest residential portion of the Project Site (Figure 4-7 refers).

Proposed minimum noise reduction by the acoustic louvre.

* Distance correction is referring to the Table 5 of the Technical Memorandum on Noise from Construction Work Other than Percussive Piling.

^ Calculated Noise Level at NSR = Reverberant SPL + Noise Reduction by Acoustic Louvre + Distance Correction + Façade Correction.

A further review on other EIA projects found that the above design requirement is feasible and achievable. According to the approved "Development of Lok Ma Chau Look" EIA report[7], the estimated maximum SWL of proposed sewage treatment works of that project is reported to be 75 dB(A) with acoustic silencer and acoustic enclosures. In addition, according to the approved "EIA and TIA Studies for the Stage 2 of PWP Item No. 215DS – Yuen Long and Kam Tin Sewerage and Sewage Disposal"[8], maximum permissible SWL at

6 Section 8.3.7 of the "Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin : EIA Study for Kam Tin Section (43CD) and Village Flood Protection Works (30 CD), " 1996. (EIA-052/BC).

7 Table 4-21 in Section 4.7.2.2, of the "Agreement No. CE53/2008(CE) Planning and Engineering Study on Development of Lok Ma Chau Loop – Investigation, Final EIA Report" (EIA-212/2013).

8 Tables 9.3 to 9.5 in Sections 9.6.2 – 9.6.4, of the "EIA and TIA Studies for the Stage 2 of PWP Item

louvre of sewage pumping station is reported to be as low as 64 dB(A) by similar noise mitigation measures such as acoustic silencer, acoustic louvre, and enclosure. Given the proposed interim STP of this Project is designed with a dry weather flow of about 148 m^3/day only, it is expected that the size of STP will be limited and the above-mentioned noise strength of 74 dB(A) at louvre of the interim STP can be achieved.

During detailed design, the acoustic performance of the interim STP should be reviewed and acoustic treatments such as provision of acoustic louvre, acoustic silencer and noise treatments inside the plant room (e.g. acoustic shrouds or enclosure at pump) shall be proposed so that the noise level at louvre of STP should be 74 dB(A) or below in order to meet the noise criteria. To be conservative, the above noise calculation assumes that the louvre of the STP will be facing the nearest NSR. In fact, by directing louvre away from the NSR as far as possible, it could provide additional noise reduction.

With careful design of the interim STP and appropriate noise treatments, it is anticipated that the interim STP would not cause unacceptable noise impact on the surrounding noise sensitive receivers. Thus, there will be no adverse noise impact due to operation of the interim sewage treatment plant.

4.3.2.2 Planned Sewage Pumping Station under Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2

According to the EIA report for "Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2", there will be a planned sewage pumping station (SPS) located at about 206m southeast of the residential portion of the Project Area with the existing village houses at Yau Mei San Tsuen in between.

According to the same, this future SPS will be self-protected with openings or louvers directed away from NSRs. It is a requirement in the above approved EIA Report that the SPS has to be designed to minimize potential noise impact to the nearby NSR. Mitigation measures such as acoustic enclosure, silencer at inlet and outlet, anti-vibration spring mount, and acoustic louvers are required during the detailed design of the SPS. It is also a requirement in the EIA report that the maximum permissible Sound Power Level (SWL) at the louver of the SPS should not exceed 83.3 dB(A).

A calculation of noise level at the NSR of this development has been carried out based on the above SWL. To provide a conservative assessment, it was assumed in this report that louvers of the SPS will face the Project Site. The location of the NSR of this Project that is nearest to the proposed SPS is shown in Figure 4-7. With a buffer distance of around 206m between the concerned NSR and the proposed SPS, the estimated noise level at the NSR will be around 32 dB(A). Thus, it is anticipated that there will be no adverse operational noise impact from the SPS on the Project Site. Details of the calculation and results are provided in Table 4-6.

Table 4-6 Calculated Noise Level Due to the Proposed Public SPS

Maximum Sound Power Level of the SPS	Shortest horizontal distance, m #	Distance Correction, dB(A) *	Façade Correction, dB(A)	Calculated Noise Level at NSR, dB(A)
83.3	206	-54	+3	32

Remark:

No. 215DS – Yuen Long and Kam Tin Sewerage and Sewage Disposal" (EIA -094/2004).

Shortest horizontal distance between the proposed SPS and the nearest residential portion of the Project Area. (Figure 4-7 refers).

* Distance correction is referring to the Table 5 of the Technical Memorandum on Noise from Construction Work Other than Percussive Piling.

4.3.2.3 Noise Impact from Nearby Industrial Activities

Within 300m of the Project Area, the only industrial activity is an open storage site with the buffer distance more than 273m southeast of the Project Area (Figure 4-7). The open storage site is surrounded by a 2m high solid boundary wall and located behind a building structure, particularly for the side facing towards the Project Area.

Site visits to the concerned industrial use were carried out between March 2009 and May 2013 (Mar 09, May 09, Aug 09, Jul 09, May 10, Jul 10, Aug 10, Oct 10, May 11, Jul 11, Sept 11, and Jan 12, Aug 12, Nov 12, Feb 13, Apr 13, May 13 respectively)(Appendix 4-1). The operation mode of the concerned industrial use was investigated. According to the nearby resident and on-site observations, the predominant noise source during the operation of the concerned open storage site is caused by loading and unloading only and there was no nighttime operation at the open storage site. There is also an existing building within the concerned open storage site which shields the line of sight from the Project Area.

Given the sufficient buffer distance (over 270m) between the nearest NSR of the Project Site and the open storage site in concern, and the screening provided by the existing building at the open storage site, it is expected that the proposed development will not be subject to any adverse noise impacts due to the operation of this premise. In addition, there are clusters of existing 3-storeys village houses at Chuk Yuen Tsuen located between the Project Site and the open storage site (Figure 4-7 refers). As these existing NSRs would be worst affected by the concerned open storage site due to closer to the industrial noise sources, it is considered to be applicable to carry out on-site noise measurements at these existing NSRs to obtain the noise inventory information generated from the open storage site based on their operation pattern. On-site measurements were conducted in April 2013 at village house locations in adjacent the identified industrial site in order obtain representative noise data regarding the concerned industrial site. Noise measurements were conducted during operation of the open storage site for loading and unloading activity for a duration of 30 minutes and background noise level (without the noise from open storage site) was also recorded. Sound Power Levels (SWL) of the identified industrial noise sources are determined based on the site measurement and general acoustic principal, which are also used for the noise calculation. Based on the measurement results, the recorded noise level at village houses due to operation of the open storage site, would be within the ANL (i.e. 60dB(A)). Details of the onsite noise measurements are also provided in **Appendix 4-8** and Figure 4-8. The measured noise data is then used to project the noise level at the proposed development site.

The noise measurement was taken using Brüel & Kjaer (B&K) Precision Integration Sound Level Meter Type 2250, which complies with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1). The weather conditions were good with calm wind condition during measurement, which satisfies the required criteria. The equipment was properly calibrated immediately prior to and following each measurement by a B&K Sound Level Calibrator Type 4321. The noise levels before and after measurement agrees to within 1.0dB.

The predicted noise level at the nearest sensitive receiver of the Project Site due to the open storage site is shown at the table below.

Table 4-7 Maximum Predicted Fixed Noise Levels at Representative NSRs

Sound Power Level of the Noise Source *	Distance between the NSR of the Project Site and the noise source at open storage site	Distance correction #	Façade Correction	Predicted Noise Level at the Project Site due to the open storage
98 dB(A)	273m	- 57 dB(A)	+ 3 dB(A)	44 dB(A)

Note: # Distance correction has been referred to the Table 5 of the Technical Memorandum on Noise from Construction Work Other than Percussive Piling.

* Based on noise measurement during operation of the open storage site and general acoustic principles.

Thus, according to the noise level presented in Table 4-6 and Table 4-7, the cumulative noise level due to operation of the proposed SPS and the identified fixed noise source will be 44dB(A), which can comply with the relevant noise criteria depicted in Table 4-4.

As such, the road traffic noise from the nearby road network would be the only dominant noise source for the proposed development. The detailed traffic noise impact assessments are described in sections 4.5.2 and 4.6.2 below.

4.4 Determination of Noise Sensitive Receivers

With reference to Annex 13 of the TM-EIAO, noise sensitive receivers are identified within the 300 m assessment area. These NSRs included all existing NSRs as well as future potential noise sensitive uses listed on the relevant Outline Zoning Plans.

4.4.1 Future Noise Sensitive Uses in the Vicinity

Information such as relevant plans[9] , current Outline Zoning Plan No. S/YL-MP/6, and Town Planning Board (TPB) records have been reviewed in order to identify potential planned/ committed NSRs. The registry of EIAO projects was also reviewed for EIA projects. Based on information reviewed, there are a few residential development projects in the vicinity of the proposed development site. These residential developments are also classified as designated project under the EIAO; as such they have to go through the EIAO process. These potential future development cases are listed in Table 4-8 below.

9 According to information available on Planning Department's website (available at: http://www.pland.gov.hk/pland_en/info_serv/tp_plan/index.html), the Project Site is not covered by existing Development Permission Area Plans. Instead, it is currently covered by the Outline Zoning Plan (OZP) No. S/YL-MP/6. Records of both the adopted and draft departmental plans in the area were obtained from Planning Department. According to the records obtained, relevant plans were reviewed such as the "L/YL-FP/1C Residential Layout - Fairview Park Access Road, Yuen Long" adopted in year 1982; as well as the draft departmental plan "DP/NWNT/1C North West New Territories - Development Plan" approved in year 1984. As all of these plans were prepared in 1980s', planned uses indicated in these plans are outdated and are superceded by the exsiting OZP. As advised by Planning Department, the existing OZP is the latest version regarding planned land uses in the area

Table 4-8 Status of the Proposed Near-by Sensitive Uses

Planned Site	NSR ID	Relevant Town Planning Board / EIAO Application Number	Description	Approval from TPB	Approval of EIAO	Proposed Ground mPD Level, m	mPD Level at Upper Floor, m
Planned residential development proposals							
REC Site	N3P	ESB-207/2009	Proposed Recreational and Ancillary Residential Development (Including the Relaxation of Maximum Building Height) at DD 104 Lots 3054ARP(Part), 3200ARP, 3201RP, 3202, 3203RP, 3204RP, 3205RP, 3211RP, 3212RP, 3213RP, 3215-3217, 3218RP and 3250B33RP(Part) and Adjoining Government Land.	No	Yes	5.4	9.6 *
Kam Pok Road Site	#	ESB-210/2009. A/YL-MP/136; Also in A/YL-MP/170 & A/YL-MP/202	Proposed Residential Development at R(D) zone	Yes	No	6.5 **(northern portion)	10.7 **
						5.4 **(southern portion)	9.9 **
RD Site	N1P	ESB-204/2009. Different scales of development and site areas were also under A/YL-MP/132, A/YL-MP/146, and A/YL-MP/193	Proposed Residential Development within R(D) Zone at Various Lots in DD 104.	Yes	No	5.4 **	10.2 **
	N2P					5.4 **	10.2 **

Remark:

* According to the OZP, the allowed building height of the planned development sites is 6m high. Thus, it is assumed the planned developments are 2 storeys buildings with floor to floor height at 3m. The mPD level shown in the table is based on 1.2m above the upper floor level. For example, the mPD level for N3P is calculated by 5.4m (ground mPD level) + 3m/ per floor + 1.2m above the ground floor = 9.6mPD).

** According to the approved planning application (A/YL-MP/193 and A/YL-MP/202) for the planned RD Site and Kam Pok Road Site, and the floor to floor height for G/F and 1/F is 3.6m and 3m for RD Site, and 3.3m for Kam Pok Road Site, respectively.

The planned development site is beyond the 300m study boundary of this Project. Thus, it is not considered further in this noise assessment.

The location of the nearby proposed sensitive uses is shown on Figure 4-1. Since the above-mentioned “Kam Pok Road Site” is beyond the 300m study boundary of this Project and there are other planned residential developments that are much closer to the Project Site (e.g. “REC Site” and “RD Site”), the “Kam Pok Road Site” is not considered further in the following noise assessments.

For the planned “REC Site”, the project has not yet been approved by the TPO, but its EIA report has recently been approved under the EIAO. According to the OZP No. S/YL-MP/6, it is within the “REC” zone. Residential houses development may be permitted upon application to the TPB. As residential use is proposed, it is considered as a potential future NSRs in this noise assessment.

None of the above residential development proposals have obtained approval from both the Town Planning Board (TPB) and under the EIAO, and there is no committed development programme for these planned development sites (except "REC Site"). Thus, noise impact due to concurrent construction activities has been assessed based on assumptions (**Section 4.8.4** refers). Noise assessment upon these potential planned NSRs taken into account the proposed noise mitigation measures of this Project, are also provided in **Section 4.7.1.**

In addition, there is a Village Development ("V") zone under the Outline Zoning Plan No. S/YL-MP/6 near to the Chuk Yuen Tsuen (see Figure 4-2A). It is expected that these proposed new territories exempted village houses will be typical 3 storeys buildings. There is currently no committed development programe for these village houses at the moment. They are considered as future NSRs and is assessed as "V1P" as shown in Figure 4-2A.

4.4.2 Noise Sensitive Receiver Used in the Assessment

4.4.2.1 Construction Phase

The use and description of the identified noise sensitive receivers within the assessment area are given in Table 4-8 and Table 4-9 below. The locations of selected assessment points for construction noise impact assessment are also shown in Figure 4-2A.

Table 4-9 Identified Noise Sensitive Receivers from the Boundary of Project Area

Use	Description	NSRs ID
Residential	Fairview Parks	N1 – N4c / N9
Residential	Palm Springs	N6 / N10
Residential	Village Houses at Yau Mei San Tsuen	N5 / N7, N11, N14
Residential	Future Residential Uses (Future Residential Development at "RD Site") along Kam Pok Road	N1P, N2P
Residential	Royal Palms	N8
Residential	Future Residential Uses (Future Residential Development at "REC Site") along Kam Pok Road	N3P
Education	Hong Chi Morning light School, Yuen Long	N_Sch
Education	Christian Ministry Institute	N_Ch
Residential	Village house at Chuk Yuen Tsuen	N12, N13

Remark:

Since the above-mentioned planned "Kam Pok Road Site" (Table 4-8 refers) is beyond the 300m study boundary of this Project and there are other planned residential developments that are much closer to the Project Site (e.g. "REC Site" and "RD Site"), the "Kam Pok Road Site" is not considered further in the following noise assessments.

Table 4-10 Description of Representative NSRs for Construction Noise Assessment

NSR ID	Use	Building Name	Ground Level meter in P.D.	No. of Storeys
N1	Residential	No.9, Lychee Rd. East, Fairview Park	4.2	3
N1b	Residential	No.17, Lychee Rd. East, Fairview Park	4.2	3
N1c	Residential	No.24, Lychee Rd. East, Fairview Park	4.2	3
N2a	Residential	No.30, Lychee Rd. East, Fairview Park	4.2	3
N3	Residential	No.45, Lychee Rd. East, Fairview Park	4.2	3
N4	Residential	No.60, 11th Street River North, Fairview Park	4.3	3
N4a	Residential	No.62, 11th Street River North, Fairview Park	4.2	3
N4c	Residential	No.55, Lychee Rd. East, Fairview Park	4.2	3
N5	Residential	Temporary house at Yau Mei San Tsuen	4.3	2
N6	Residential	No.180, Cypress Drive, Palm Springs	5.7	3
N7	Residential	Temporary house at Yau Mei San Tsuen	4.9	1
N8	Residential	No. 2, Peony Path, Palm Springs	4.9	3
N9	Residential	No. 19, 12th Street River North, Fairview Park	4.2	3

NSR ID	Use	Building Name	Ground Level meter in P.D.	No. of Storeys
N10	Residential	No.108, Cypress Drive, Palm Springs	5.7	3
N_Sch	Educational	Hong Chi Morning light School Yuen long	4.4	3
N_Ch	Educational	Christian Ministry Institute	4.1	2
N11	Residential	Temporary house at Yau Mei San Tsuen	4.9	1
N12	Residential	Village house at Chuk Yuen Tsuen	2.3	2
N13	Residential	Village house at Chuk Yuen Tsuen	3.5	3
N14	Residential	Village house at Yau Mei San Tsuen	3.6	3
N1P	Residential	Future Residential Development at “RD Site”	5.4 *	2 *
N2P	Residential	Future Residential Development at “RD Site”	5.4 *	2 *
N3P	Residential	Future Residential Development at “REC Site”	2.4 *	2 *
V1P	Residential	Future village house within “V” zone	2.4	3

Remark:

Please refer to Figure 4-2A for the locations of NSRs.

* NSR information based on Table 4-8.

4.4.2.2 Operational Phase Road Traffic Noise

The locations of selected assessment points for NSRs of this Project for the operation phase assessment (i.e. road traffic noise assessment) are given in Figure 4-3 and Table 4-11 below.

Table 4-11 Assessment Points of the Representative NSRs of this Project Site for Operational Phase Assessment

NSR	No. of Storey	Height, mPD
N01	3	5.5 (G/F) – 17 (Roof)
N02a	3	
N02b	3	
N03	3	6.5 (G/F) – 18(Roof)
N04a	3	
N04b	3	
N05a	3	
N05b	3	
N06	3	
N07	3	
N08a	3	
N08b	3	
N09	3	5.5 (G/F) – 17 (Roof)
N10	3	
N11a	3	
N11b	3	
N12a	3	
N12b	3	
N13a	3	
N13b	3	
N14a	3	
N14b	3	
N15a	2	Club House
N15b	2	

Remark:

Please refer to Figure 4-3 for the locations of NSRs.

4.5 Assessment Methodology

4.5.1 Construction Phase

The approach used in the assessment of noise from construction works other than percussive piling has been based on standard acoustic principles and with reference to the guidelines given Para. 5.3 and 5.4 of Annex 13 of the EIAO TM. The methodology adopted is the same as that presented in GW-TM.

The construction area of the Project is divided into 4 portions as shown in Figure 4-4. It represents the construction area for the Wetland Restoration Area (Phase A), and the residential portion (Phases B, C and D), respectively. Phase A will be constructed first, which only involves limited re-profiling work area within the WRA. Once the WRA is constructed, site formation work for Phases B, C and D will be carried out later on. Once the site formation work for the residential portion has been completed, the construction of superstructure and utilities of the whole residential portion will commence.

For the construction work of Phase A, it will be a re-profiling work of the existing earth bund of the ponds to provide as shallow a slope as feasible according to the properties of the bund material to provide various habitats. Minimal small PME such as mini excavator would be used in the re-profiling the pond bund for re-distributing the soil to provide gentle slope and deep water area.

Noise impact arising from the construction works have been predicted using the following typical procedures: -

- Based on the tentative construction programme (see Appendix 1-1), the worst construction scenarios of each construction activities were identified;
- Identify from the Sound Power Level (SWL) of each preliminary planned powered mechanical equipment (PME) listed in the GW-TM of NCO and EPD's Quality PMEs (QPMEs) inventory, where appropriate, for used in the construction works;
- Select representative NSRs for the construction noise impact assessment;
- Identify the notional source position for each representative assessment point (RAP). As a worst case scenario, all PME proposed of each construction phase will be assumed to be located at the notional source. The identification of the notional source position will follow the methodology given in the Section 2 of the GW-TM of the NCO, which has been used in the approved EIA (EIA-144/2008) of the proposed comprehensive development at Wo Shang Wai (Section 4.6.4) and that of the approved EIA (EIA-94/2004) of the Stage 2 of PWP Item No. 215 DS – Yuen Long and Kam Tin Sewerage and Sewage Disposal (Section 8.1) ;
- Calculate the Predicted Noise Level (PNL) based on distance attenuation from notional source positions to the representative NSRs;
- With consideration of the effect of facade reflection at the NSRs, the Corrected Noise Level (CNL) at the NSRs was predicted; and
- Based on a comparison of the CNL with the noise criteria presented in Table 4-1, situations/ locations where the need for noise mitigation measures can be identified.

Details of plant inventory for each phase, which are provided by the Project Engineer, are given in Appendix 4-3A. As confirmed by the Project Engineer and the Project Proponent, the plant inventory and the number of vehicles travelling along the haul road adopted in this assessment are technically feasible for carrying out the construction works. The alignment of site access and haul road is shown in Figure 4-5.

Noise due to the travelling of dump truck along the site access and haul road within the Project Area has been evaluated according to the procedures given in British Standard, Noise Control on Construction and Open Sites, BS 5228: Part 1: 2009 with the equation below:

LAeq = SWL – 33 + 10log10 Q – 10 Log10 V – 10log10d

Where,

SWL = Sound Power Level of the dump truck

Q is the number of vehicles per hour

V is the average speed (10 km/hr)

D is the distance of receiver position from the haul road (m)

4.5.2 Operational Phase

4.5.2.1 Traffic Noise

The assessment involves the prediction of the maximum hourly L_{10} level at the noise sensitive receivers (NSRs) of the proposed development due to the projected traffic flow from major road 300 m from the proposed development. The best available information on the planned residential development projects along Kam Pok Road as well as the future Kam Pok Road Extension has been taken into account in deriving the projected peak hour traffic flow. Traffic forecast data for Year 2034, which is considered to be the worst case in terms of traffic within between year 2018 and year 2034, has been provided by the traffic consultant of this Project..

The peak hour of the traffic forecast of the above-mentioned scenario is attached in Appendix 4-2. Transport Department has no comment on the traffic forecast.

The U.K. Department of Transport's procedure "Calculation of Road Traffic Noise" has been applied to predict the hourly L_{10} noise level generated from road traffic at selected representative facades (NSRs) of the residential development.

The predicted noise levels were then compared with the criterion given in Table 4-2 for assessing the impact. The noise prediction was carried out using the in-house computer noise model, Traffic Noise Impact Assessment System (TNIA) V2.0, which is a computerized model developed on the basis of *the UK Department of Transport's Calculation of Road Traffic Noise* (CRTN) procedures.

4.5.2.2 Fixed Noise Source

As mentioned in Section 4.3.2 which shows that the predicted noise level at the Project Area due to the proposed Ngau Tam Mei SPS and the open storage site is 32 dB(A) (with a separation distance of about 206m between the proposed SPS and the nearest NSR) and 44 dB(A) (273m between the open storage site and the nearest NSR) respectively. The cumulative predicted fixed noise at the Project Area would be 44 dB(A) which complies with the relevant noise criteria specified in Table 4-4.

4.6 Prediction and Evaluation of Noise Impacts

4.6.1 Unmitigated Construction Phase Noise Impacts

According to the EIAO-TM, the construction noise standard relevant to daytime construction activities for domestic premises is $L_{eq\ (30\ minutes)}$ 75 dB(A) and that for education institute is L_{eq}

$_{(30\ minutes)}$ 70 dB(A). As indicated in Section 4.2.1.2, construction works in restricted hours and percussive piling works are controlled under NCO. Should such works be required for the Project, suitable CNP applications will be made to the Noise Control Authority.

Table 4-12 below shows the predicted construction noise levels at the representative existing NSRs without any mitigation measures applied. The predicted construction noise levels at the planned NSRs are also provided in Section 4.7.1. Figure 4-4 also shows the boundary of the construction area of each phase.

The unmitigated noise level results demonstrate that most of the NSRs will experience the noise level exceeding the relevant standard. Details of the construction noise level from each phase to each NSR are provided in Appendix 4-3A. Since elevated noise levels are predicted, mitigation measures would be required to alleviate the potential construction noise impact.

Table 4-12 Maximum Predicted Unmitigated Construction Noise Levels at Representative NSRs under a worst case scenario

NSR	Noise Criteria, dB(A)	Highest Noise Level, dB(A)
N1	75	**81**
N1b	75	**83**
N1c	75	**84**
N2a	75	**86**
N3	75	**91**
N4	75	**84**
N4a	75	**85**
N4c	75	**91**
N5	75	**92**
N6	75	**80**
N7	75	**80**
N9	75	**76**
N8	75	**78**
N10	75	**80**
N_Sch	70 (65 during examination)	**72**
N_Ch	70 (65 during examination)	**76**
N11	75	**91**
N12	75	**76**
N13	75	**76**
N14	75	**76**

Note: Bold numbers indicate exceedance of relevant noise criteria. Please refer to Appendix 4-3A for details of calculation results.

Predicted construction noise levels upon the planned NSRs described in Section 4.4.1 above, are also provided in Section 4.7.1.

4.6.2 Operational Phase

Table 4-13 shows the predicted road traffic noise impact assessment at the representative NSRs within the proposed development in year 2034. The assessment has been carried out based on the layout plan of proposed residential houses as shown in Figure 2-10 and the projected traffic flow data in year 2034. The assessment results show that all representative NSRs will not be subject to unacceptable traffic noise impact from the surrounding road networks, as there is sufficient setback distance in between. A 100% compliance of noise criterion of $L_{10(1\ hour)}$ 70 dB(A) is expected..

Table 4-13 Maximum Predicted Road Traffic Noise Levels at Representative NSRs

NSR	Noise Level (L_{10} dB(A))	NSR	Noise Level (L_{10} dB(A))	NSR	Noise Level (L_{10} dB(A))
N1	61	N6	63	N12a	68
N2a	64	N7	66	N12b	69
N2b	65	N8a	66	N13a	68
N3	63	N8b	67	N13b	69
N4a	66	N9	63	N14a	68
N4b	67	N10	63	N14b	68
N5a	67	N11a	67	N15a	61
N5b	68	N11b	69	N15b	62

A sensitive test using the traffic data of an nearby approved planning application (projected to year 2034) has been carried out. The sensitive test results have also shown that the predicted noise level at all representative NSRs will comply with the relevant traffic noise standard (Appendix 4-6).

4.7 Mitigation Measures

4.7.1 Operational Phase

4.7.1.1 Traffic Noise

No mitigation measure is required as the predicted traffic noise results at the proposed development presented in Section 4.6.2 above, can fully comply with the noise criteria.

4.7.1.2 Fixed Noise

As mentioned in Section 4.3.2 and 4.5.2.2, the future SPS will be self-protected and the predicted noise level at the NSR due to the SPS (~ 206m) and the nearest open storage site (~ 273m) is about 44 dB(A) which complies with the noise standard for the Area Sensitive Rating "A". Therefore, no mitigation measure for fixed noise source is required. No industrial/residential interface is anticipated.

4.7.2 Mitigated Construction Phase Noise with the Adoption of QPMEs and Movable Noise Barriers

Based on the predicted unmitigated construction noise level at the representative NSRs (Table 4-12 refers), provision of noise mitigation measure would be required. It must be noted that the works to be carried out at WRA (i.e. Phase A) are mainly limited to re-profiling works for the WRA, thus only minimal construction plants will be required. The concerned works are also similar to those carried out at the existing fish pond by the fish farmer as well as the works for the creation of wetland area for the Spurline.

Noise mitigation measure in terms of Quiet Type PMEs (QPMEs) has been proposed. Asides from QPMEs, additional noise mitigation measures in terms of movable noise barriers are also proposed to shield construction plants. The movable noise barriers should have sufficient surface density of at least 10 kg/m^2 or material providing equivalent acoustic performance to block the line of sight from the sensitive receivers. There should not be any gaps and openings at the noise barriers and site hoardings to avoid noise leakage. The design of the noise barriers shall be proposed by the work contractor(s), and approved by the Engineers Representative (RE) and the Environmental Team in accordance with the Project EM&A Manual.

As discussed earlier, there will be minor construction works within the Phase A area in order to establish the wetland area within a relatively short duration (i.e. re-profiling work of the

existing earth bund to be carried out within 1 wet season within the WRA). Erection of the tall fixed construction phase noise barrier along the boundary of the wetland in Phase A, would definitely reduce the effectiveness of the wetland during the construction phase of the residential portion of the Project Site, thus it is not proposed.

Instead, the amount of QPMEs at Phase A's works area will be kept to a minimum in order to minimize potential noise impact. During the Phase A works, movable noise barriers shall also be erected near the site boundary adjacent to the nearby NSRs at Yau Mei San Tsuen (e.g. N5 and N11) so as to shield construction plant from these NSRs. In addition, 3m tall site hoarding will also be erected along the Project site boundary. After the completion of the re-profiling work of the wetland, minor landscape work will be carried out and that the wetland is assumed to function during the construction phase of the residential portion of the Project Site (i.e. Phase B to D). In view of maintaining the function of the wetland (Phase A), there is a possibility to demolish the site hoarding surrounding the Phase A once the Project Ecologist considers that the wetland is ready to function as it is designed.

According to EIAO Guidance Note No. 9/2010, with provision of noise barriers, a 5dB(A) noise reduction for movable plant, 10 dB(A) for stationary plant and 15 dB(A) for enclosed ones are assumed in the noise assessment.

The calculated construction noise level with the use of QPMEs and movable noise barriers are shown in Table 4-14, and details of noise calculation are also provided in Appendix 4-3B. According to the results, with the adoption of QPMEs and movable noise barriers construction noise levels can be significantly reduced and would comply with the relevant noise criteria with the exception of NSRs at existing Fairview Park (i.e. N3, N4c) as well as the planned REC development site (N3P). According to the results, elevated noise levels were predicted during construction of the Phases B, C, and D areas. Thus, further noise mitigation measures would be required for these NSRs (see Section 4.7.3).

For NSRs at existing Yau Mei San Tsuen (e.g. N5), the calculated noise level is marginally within the noise criteria (74 dB(A)). Taking into account calculated construction noise level due to concurrent construction of other approved/ planned EIA projects (i.e. 71 dB(A) at N5 as presented in Table 4-16 in Section 4.8.4), the cumulative noise level due to this Project as well as the approved/ planned EIA projects would likely exceed the relevant noise criteria. As such, temporary fixed noise barrier is also proposed along in adjacent to the existing Yau Mei San Tsuen (please refer to Section 4.7.3).

Table 4-14 Maximum Predicted Mitigated Construction Noise Levels at Representative NSRs with Adoption of QPMEs and Movable Noise Barriers

NSR	Noise Criteria, dB(A)	Highest Noise Level, dB(A)
N1	75	69
N1b	75	71
N1c	75	72
N2a	75	74
N3	75	**79**
N4	75	72
N4a	75	73
N4c	75	**79**
N5	75	74
N6	75	67
N7	75	69
N9	75	64
N8	75	66
N10	75	67
N_Sch	70 (65 during examination)	60

NSR	Noise Criteria, dB(A)	Highest Noise Level, dB(A)
N_Ch	70 (65 during examination)	65
N11	75	75
N12	75	65
N13	75	65
N14	75	66
N1P	75	70
N2P	75	70
N3P	75	**77**
V1P	75	68

Note: Bold numbers indicate exceedance of relevant noise criteria. Please refer to Appendix 4-3B for details of calculation.

4.7.3 Mitigated Construction Noise with Adoption of QPMEs, Movable Noise Barriers and Fixed Temporary Noise Barriers

As mentioned above, there may be residual noise impacts at some of the existing residential houses at the existing Fairview Park, Yau Mei San Tsuen, and the planned REC Site. Thus, additional noise mitigation measures in terms of fixed temporary noise barrier are also proposed.

Fixed temporary noise barrier is proposed near the existing Fairview Park as well as near the existing Yau Mei San Tsuen in order to alleviate elevated construction noise level over there. In addition, when the planned REC Site in adjacent to the Project Site is occupied with sensitive receivers during construction of this Project, fixed temporary noise barrier will also need to be erected near the concerned development site. Locations of proposed fixed temporary noise barriers are shown in **Figure 4-6**. The exact location is subject to the contractor(s) and the prior approval from the Resident Engineer (RE). Cross sectional diagrame showing the proposed noise barrier and nearby sensitive uses are also provided in **Figure 4-6A** and **4-6B**.

In order to ensure construction noise is controlled throughout the construction period, fixed temporary noise barriers shall be erected prior to site formation works of Phases B to D. It is estimated that 6m high temporary fixed noise barriers (with top level at 8mPD level) shall be sufficient to shield the concerned existing/ planned NSRs at Fairview Park and the planned REC Site, while 4.5m high noise barriers is required to be erected adjacent to the existing Yau Mei San Tsuen (**Figures 4-6, 4-6A and 4-6B** refer) (Information such as mPD level and building height is extracted from Table 4-8). Erection of temporary fixed noise barriers will be carried out section by section and precast units will be used for the foundation of the noise barrier as much as possible. Since standard site hoarding of 3m tall will also be erected along the site boundary, the concerned temporary fixed noise barriers can be combined with the site hoarding.

The concerned temporary fixed noise barriers should have sufficient surface density of at least 10 kg/m^2 or material providing equivalent acoustic performance. There should not be any gaps and openings at the noise barriers and site hoardings to avoid noise leakage. The design of the noise barriers shall be proposed by the work contractor(s), and approved by the Engineers Representative (RE) and the Environmental Team in accordance with the Project EM&A Manual.

The estimated noise level with the adoption of temporary fixed noise barriers, are depicted in **Appendix 4-3C**. By using a combination of QPMEs, movable noise barriers, and temporary fixed construction noise barriers, the mitigated construction noise levels at the concerned NSRs would comply with the relevant noise criteria. Therefore, all the mitigated construction noise levels would comply with the relevant construction noise standard.

Table 4-15 summarises the estimated mitigated noise levels at the NSRs with the proposed noise mitigation measures.

Table 4-15 Maximum Predicted Mitigated Construction Noise Levels at Representative NSRs with the Use of QPME, Movable Noise Barriers and Temporary Fixed Noise Barriers

NSR	Noise Criteria, dB(A)	Highest Noise Level, dB(A)
N1	75	69 #
N1b	75	71 #
N1c	75	72 #
N2a	75	69 *
N3	75	74 *
N4	75	67 *
N4a	75	68 *
N4c	75	74 *
N5	75	72 *
N6	75	68 #
N7	75	64 *
N9	75	65 #
N8	75	61 *
N10	75	67 #
N_Sch	70 (65 during examination)	60 #
N_Ch	70 (65 during examination)	60 *
N11	75	72 *
N12	75	66 #
N13	75	65 #
N14	75	61 *
N1P	75	71 #
N2P	75	70 #
N3P	75	72 *
V1P	75	69 #

Note: # The predicted mitigated construction noise level shown in Table 4-14 based on the adoption of QPMEs and movable noise barriers.

* NSRs that will be protected/ benefited by the proposed temporary fixed noise barriers. Predicted mitigated construction noise levels with the adoption of QPMEs, movable noise barriers and Fixed temporary noise barriers. Please refer to Appendix 4-3C for details of calculation.

Based on the assessment results, with the adoption of the recommended noise mitigation measures, the construction noise level due to this Project would be within the relevant noise criteria. Thus, no further noise mitigation measures will be necessary.

4.7.4 Recommendations on Noise Mitigation Measures

It is also recommended that good housekeeping activities shall also be carried out to further minimize the potential construction noise impact, and these are summarised below. The following good site practices are also recommended for incorporation into the contractual requirements:

- Before the commencement of any work, the Contractor shall submit to the Engineer for approval the method of working, equipment and sound-reducing measures intended to be used at the Project Area;

- Contractor shall comply with and observe the Noise Control Ordinance (NCO) and its current subsidiary regulations;
- Before the commencement of any work, the Contractor shall submit to the Engineer for approval the method of working, equipment and sound-reducing measures intended to be used at the Project Area;
- Contractor shall devise and execute working methods that will minimize the noise impact on the surrounding environment; and shall provide experienced personnel with suitable training to ensure that these methods are implemented;
- Only well-maintained plants should be operated on-site;
- Plants should be serviced regularly during the construction programme;
- Machines that may be in intermittent use should be shut down or throttled down to a minimum between work periods;
- Silencer and mufflers on construction equipment should be utilised and should be properly maintained during the construction programme;
- Noisy activities can be scheduled to minimize exposure of nearby NSRs to high levels of construction noise. For example, noisy activities can be scheduled for midday or at times coinciding with periods of high background noise (such as during peak traffic hours);
- Noisy equipment such as emergency generators shall always be sited as far away as possible from noise sensitive receivers;
- Mobile plants should be sited as far away from NSRs as possible; and
- Material stockpiles and other structures should be effectively utilised as noise barrier, where practicable.
- The contractor(s) is also encouraged to arrange construction activities with care so that concurrent construction activities are avoided as much as possible. The contractor(s) should closely liaise with the school so that noisy activities are not undertaken during school's examination period. With the above noise mitigation measures in place and good site practices, residual noise impact at the school would be temporary and unacceptable noise impact is not expected.
- Similar to other EIA projects, EM&A will be carried out for this Project during the Project construction phase in order to monitor the construction noise level and to verify the effectiveness of the noise mitigation measures. A Project Environmental Team will be formed as part of the Project EM&A works, which will closely monitor contractor(s)' performance and the residual noise level at the school. Should unacceptable construction noise level be identified during the construction noise monitoring, necessary actions following the standard Event and Action Plan specified in the Project EM&A Manual, will be required by the Project Environmental Team.

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4.8 Cumulative Construction Noise

4.8.1 Concurrent Projects

As discussed in Section 1.9, there are a few works projects near the Project Site. These are the approved cycle track project; approved public sewerage project; and 3 planned

development sites (namely, the planned "Kam Pok Road Site", "RD Site" and "REC Site" as shown in Figure 1-2). The first two projects are Government projects which have already obtained approval on their EIA reports under the EIAO process. The status of these projects has been reviewed in Section 1.9. There is currently no fixed construction programme for these Government projects. However, since the concerned projects have already obtained EIA approval, overlapping of their works programme with that of this Project Site cannot be precluded at this stage, hence they are considered in the cumulative noise assessment.

For the 3 planned development sites, they are also EIA projects and will need to obtain EIA approval. Development programme in the respective Project Profile of these planned projects is outdated and there is no committed development programme available (except "REC Site"). Among the three above-mentioned projects, the planned "Kam Pok Road Site" and "RD Site" projects have already obtained approval from the TPB, reference is made to the planning application of these planned sites. Based on the current best available information, the construction of the planned "RD Site" will commence in year 2016 for completion in year 2019 (it is also understood from the project proponent of that project that the construction works of that project may be further delayed), while the construction of the planned "Kam Pok Road Site" will commence in 2016 for completion in year 2017. Thus, Project works of this Project may partially overlap with these 2 planned development sites. Since the planned "Kam Pok Road Site" falls outside the 300m study radius of this Project (Figure 4-1 refers), it is not considered further in this noise assessment. As such, only the planned "RD Site" is taken into account in the following cumulative noise assessment.

Cumulative construction noise impacts due to the above approved/ planned development projects are described in Sections 4.8.2 to 4.8.4.

For the planned "REC Site", its EIA report has recently been published and approved. Construction programme of the planned "REC Site" has been referenced. According to the "REC Site" EIA report, there will be concurrent construction activities during the later stage of construction of this Project between later year of 2017 and year 2018. As such, cumulative noise impacts due to the planned "REC Site" Project have been assessed as well. Results of the assessment are presented in Section 4.8.5 and **Appendix 4-5A**.

4.8.2 Cumulative Construction Noise Due to Adjacent Approved Cycle Track Project as well as Public Sewerage Project

Within the Assessment Area, there is a proposed public sewerage project near Ngau Tam Mei Channel and Castle Peak Road between Ngau Tam Mei and San Tin under PWP Item 4235DS. The concerned public sewerage project has been assessed in a separate EIA report for "Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2" (EIA Application No. EIA-094/2004). The concerned public sewerage project near Ngau Tam Mei covers the construction of a section of gravity trunk sewer underneath Kam Pok Road and Yau Pok Road as well as construction of proposed Ngau Tam Mei Sewage Pumping Station (NTMSPS) near the road junction between Kam Pok Road and Castle Peak Road.

The section of proposed public sewers and the NTMSPS are shown in **Figure 4-2a**. The construction of the above sewerage project has been addressed in the above-mentioned EIA report. The EIA report has stated that all works will be carried out in small section areas within a short period. These activities should not generate significant amount of construction dust and result in cumulative impact. It has also recommended in the same report the construction works will be carried out in 50m segments.

There is currently no fixed construction programme for the above-mentioned public sewerage project. Since overlapping of construction programme of these projects with the construction programme of this Project cannot be precluded at this stage, cumulative construction noise due to construction of the public sewers and the construction of this Project has been considered in this assessment as a worst case scenario. Information such

as the plant inventory and SWLs has been extracted from the corresponding EIA report, which is also summarised in **Appendix 4-4**. The calculated construction noise levels at representative NSRs locations due to these approved EIA projects are also presented in **Appendix 4-4**.

Asides from the proposed public sewerage works, there is also a proposed alignment of cycle track between Sha Po Tsuen and Shek Sheung River (EIA Application No. EIA 159/2008). The section of cycle track near the Project Site will be constructed along the edge of Yau Pok Road on the other side of existing Ngau Tam Mei Channel. According to the EIA report, the concerned construction of cycle track project will involve construction of a narrow strip of cycle track, which will be constructed in sections. Typically, the working area will be 40 m long by 4 m wide and no adjacent sections (200m between two neighbouring sections) will be constructed simultaneously. There is currently no fixed construction programe for the proposed cycle track between Sha Po Tsuen and Shek Sheung River (EIA Application No. EIA 159/2008). Cumulative construction noise due to cycle track project and construction of this Project is also assessed and the results are presented in **Appendix 4-4**.

Construction plant inventory presented in the approved EIA report of the above-mentioned projects has been adopted in this noise assessment. Although concurrent construction of the above-mentioned approved EIA projects and this Project is unlikely, cumulative construction noise impact has been assessed based on the highest noise level predicted for the above approved projects (using the shortest separation distance) and the highest noise level predicted for this Project, and the results are presented in the following paragraphs. However, since the concerned approved EIA projects will be constructed in short sections (50m for cycle track and 40m for public sewers), it is expected that both the noise strength and duration of construction nearby the NSRs would be smaller than that predicted in this assessment.

4.8.3 Cumulative Construction Noise Due to Planned "RD Site"

As discussed earlier (**Sections 1.9** and **4.8.1**), there are other planned development projects in adjacent to the Project Site which may overlap in terms of time with works of this Project. The planned project (i.e. Planned "RD Site") may overlap with this Project, and the cumulative construction noise impact has been assessed. As the concerned planned development project will be subject to approval from both TPB and EIAO, and also subject to fulfilment of relevant approval conditions, it is expected that overlapping of the peak construction activities of these development sites will unlikely to occur. Thus, adverse impacts due to concurrent construction of peak construction activities of these projects are not anticipated. Having said that, a sensitivity test based on the assumption has been conducted to provide a more conservative assessment.

According to the Study Brief of the planned development projects, the development intentions of this project are also for low-rise and low-density residential developments (similar to this Project). Since the planned projects are located in relatively flat area, it is expected that the construction scale of the planned project site will be similar to this Project. Thus, the construction scale and plant inventory of the planned project have been based on best available information and assumptions, which is also presented in **Appendix 4-5**.

Since the planned development Project will also be controlled under the EIAO with regard to construction impacts, it is expected that noise mitigation measures (e.g. QPMEs and movable noise barriers) would be adopted for these Projects during the construction. Thus, this noise assessment has taken into account these noise mitigation measures for the purpose of this noise assessment. The calculated construction noise levels due to these planned development projects are also presented in **Appendix 4-5**.

4.8.4 Cumulative Construction Noise Assessment Due to Cycle Track Project; Public Sewerage Project; and "RD Site"

Cumulative construction noise impact due to concurrent construction with the approved cycle track project; approved public sewerage project; as well as adjacent planned development project (i.e. "RD Site"), has also been assessed. The assessment has been conducted for both the existing NSRs and planned NSRs based on the following assumptions. The common NSR locations that may be worst affected by these construction projects have been selected for the noise assessment.

For existing NSRs, cumulative construction noise levels due to the adjacent approved EIA projects as well as planned development site, have been estimated.

As these development sites have no committed development programme, two scenarios have been assumed in the noise assessment:

Scenario A – the concerned planned development sites are already occupied during the construction of this Project; and

Scenario B – the planned development sites are constructed at the same time during the construction of this Project.

Results of the estimated cumulative construction noise levels are presented in Table 4-16. The calculation of cumulative construction noise due to concurrent projects should be based on the concurrent construction activities shown in the respective construction programme and its plant inventory for evaluation of cumulative impacts. However, since there is no committed construction programme of the concerned nearby project sites (i.e. planned "RD Site"; the approved cycle track project; and approved public sewerage project), the noise levels presented is based on a conservative approach by assuming concurrent construction of the peak construction activities of these projects (i.e. calculation of cumulative noise is based on highest noise level to be generated from the nearby project sites), which is not very likely to occur.

Based on the assessment results, the calculated cumulative construction noise levels with noise mitigation measures would comply with the relevant noise criteria at most of the NSR locations or the noise level is dominant by other construction projects while the contribution due to this Project is negligible. Thus, no further noise mitigation measures would be required for these NSRs.

However, for planned NSR V1P, the cumulative noise level at the NSR would slightly exceed the relevant noise criteria when there is concurrent construction of this Project and that of the nearby approved/ planned EIA projects.

Thus, 3m tall fixed temporary noise barrier is proposed to be erected at Project Site boundary adjacent to Yau Pok Road when the "V" zone in adjacent to Kam Pok Road is developed and occupied and there is concurrent construction from both the planned RD Site as well as from the approved EIA projects mentioned above in order to alleviate any residual noise impacts (see **Figures 4-6 and 4-6B**) (Information such as mPD level and building height is extracted from Table 4-8). Since standard site hoarding of 3m tall will also be erected along the site boundary, the concerned temporary fixed noise barriers can be combined with the site hoarding. The concerned temporary fixed noise barriers should have sufficient surface density of at least 10 kg/m^2 or material providing equivalent acoustic performance. There should not be any gaps and openings at the noise barriers and site hoardings to avoid noise leakage. The design of the noise barriers shall be proposed by the work contractor(s), and approved by the Engineers Representative (RE) and the Environmental Team in accordance with the Project EM&A Manual.

The proposed noise barrier would protect planned V1P and would also provide additional noise shielding to existing village houses to the further south-eastern location (i.e. N13, N12) and planned NSRs such as N1P and N2P. Details of the noise calculation with the proposed temporary noise barrier are provided in **Appendix 4-3C**, and the resultant noise levels are summarised in Table 4-17. Table 4-17 summarises the mitigated cumulative noise levels at the NSRs with the proposed noise mitigation measures in place. Based on the assessment results, the calculated cumulative construction noise levels with the proposed noise mitigation measures would comply with the relevant noise criteria or the noise level is dominant by other construction projects. Thus, no further noise mitigation measures will be necessary.

Nevertheless, the Contractor(s) of this Project will be reminded to carefully arrange construction programme so as to minimize simultaneous construction activities. As part of the EM&A programme, an appropriate EM&A programme shall also be established. The ET shall closely monitor the Contractor(s)' construction program and the construction noise level at NSRs. Should there be adverse noise impact due to construction of this Project, the concerned construction activity shall be stopped and the ET shall liaise with the Contractor(s) to review the concerned construction activity and the need to implement additional noise mitigation measures.

Therefore, with the implementation of the recommended noise mitigation measures of this Project, unacceptable construction noise impacts due to construction of this Project is not expected. Cumulative construction noise impact from this Project will be controlled through implementation measures described in this report and those committed for the other projects.

4.8.5 Cumulative Construction Noise Assessment with Due Consideration of Approved "REC Site"

As discussed above, there was previously no information available regarding the planned "REC Site" development project, so it was not assessed in the noise assessment described above. Given that the planned "REC Site" EIA report has recently been published and approved, cumulative construction noise impact due to that project has been assessed as well. The assessment approach and results are presented **Appendix 4-5A**.

According to the assessment results, with the proposed noise mitigation measures of this Project, there will be no adverse construction noise impacts due to concurrent construction of this Project with the planned "REC" Site. Thus, no further noise mitigation measures would be necessary.

4.9 Conclusion

4.9.1 Construction Phase

With the implementation of noise mitigation measures such as careful design of layout and construction methodology for proposed WRA as well as erection of sufficient noise barrier for residential portion, construction noise levels at the NSRs will comply with the noise standard. No residual noise impact is expected.

4.9.2 Operational Phase

With acoustic louvre and noise treatment at the proposed interim sewage treatment plant, no adverse noise impact is anticipated. As there will be full compliance of noise standard during the operational phase and further no mitigation measure is required, there is no residual noise impact.

Table 4-16 Estimated Cumulative Construction Noise Levels at Representative NSRs With the Use of QPMEs, Movable Noise Barriers, and Temporary Fixed Noise Barriers

		Calculated Noise Level due to Approved EIA Projects *			Calculated Noise Level due to Adjacent Approved EIA Projects *	Cumulative Noise Level - Scenario A			Cumulative Noise Level - Scenario B			
NSR Label		Construction of Cycle Track, dB(A)	Construction of Public Sewers, dB(A)	Construction of Ngau Tam Mei Sewage Pumping Station, dB(A)	Construction of RD site, dB(A)	Cumulative Noise Level Due to Approved EIA Projects only, dB(A)	Highest Mitigated Noise Level Due to Current Project, dB(A) #	Cumulative Noise Level, dB(A)	Cumulative Noise Level Due to Approved EIA Projects and Planned Development Projects, dB(A)	Highest Mitigated Noise Level Due to Current Project, dB(A) #	Cumulative Noise Level, dB(A)	Noise Criteria
		A	B	C	F	= A+B+C	D	=A+B+C+D	=A+B+C+F	D	=A+B+C+F+D	
Existing NSRs	N3	58	56	48	62	60	74	74	64	74	74	75
	N4	57	56	47	62	60	67	68	64	67	69	75
	N4c	59	58	48	63	62	74	74	65	74	75	75
	N5	69	67	57	65	71	72	75	72	72	75	75
	N6	50	49	46	58	53	67	67	59	67	68	75
	N7	56	55	51	61	59	64	65	63	64	67	75
	N9	62	60	45	64	64	64	67	67	64	69	75
	N8	54	53	50	60	57	61	62	62	61	65	75
	N_sch	47	46	42	56	50	60	60	57	60	62	70 (65 during examination)
	N_ch	63	61	58	62	66	60	67	67	60	68	70 (65 during examination)
	N12	55	58	52	75	60	65	66	75	65	75	75
	N13	55	57	53	74	60	65	66	74	65	75	75
	N14	67	66	61	62	70	61	71	71	61	71	75
Planned Development Sites	N1P	64	74	53	-	74	70	75	74	-	-	75
	N2P	64	74	56	-	74	70	75	74	-	-	75
	N3P	64	62	48	-	66	72	73	66	-	-	75
	V1P	64	74	58	74	75	68	75	77	68	78	75

Note: * Please refer to Appendix 4-4 and Appendix 4-5 for the calculation of construction noise level due to the approved/ planned EIA projects. Since the planned development sites (i.e. the RD Site) are subject to approval from both the TPB and EIAO, the estimated construction noise levels of these projects are presented for reference only and are based on best available information and assumptions with the adoption of QPMEs and movable noise barriers for the purpose of this noise assessment.

The calculated mitigated noise level due to construction of this Project as presented in Table 4-15 with the adoption of QPMEs, movable noise barriers and fixed temporary noise barriers. Please refer to Figure 4-2a for the NSR locations.

Hatched numbers, if any, indicate exceedance of the relevant noise criteria for construction activities.

Table 4-17 Summary Table of Mitigated Cumulative Construction Noise Levels at Representative NSRs With the Use of QPMEs, Movable Noise Barriers, and Temporary Fixed Noise Barriers

		Calculated Noise Level due to Approved EIA Projects *			Calculated Noise Level due to Adjacent Approved EIA Projects *	Cumulative Noise Level - Scenario A			Cumulative Noise Level - Scenario B			
NSR Label		Construction of Cycle Track, dB(A)	Construction of Public Sewers, dB(A)	Construction of Ngau Tam Mei Sewage Pumping Station, dB(A)	Construction of RD site, dB(A)	Cumulative Noise Level Due to Approved EIA Projects only, dB(A)	Highest Mitigated Noise Level Due to Current Project, dB(A) #	Cumulative Noise Level, dB(A)	Cumulative Noise Level Due to Approved EIA Projects and Planned Development Projects, dB(A)	Highest Mitigated Noise Level Due to Current Project, dB(A) #	Cumulative Noise Level, dB(A)	Noise Criteria
		A	B	C	F	= A+B+C	D	=A+B+C+D	=A+B+C+F	D	=A+B+C+F+D	
Existing NSRs	N3	58	56	48	62	60	74	74	64	74	74	75
	N4	57	56	47	62	60	67	68	64	67	69	75
	N4c	59	58	48	63	62	74	74	65	74	75	75
	N5	69	67	57	65	71	72	75	72	72	75	75
	N6	50	49	46	58	53	67	67	59	67	68	75
	N7	56	55	51	61	59	64	65	63	64	67	75
	N9	62	60	45	64	64	64	67	67	64	69	75
	N8	54	53	50	60	57	61	62	62	61	65	75
	N_sch	47	46	42	56	50	60	60	57	60	62	70 (65 during examination)
	N_ch	63	61	58	62	66	60	67	67	60	68	70 (65 during examination)
	N12	55	58	52	75	60	60	63	75	60	75	75
	N13	55	57	53	74	60	60	63	74	60	74	75
	N14	67	66	61	62	70	61	71	71	61	71	75
Planned Development Sites	N1P	64	74	53	-	74	65	75	74	-	-	75
	N2P	64	74	56	-	74	65	75	74	-	-	75
	N3P	64	62	48	-	66	72	73	66	-	-	75
	V1P	64	74	58	74	75	63	75	77	63	77	75

Note:

* Based on calculated construction noise level as shown in Table 4-16 and based on the adoption of QPMEs and movable noise barriers.

The calculated mitigated noise level due to construction of this Project as presented in Table 4-16. For planned NSRs N1P, N2P, V1P, and existing NSRs N12 and N13, please refer to Appendix 4-3C for the calculated noise level based on the adoption of QPMEs, movable noise barriers and noise barrier effect due to the proposed fixed temporary noise barrier mentioned in Section 4.8.4.

Hatched numbers, if any, indicate exceedance of the relevant noise criteria for construction activities.

5. WATER QUALITY

5.1 Summary

This section presents an assessment of the potential water quality impact that may arise from construction and operation of the Project. The assessment has been carried out in accordance with the requirements given in Clause 3.9.3 of the EIA Study Brief and the criteria and guidelines given in Annexes 6 and 14 of the EIAO-TM respectively. The Assessment area for the water quality impact assessment is defined by a distance of 500m from the boundary of the Project Site as per the EIA Study Brief.

The "assessment area" covers fish ponds, existing drainage channels surrounding the Project Area. Surrounding areas in the larger Deep Bay Catchment Area of the Deep Bay Water Control Zone (WCZ) and the Ramsar Site are also covered.

The proposed Project is for comprehensive development and wetland protection near Yau Mei San Tsuen. Detailed elements of the proposed development and the MLP are discussed in Section 1.3.

5.2 Environmental Legislation, Standards, Guidelines and Criteria

The relevant legislation, standards and guidelines applicable to the present study for the assessment of water quality impacts include:

- Water Pollution Control Ordinance (WPCO) CAP 358;
- Technical Memorandum on "Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters" (TM-Effluents);
- Environmental Impact Assessment Ordinance (EIAO) (CAP. 499), and the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM);
- No Net Increase in Pollution Loads Requirement in Deep Bay under the Town Planning Board Guideline no. 12C;
- Hong Kong Planning Standards and Guidelines; and
- ProPECC PN 1/94 "Construction Site Drainage"

5.2.1 Water Pollution Control Ordinance

The Water Pollution Control Ordinance (WPCO) (Cap. 358) enacted in 1980 is the principal legislation controlling water quality in Hong Kong. Under the WPCO, Hong Kong waters are classified into 10 Water Control Zones (WCZ). The Project Site is situated within the catchment area of the Deep Bay WCZ.

Statutory Water Quality Objectives (WQOs) are specified for each WCZ. The WQOs for any particular waters, as defined in the WPCO, shall be the quality, which should be achieved and maintained in order to promote conservation and best use of those waters in the interest of the public.

5.2.2 Technical Memorandum on "Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters"

The TM-Effluents issued under Section 21 of the WPCO defines acceptable discharge limits of effluent to different types of receiving waters. Under the Ordinance, any discharge into the WCZ requires a license, which the terms and conditions specified therein should be complied with, except for domestic sewage discharged into public foul sewers, and unpolluted water into storm water drains and river courses.

The discharge from the Project Site shall comply with the standards for effluent discharge into inland water. Group D and C inland water standards are adopted, which are also provided in Table 5-1 and Table 5-2, respectively.

Table 5-1 Standards for Effluent Discharged into Group D Inland Waters (All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated)

Flow Rate (m^3/day) / Determinant	≤ 200	> 200 and ≤ 400	> 400 and ≤ 600	> 600 and ≤ 800	> 800 and ≤ 1000	> 1000 and ≤ 1500	> 1500 and ≤ 2000	> 2000 and ≤ 3000
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (°C)	30	30	30	30	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1
Suspended solids	30	30	30	30	30	30	30	30
BOD	20	20	20	20	20	20	20	20
COD	80	80	80	80	80	80	80	80
Oil & Grease	10	10	10	10	10	10	10	10
Iron	10	8	7	5	4	2.7	2	1.3
Boron	5	4	3.5	2.5	2	1.5	1	0.7
Barium	5	4	3.5	2.5	2	1.5	1	0.7
Mercury	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	1	1	0.8	0.8	0.5	0.5	0.2	0.2
Total toxic metals	2	2	1.6	1.6	1	1	0.5	0.4
Cyanide	0.4	0.4	0.3	0.3	0.2	0.1	0.1	0.05
Phenols	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1
Sulphide	1	1	1	1	1	1	1	1
Sulphate	800	600	600	600	600	400	400	400
Chloride	1000	800	800	800	600	600	400	400
Fluoride	10	8	8	8	5	5	3	3
Total phosphorus	10	10	10	8	8	8	5	5
Ammonia nitrogen	20	20	20	20	20	20	20	10
Nitrate + nitrite nitrogen	50	50	50	30	30	30	30	20
Surfactants (total)	15	15	15	15	15	15	15	15
E. coli (count/100 ml)	1000	1000	1000	1000	1000	1000	1000	1000

Table 5-2 Standards for Effluent Discharged into Group C Inland Waters (All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated)

Flow Rate (m^3/day) / Determinand	≤ 100	> 100 and ≤ 500	> 500 and ≤ 1000	> 1000 and ≤ 2000
pH (pH units)	6-9	6-9	6-9	6-9
Temperature (°C)	30	30	30	30
Colour (lovibond units) (25 mm cell length)	1	1	1	1
Suspended solids	20	10	10	5
BOD	20	15	10	5
COD	80	60	40	20
Oil & Grease	1	1	1	1
Boron	10	5	4	2
Barium	1	1	1	0.5
Iron	0.5	0.4	0.3	0.2
Mercury	0.001	0.001	0.001	0.001

Flow Rate (m^3/day) / Determinand	≤ 100	> 100 and ≤ 500	> 500 and ≤ 1000	> 1000 and ≤ 2000
Cadmium	0.001	0.001	0.001	0.001
Silver	0.1	0.1	0.1	0.1
Copper	0.1	0.1	0.05	0.05
Selenium	0.1	0.1	0.05	0.05
Lead	0.2	0.2	0.2	0.1
Nickel	0.2	0.2	0.2	0.1
Other toxic metals individually	0.5	0.4	0.3	0.2
Total toxic metals	0.5	0.4	0.3	0.2
Cyanide	0.05	0.05	0.05	0.01
Phenols	0.1	0.1	0.1	0.1
Sulphide	0.2	0.2	0.2	0.1
Fluoride	10	7	5	4
Sulphate	800	600	400	200
Chloride	1000	1000	1000	1000
Total phosphorus	10	10	8	8
Ammonia nitrogen	2	2	2	1
Nitrate + nitrite nitrogen	30	30	20	20
Surfactants (total)	2	2	2	1
E. coli (count/100 ml)	1000	1000	1000	1000

Asides from the above, the applicable key WQOs designated for inland waters in Deep Bay WCZ is also provided in Table 5-3.

Table 5-3 Key Water Quality Objectives for Inland Waters in Deep Bay Water Control Zone

Parameter	WQOs
pH range	6-9
Maximum 5-Day Biochemical Oxygen Demand, mg/L	5
Maximum Chemical Oxygen Demand, mg/L	30
Maximum Annual Median Suspended Solids, mg/L	20
Minimum Dissolved Oxygen, mg/L	4
Unionised Ammonia (annual mean), mg/L	0.021
E. coli (count/100 ml)	1,000

Remark: WQO follows River Water Quality in Hong Kong in 2009, published by EPD.

5.2.3 EIAO-TM

The general criteria and guidelines for evaluating and assessing water quality impacts are listed in Annexes 6 and 14 of the TM-EIAO.

5.2.4 No Net Increase in Pollution Loads Requirement in Deep Bay

The 'No Net Increase in Pollution Loads Requirement' aims to provide protection to the inland and marine water quality of the Deep Bay WCZ. According to Clause 3.9.3.4(x) and (xv) of the EIA Study Brief and Town Planning Board Guideline No.12C, no net increase in pollution load to Deep Bay will be required for this Project.

5.2.5 Hong Kong Planning Standards and Guidelines

Chapter 9 of the Hong Kong Planning Standards and Guidelines (HKPSG) outlines environmental requirements that need to be considered in land use planning of both public and private developments. It also lists out environmental factors influencing land use planning and recommends buffer distances for land uses.

5.2.6 ProPECC PN 1/94 "Construction Site Drainage"

The Practice Note for Professional Persons (ProPECC Note PN1/94) on Construction Site Drainage provides guidelines on good practice for dealing with discharges from construction sites. It is applicable to this study for control of site runoff and wastewater generated during the construction phase.

5.3 Description of the Environment and Sensitive Receivers

5.3.1 Existing Environment within and adjacent to the Project Site

Within Project Site

The Project Site is situated at the fringe of the Deep Bay area. The Project Site is entirely within the Deep Bay Buffer Zone 2 (see Figure 1-1), which is subject to planning control for the protection of the adjoining Ramsar Site from incompatible land uses. There is however no part of the Project Site which will encroach into the Deep Bay Buffer Zone 1.

The Project Site is generally low-lying in terrain and the geographical characteristic of the Project Site is relatively flat. The Project Site is primary dry agricultural land, runoff with chemical fertilizers or pesticides from agricultural land may affect the nearby Water Sensitive Receivers. Surface runoff carrying sediment laden will also flow from the farming area directly into the nearby existing drainage channels without any treatment. Two small irrigation channels of low ecological value (Section 8.8.6 refers), are flowing from southern portion of the Project Site close to the Ngau Tam Mei Drainage Channel (NTMDC) to its north, which connects to Fairview Park Nullah.

There are also a few existing ponds within the north-western corner of the Project Site. Currently, during heavy rainfall, water in these ponds will flow over the access and bunds to other ponds and nearby drainage channels into the Inner Deep Bay and NTMDC. Both point and non-point source discharges from the ponds could possibly occur in wet seasons during heavy rainfalls. Ponds within the Project Area are not actively managed for aquaculture of edible fish, but overflow may occur during heavy storm. Surface runoff carrying sediment laden is another existing source of pollution.

Livestock farms and unsewered village upstream of Ngau Tam Mei Drainage Channel generate particulates, BOD_5 and others, which result in poor water quality in the Inner Deep Bay area.

Outside Project Site

The Project Site is adjacent to existing residential developments on three sides and is abutting the Ngau Tam Mei Drainage Channel (NTMDC) to its south. The NTMDC is an engineered channel which is divided into upstream section (Section B – upstream of San Tin Highway) and downstream section (Section A – between San Tin Highway and Kam Tin River). The river training works for Section B and Section A were completed in 2003 and early 2005 respectively under the project "Construction of Main Drainage Channels for Ngau

Tam Mei" by DSD. The NTMDC is located about 20m to the east of the Project Site with Yau Pok Road situated between the NTMDC and the Project Site.

There are also existing drainage channels surround the Project Site. Adjacent to the western Project Site boundary is the existing Fairview Park Nullah. To the immediate north of the Project Site, there is also a watercourse running along the southern boundary of the Palm Springs. Stormwater u-channels are also located along roadside of Yau Pok Road to the immediate south of the Project Site with outfalls connected to the NTMDC. Please refer to **Figure 5-1B**. Currently, surface runoff within the Project Site is discharged into these existing drainage channels.

Existing fishponds are also located at off-site locations to the north-west and north-east of the Project Site between Fairview Park and Palm Springs and between the Project Site and Palm Springs, respectively. **Figure 5-1B** refers. Some of these ponds at off-site locations are still being used for fish farming although some of them have been abandoned. For active managed ponds, pond water is being discharged intentionally during heavy storm to avoid overflow at the pond and loss of fish stock. Such discharges contain fish excreta and could be one of the factors causing the anoxic situation in the Inner Deep Bay. Currently, during heavy rainfall, water in these ponds will flow over the access and bunds to other ponds and nearby drainage channels into the Inner Deep Bay and NTMDC.

Currently, the Project Site and the surrounding areas are not equipped with any public sewerage system, but there is planned public sewerage system nearby.

5.3.2 Identification of Water Quality Sensitive Receivers (WSRs)

Water sensitive receivers within the 500m radius of Assessment Area are identified in accordance with the Project EIA Study Brief. Information such as relevant plans[10] , current Outline Zoning Plan No. S/YL-MP/6, and Town Planning Board (TPB) records have been reviewed in order to identify potential planned/ committed WSRs. The registry of EIAO projects was also reviewed for EIA projects. Based on information reviewed, there are a few planned development projects in the vicinity of the proposed development site (Section 1.9 refers). These development projects are also classified as designated project under the EIAO; as such they have to go through the EIAO process.

5.3.2.1 Within Project Site

The identified two small irrigation channels are not identified as the existing WSRs as they will be removed to form part of the development during construction phase.

A Wetland Restoration Area (WRA) is proposed, which includes all wetland/ ponds to be restored and ecological corridors within the Project Site. For the existing water ponds at the north-western corner of Project Site, they will be part of the construction site during the construction of the proposed WRA of this Project. Thus, they are not WSRs. However,

10 According to information available on Planning Department's website (available at: http://www.pland.gov.hk/pland_en/info_serv/tp_plan/index.html), the Project Site is not covered by existing Development Permission Area Plans. Instead, it is currently covered by the Outline Zoning Plan (OZP) No. S/YL-MP/6. Records of both the adopted and draft departmental plans in the area were obtained from Planning Department. According to the records obtained, relevant plans were reviewed such as the "L/YL-FP/1C Residential Layout - Fairview Park Access Road, Yuen Long" adopted in year 1982; as well as the draft departmental plan "DP/NWNT/1C North West New Territories - Development Plan" approved in year 1984. As all of these plans were prepared in 1980s', planned uses indicated in these plans are outdated and are superceded by the exsiting OZP. As advised by Planning Department, the existing OZP is the latest version regarding planned land uses in the area

once the WRA (as shown in Figure 8-5) is operating, these will become WSRs during its operational stage.

A temporary wetland enhancement area (see Figure 8-6 for the location) will be constructed at the start of construction period of the WRA to form shallow water pond and marsh (third paragraph in Section 8.11.1.4 refers). Thus, the concerned temporary wetland enhancement area will be planned WSR during its operation period (up to completion of the construction and planting works of the WRA) during the Project construction phase.

5.3.2.2 Outside Project Site

Existing WSRs

As the concerned Fairview Park Nullah, NTMDC, Kam Tin River further downstream, water course along the southern boundary of Palm Springs, and existing ponds immediately adjacent to the Project Site boundary at off-site locations (including abandoned pond within the adjacent REC zone) will be the existing receiver of surface runoff from the Project Site, they are identified as the existing WSRs that may be affected by the Project during both construction and operational phase.

Within the 500m Assessment Area, there are other potential water sensitive receivers at off-site locations such as existing drainage ditches along Ha San Wai Road as well as those along Ha Chuk Yuen Road to the further east of NTMDC. The drainage ditches along Ha Chuk Yuen Road are connected to DSD's water storage pond for Chuk Yuen Floodwater Pumping Station, which operates during heavy rainfall. There are also water ponds within Palm Springs. Please refer to Figure 5-1B. However, these existing sensitive receivers are further away from the Project Site and are physically separated from the Project Site by the NTMDC, adjacent vacant land and Palm Springs, thus they are not affected by this Project.

Beyond the 500m Assessment Area and further downstream, Inner Deep Bay SSSI, Ramsar Site, Mai Po Nature Reserve, and Ma Po Marshes SSSI are further downstream to the Project Site. Their locations are shown in Figure 5-1A. However, these sensitive receivers are distant away from the Project Site (over 1km away) and there will be no discharge to these areas due to this Project, thus they are unlikely to be affected. As such, these sensitive receivers are not identified as WSRs of this Project and are not considered further.

Planned WSRs

As discussed in Section 1.9, there are a few planned development sites nearby. For the two approved Government projects (i.e. the public sewerage project and the cycle track project), there will be no planned WSRs.

There is a planned landscape pond to the south-west of the Project Site within the approved "REC Site" (EIA-220/2014 refers). This planned landscape pond will be a planned WSR of this Project (its location is shown in Figure 5-1B).

For the Planned "RD Site", a landscape pond is also proposed on the opposite side of the NTMDC based on its approved planning application no. A/YL-MP/205. As the pond is further away from Project Site and is physically separated by the NTMDC, they are not affected by this Project.

As for the Planned "Kam Pok Road Site", there is no proposed WSR within that development site according to its approved planning application no. A/YL-MP/202.

Asides from the above, there are no other known planned WSRs in adjacent that would be affected by this Project.

5.3.2.3 WSRs Potentially Affected by this Project

The identified WSRs which may potentially be affected by this Project (based on the above discussion), are summarised below:

Location	**Is it WSR of this Project?** ("✓" denotes Yes; "×" denotes No)	
	Construction Phase	**Operational Phase**
<u>WSRs Potentially Affected:</u>		
Fairview Park Nullah	✓	✓
Watercourse south of Palm Springs	✓	✓
Existing fishponds to the north-west and north-east of the Project Site	✓	✓
NTMDC (Kam Tin River further downstream)	✓	✓
Two small irrigation channels within Project Site (to be removed)	×	×
Proposed WRA (including all wetland/ ponds to be restored and ecological corridors within the Project Site)	× (it will be part of construction site)	✓
Proposed temporary wetland enhancement area (up to completion of construction and planting works at the WRA)	✓	×
Planned landscape pond within the approved "REC Site"	✓	✓
<u>WSRs not Affected or Beyond the Assessment Area:</u>		
Existing drainage ditches along Ha San Wai Road and Ha Chuk Yuen Road; DSD's water storage pond for Chuk Yuen Floodwater Pumping Station; and water ponds within Palm Springs, & planned landscape pond within the planned "RD" Site.	×	×
Inner Deep Bay SSSI, Ramsar Site, Mai Po Nature Reserve, and Ma Po Marshes SSSI	×	×

5.3.3 Baseline Water Quality Survey

5.3.3.1 Background Water Quality Information at Fairview Park Nullah

The Fairview Park Nullah is an engineering channel within the Fairview Park residential development. There is an EPD's river water quality monitoring station located at the Fairview Park Nullah. Data of key water quality parameters measured at that station between year 2007 and year 2012 by EPD[11] was also summarised in Table 5-4 for reference.

Table 5-4 Summary of River Water Quality at Nearby Fairview Park Nullah in the Deep Bay Water Control Zone between 2007 and 2012

Parameters	WQO	2007	2008	2009	2010	2011	2012
pH	6.0-9.0	7.7 (7.2-9.3)	7.4 (6.8-9.3)	7.8 (7.3-8.9)	7.8 (7.2–9.0)	7.8 (7.1-8.9)	7.5 (7.3-8.5)
BOD_5 (mg/L)	≤ 5	15 (4-21)	8 (3-19)	8 (4 – 26)	11 (3 - 37)	11 (4-20)	5 (3-14)
COD (mg/L)	≤ 30	40 (13-70)	30 (16-51)	33 (18 – 87)	28 (16 – 61)	30 (13-46)	22 (12-54)
SS (mg/L)	≤ 20	36 (16-62)	30 (6-64)	36 (14-64)	40 (11–150)	29 (6-49)	26 (11-56)
DO (mg/L)	≥ 4	7.7 (3.2-17.7)	6.7 (3.9-12.9)	7.3 (2.1-18.6)	7.5 (3.5-15.1)	9.2 (3.9-17.2)	5.5 (3.8-11.7)
E. coli (count/100 ml)	≤ 1000	44,000 (2,200-900,000)	16,000 (2,200-75,000)	23,000 (4,400-1,000,000)	31,000 (4,600-220,000)	18,000 (4,200-97,000)	16,000 (2,800-330,000)
Ammonia-nitrogen (mg/L)	Annual average ≤0.021	4.35 (1.70-7.90)	3.45 (0.27-6.80)	2.90 (0.80-7.20)	4.30 (1.40-6.70)	4.55 (0.74-5.60)	4.15 (2.30-6.60)
Nitrate-nitrogen (mg/L)	--	0.52 (0.16-2.10)	1.10 (0.40-3.50)	0.45 (<0.01-1.20)	0.52 (0.31-0.89)	0.56 (0.10-1.00)	0.96 (0.35-1.30)
Total Kjeldahl nitrogen (mg/L)	-	6.90 (3.10-12.00)	5.35 (1.60-8.20)	5.70 (1.80-8.30)	6.10 (5.10-8.80)	6.15 (4.00-11.00)	5.85 (3.30-7.80)
Oil & grease (mg/L)	-	0.7 (0.5-1.7)	0.9 (<0.5-6.8)	<0.5 (<0.5-0.9)	<0.5 (<0.5-2.4)	0.7 (<0.5-2.0)	<0.5 (<0.5-0.7)
Aluminum (µg/L)	Waste discharges shall not cause the toxins in water to attain such levels as to produce significant toxic carcinogenic, mutagenic or teratogenic effects in	170 (110-420)	225 (<50-350)	255 (160-610)	285 (100-750)	170 (60-400)	240 (110-470)
Cadmium (µg/L)		0.1 (0.1-0.1)	<0.1 (<0.1-0.2)	<0.1 (<0.1-0.1)	<0.1 (<0.1-0.3)	<0.1 (<0.1-<0.1)	<0.1 (<0.1-<0.1)

11 River Water Quality In Hong Kong (various years), HKSAR Government Environmental Protection Department.

Parameters	WQO	2007	2008	2009	2010	2011	2012
Chromium (µg/L)	humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chain and to toxicant interactions with each other. Waste discharges shall not cause a risk to any beneficial uses of the aquatic environment.	1 (1-1)	1 (<1-2)	<1 (<1-2)	1 (<1-3)	<1 (<1-2)	1 (<1-3)
Copper (µg/L)		3 (2-6)	5 (3-27)	4 (3-8)	5 (2-17)	3 (2-5)	3 (2-7)
Lead (µg/L)		2 (1-7)	3 (<1-15)	4 (2-5)	4 (1-14)	2 (<1-4)	2 (1-7)
Zinc (µg/L)		30 (20-100)	45 (10-120)	45 (20-100)	35 (20-110)	35 (20-170)	30 (10-120)

Remark: Data presented is based on River Water Quality in Hong Kong (various years), published by EPD. Figures in brackets are annual ranges. *E. coli* stands for Escherichia coli.

From Table 5-4, it can be seen that the water quality at Fairview Park Nullah was poor. There were high levels of BOD_5, COD, SS, Ammonia-nitrogen, and *E.coli* at the Fairview Park Nullah. There is gradual improvement on water quality over the past few years.

5.3.3.2 Baseline Water Quality Survey

Baseline Surveys in Year 2008

Information on baseline water quality at the Project Site and its vicinity water was collected by sampling in March 2008 and in September 2008. Water samples were collected at the identified existing WSRs that may be affected by the Project (i.e. Fairview Park Nullah (WY3), NTMDC (W1, W2) and water course along the southern boundary of Palm Springs (WY1). Water samples were also collected from the existing off-site water pond at WY6. In addition, water samples were also collected from water pond within the Project Site (WY7). The water samples were collected and analysed by a HOKLAS accredited laboratory. The water quality sampling locations are shown in Figure 5-1B. Table 5-5 presents the results of survey on representative water quality sensitive receiver.

Table 5-5 Water Quality Monitoring at Nearby Representative Water Sensitive Receivers in Year 2008

Sampling Location	W1 (NTMDC)	W2 (NTMDC)	WY6 (Pond outside the Project Site)	WY7 (Pond within the Project Site)	WY1 (Water course near the Palm Springs)	WY3 (Fairview Park Nullah)
Salinity (ppt)	0.2	0.7	0.1	0.0	0.1	4.2
Water Temperature (°C)	30.5	30.0	30.1	31.5	31.4	30.9
pH Value (at 25°C)	7	7.3	8.1	6.3	6.7	7.3
Dissolved Oxygen (mg/L)	4.97	5.94	4.87	3.08	6.54	5.07
Dissolved Oxygen Saturation (%)	65.2	79.0	65.1	41.7	87.6	68.2
Turbidity (NTU)	9.7	11.5	26.2	5.79	15.4	20.2
BOD5 (mg/L)	5.5	5.9	9.9	5.1	3.7	12.0
COD (mg O_2/L)	<10	12	27	17	15	36
Total Phosphorous (mg/L)	0.1	0.3	0.1	<0.1	<0.1	0.2

Sampling Location	W1 (NTMDC)	W2 (NTMDC)	WY6 (Pond outside the Project Site)	WY7 (Pond within the Project Site)	WY1 (Water course near the Palm Springs)	WY3 (Fairview Park Nullah)
Ortho-Phosphate (mg/L)	0.15	0.18	0.04	0.04	0.07	0.13
Oil and Grease (mg/L)	<5	<5	<5	<5	<5	<5
Conductivity (μS/cm)	320	1400	320	57	280	8,400
Suspended Solids (mg/L)	5.6	9.4	23.0	9.3	13.0	21.0
Total Kjeldahl Nitrogen (mg/L)	0.6	2.0	1.6	0.5	1.0	2.6
Ammonia-nitrogen (mg/L)	0.390	1.500	0.490	0.036	0.270	1.300
E-coli (cfu/100 ml)	3,600	40,000	<1	32	470	64
F-coli (cfu/100 ml)	200,000	100,000	45	37	500	380
Aluminium (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Copper (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Lead (mg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc (mg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium (mg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Remark: All measurements conducted by ETS-TestConsult Limited on 30 Sep 2008.

Water Depth, Water Flow Rate, Salinity, Water Temperature, pH Value, Dissolved Oxygen, Dissolved Oxygen Saturation and Turbidity were measured in-situ by using portable meters.

F. coli stands for Faecal coliforms.

E. coli stands for Escherichia coli.

Asides from the above, water samples were also collected from the existing irrigation channels within the Project Site in order to provide background information of water quality for reference only. Table 5-6 shows the water quality at the irrigation channels.

Table 5-6 Water Quality Monitoring at the Irrigation Channels within the Project Site in Year 2008

Sampling Location	WY8	WY9
Water Temperature (°C)	23.6	24.2
pH Value (at 25°C)	6.7	7.5
Dissolved Oxygen (mg/L)	2.15	6.83
Turbidity (NTU)	26.5	18.5
BOD5 (mg/L)	12	21
COD (mgO2/L)	37	41
Total Phosphorous (mg/L)	0.68	1.6
Oil and Grease (mg/L)	9.8	13
Conductivity (μS/cm)	357	299
Total Nitrogen (mg/L)	4.1	4.1

Remarks: All measurements by ETS-TestConsult Limited on 28 March 2008.

Additional Survey in Year 2012/2013

In order to better establish the baseline water quality at the WSRs with due regard to natural and seasonal variation, further water samplings were also carried out during the wet season in September 2012 and October 2012, as well as during the dry season in December 2012 and January 2013. The water sampling locations are shown in **Figure 5-1C** and the raw test results are provided in **Appendix 5-1**.

Water samples were collected from the existing WSRs at Fairview Park Nullah (WY3), NTMDC (W1 to W3), water course along the southern boundary of Palm Springs (WY1 and

WY2), and existing ponds immediately adjacent to the Project Site boundary at off-site locations (WY4 and WY5). No water sample were collected from existing off-site ponds to the further east of the Project Site within the existing Yau Mei San Tsuen, as they are further away from the Project Site and are physically separated from the Project Site by the existing water course along the southern boundary of Palm Springs, and are unlikely to be affected. As discussed in Section 5.3.2, the existing water ponds within the Project Site as well as the existing irrigation channels within the Project Site will be part of the construction site during Project construction phase, thus no water samples were taken from these locations.

During wet season surveys, water samples were collected from the sampling locations three times per week and for a duration of four consecutive weeks. The water sampling and testing were performed by a HOKLAS accredited laboratory.

Since the wet season water quality survey results have found lower levels of Dissolved Oxygen (DO), and higher concentrations of ammonia-nitrogen content, SS, BOD_5, COD, and *E. coli* at most of the sampling locations, the above-mentioned parameters were selected for a close monitoring during the subsequent water sampling and testing during the dry season surveys. In addition, testing on the key WQO parameters stated in Table 5-3 were also carried out. Water samples were collected once per week and for four consecutive weeks as no particular patterns of water quality was observed during the previous wet season surveys.

Table 5-7 and Table 5-8 summarise the water quality survey results during both the wet season and dry season, while the raw data is also provided in the **Appendix 5-1**.

Summary of Baseline Water Quality Survey Results

General speaking, water quality at the water sampling locations was found to be in poor condition. Based on the test results, water quality at NTMDC is generally poor. Based on the test results, lower levels of Dissolved Oxygen (DO), and higher concentrations of ammonia-nitrogen content, SS, BOD_5, COD, and *E. coli* were detected at most of the sampling locations. Other parameters tested were either within the water quality criteria or below the detection limit. The above results are generally in line with EPD's monitoring data at Fairview Park Nullah.

No significant pattern of natural or seasonal variation was observed during the baseline water quality survey. The dry season survey results were found to be similar to that in wet season (i.e. low in DO, but high in ammonia-nitrogen content, SS, BOD_5, COD, and *E. coli).*

Overall, water quality at the water sampling locations was poor. However, there is gradual improvement on river water quality (e.g Fairview Park Nullah) according to EPD's regular monitoring results.

Table 5-7 Average Baseline Water Quality Monitoring Results During Wet Season in September 2012 and October 2012

Parameters	Effluent Discharge Std. #	WQO	NTMDC			Watercourse Along Southern Boundary of Palm Springs		Fairview Park Nullah	Existing Water Ponds at Off-site Locations	
			W1	W2	W3	WY1	WY2	WY3	WY4	WY5
Salinity (ppt)	-	-	1.1	5.4	5.9	1.2	0.4	7.9	0.2	0.7
Water flow (L/s)	-	-	128	269	183	<1.0 *	<1.0 *	<1.0 *	-	-
Water depth (m)	-	-	1.0	0.9	1.0	0.3	0.2	0.3	0.7	0.6
Water Temperature(°C)	30 (30)	-	27.8	27.8	27.1	25.8	26.9	25.8	28.3	28.2
pH Value	6-10 (6-9)	6-9	7.4	7.3	7.2	7.1	7.4	7.2	7.1	7.5
Dissolved Oxygen (DO) (mg/L)	-	4	6.6	4.7	2.9	2.1	3.8	3.9	6.4	5.3
DO Saturation (%)	-	-	85.2	60.8	38.2	26.5	48.0	50.1	81.7	60.5
Turbidity (NTU)	-	-	48	83	146	15	25	45	35	32
BOD5 (mg/L)	20 (5-20)	5	4	5	5	2	9	4	2	5
COD (mg O_2/L)	80 (20-80)	30	19	28	33	16	32	37	18	28
Total Phosphorous (mg/L)	5-10 (8-10)	-	0.5	0.7	0.8	0.3	0.7	1.1	<0.1 *	0.4
Reactive-Phosphate (mg/L)	-	-	0.3	0.4	0.5	0.2	0.4	0.5	0.02	0.1
Oil and Grease (mg/L)	10 (1)	-	<5 *	<5 *	<5 *	<5 *	<5 *	<5 *	<5 *	<5 *
Conductivity (mS/cm)	-	-	1998	8099	9003	1919	787	11750	307	1238
Suspended Solids (mg/L)	30 (5-20)	20	45	67	82	6	29	51	36	10
Total Kjeldahl Nitrogen (mg/L)	-	-	3.4	5.2	5.7	1.2	6.8	3.4	1.0	3.2
Ammonia-nitrogen	10-20	0.021	1.9	3.4	3.7	0.4	3.9	1.2	0.1	2.0

Parameters	Effluent Discharge Std. #	WQO	NTMDC			Watercourse Along Southern Boundary of Palm Springs		Fairview Park Nullah	Existing Water Ponds at Off-site Locations	
			W1	W2	W3	WY1	WY2	WY3	WY4	WY5
(mg/L)	(1-2)									
E-coli (count/100 ml)	1,000 (1000)	1,000	12,450	10,775	18,517	5,279	383,175	10,208	1,004	2,776
F-coli (cfu/100 ml)	-	-	20,042	16,675	27,950	7,307	656,558	13,991	1,222	6,138
Aluminum (mg/L)	-	Waste discharges shall not cause the toxins in water to attain such levels as to produce significant toxic carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chain and to toxicant interactions with each other. Waste discharges shall not cause a risk to any beneficial uses of the aquatic environment	0.91	1.31	2.65	0.06	0.28	0.82	0.47	0.05
Copper (mg/L)	-		0.007	0.008	0.013	0.002	0.004	0.007	0.002	0.002
Chromium (mg/L)	-		<0.01 *	< 0.01 *	0.02	<0.01 *	<0.01 *	<0.01 *	<0.01 *	<0.01 *
Lead (mg/L)	-		0.006	0.006	0.010	<0.001 *	0.004	0.008	0.003	0.001
Zinc (mg/L)	-		0.07	0.11	0.16	0.02	0.04	0.27	0.02	0.01
Cadmium (mg/L)	0.001-0.1 (0.001)		0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	<0.0002 *	<0.0002 *
Sulphide as S2-	1 (0.1-0.2)	-	<0.1 *	<0.1 *	<0.1 *	<0.1 *	<0.1 *	<0.1 *	<0.1 *	<0.1 *
Nitrate as N	20-50 ** (20-30)	-	1.88	1.16	1.12	0.81	0.88	0.23	0.07	0.03
Nitrite as N	20-50 ** (20-30)	-	0.19	0.31	0.34	0.10	0.13	0.15	0.01	0.02

Remark: * denotes that the measured concentration is below the laboratory's detection limit.
** Effluent discharge standard for "Nitrate + nitrite nitrogen".
# Effluent discharge standard for Group D inland water. Values shown in blanket are the effluent discharge standards for Group C inland water.
All sampling and measurements were undertaken by the laboratory, ALS Technichem (HK) Pty Ltd.
F. coli stands for Faecal coliforms; and *E. coli* stands for Escherichia coli.

Table 5-8 Average Baseline Water Quality Monitoring Results During Dry Season in December 2012 and January 2013

Parameters	Effluent Discharge Std. #	WQO	NTMDC			Watercourse Along Southern Boundary of Palm Springs		Fairview Park Nullah	Existing Water Ponds at Off-site Locations	
			W1	W2	W3	WY1	WY2	WY3	WY4	WY5
Salinity (ppt)	-	-	0.5	2.7	5.6	0.5	0.3	1.2	0.2	2.5
Water flow (L/s)	-	-	19	78	35	1.5	1.9	4	-	-
Water depth (m)	-	-	0.3	0.4	0.5	0.2	0.2	0.2	0.4	0.4
Water Temperature (°C)	30 (30)	-	18.4	17.8	17.1	16.7	17.0	17.7	16.8	17.4
pH Value	6-10 (6-9)	6-9	7.3	7.2	7.3	7.4	7.7	7.6	7.8	7.2
Dissolved Oxygen (mg/L)	-	4	7.2	4.7	4.0	4.4	5.8	7.6	8.6	7.1
Dissolved Oxygen Saturation (%)	-	-	76.7	49.8	42.1	45.0	59.8	80.8	88.9	74.9
Turbidity (NTU)	-	-	30	201	149	20	18	38	25	5
BOD5 (mg/L)	20 (5-20)	5	5	10	9	18	6	17	6	2
COD (mg O_2/L)	80 (20-80)	30	16	36	39	39	36	37	35	16
Oil and Grease (mg/L)	10 (1)	-	<5 *	<5 *	<5 *	<5 *	<5 *	<5 *	<5 *	<5 *
Suspended Solids (mg/L)	30 (5-20)	20	33	105	138	17	23	34	22	6
Total Kjeldahl Nitrogen (mg/L)	-	-	3.2	6.0	7.0	5.9	10.0	6.8	1.7	0.9
Ammonia-nitrogen (mg/L)	10-20 (1-2)	0.021	2.0	3.9	5.5	4.7	8.2	5.0	0.1	0.1
E-coli (count/100 ml)	1,000	1,000	11,525	26,550	51,000	458,605	10,280	542,275	824	70

Parameters	Effluent Discharge Std. #	WQO	NTMDC			Watercourse Along Southern Boundary of Palm Springs		Fairview Park Nullah	Existing Water Ponds at Off-site Locations	
			W1	W2	W3	WY1	WY2	WY3	WY4	WY5
	(1000)									
Nitrate as N	20-50 ** (20-30)	-	2.72	2.10	1.56	0.96	0.68	1.38	0.32	0.08
Nitrite as N	20-50 ** (20-30)	-	0.12	0.15	0.25	0.08	0.21	0.14	0.02	0.01

Remark:

* denotes that the measured concentration is below the laboratory's detection limit.

** Effluent discharge standard for "Nitrate + nitrite nitrogen"

Effluent discharge standard for Group D inland water. Values shown in blanket are the effluent discharge standards for Group C inland water.

All sampling and measurements were undertaken by the laboratory, ALS Technichem (HK) Pty Ltd.

E. coli stands for Escherichia coli.

5.4 Identification and Evaluation of Impacts

5.4.1 Project Construction Phase

5.4.1.1 Construction Site Runoff

Construction of Residential Portion

In order to prevent flooding, the residential development would be formed by filling up to an average level of about +5.5mPD from the existing +2.2 mPD approximately. Vertical drains may be adopted to increase the rate of consolidation of the clay layer and settlement of fill. Construction works involve site formation works and clearance of sheds; retaining walls and utilities construction; road paving; foundation; and superstructure works (Section 2.10.2 refers). Construction of the residential portion of the Project does not require ponds draining or filling.

Site formation stage during construction will involve fill/ excavation materials and may result in significant water quality impact if it is not controlled. Excavation and filling may also be required during the foundation; utilities and road works. If not properly controlled, the stormwater runoff carrying sediment laden may bring along other pollutants so as to pollute the nearby water bodies depending upon the topography. Superstructure works are typical of many building construction works, which would generate insignificant degree of wastewater impact.

Particulates as well as effluent, fuels and lubricants from machinery, liquid spillage and the like may be generated on-site during the construction phase. Pollutants can flow into nearby water bodies as non-point source discharge which has to be properly controlled.

During construction of the residential portion, the newly constructed WRA including the ecological corridors will become WSR. Construction site runoff from the residential portion will need to be properly controlled in order to prevent adverse impact upon the WRA and the ecological corridors.

According to the estimation, the increase in construction site runoff flow rate due to the construction activities is about 1.4 m^3/s in 1 in 20 years event[12], which is negligible when compared with the design capacity of the Ngau Tam Mei Drainage Channel (500m^3/s). Thus, there will be no adverse water quality impact.

Appropriate site drainage comprising precast concrete u-channels, sedimentation basins, sand traps and similar facilities together with those good site practices stipulated in ProPECC Note PN 1/94 as listed in Sections 5.5.1 and 5.5.2, will be adopted in order to avoid any uncontrolled discharge and potential impacts on the nearby WSRs. Treated construction site runoff will be discharged into NTMDC. There will be no discharge of surface runoff into Fairview Park Nullah; existing watercourse to the south of Palm Springs; and existing ponds at off-site locations.

With regard to the above, sedimentation basin and sand trap designed in accordance with the requirements of ProPECC Note PN 1/94 should be installed at the construction site for collecting surface runoff. In addition, the discharge from construction site will also need to comply with the terms and conditions of the discharge licence under the WPCO. With the

12 The estimated surface runoff discharge flow rate before the construction is about 2.4 m^3/s, while the construction site runoff during construction is about 3.8m^3/s in 1 in 20 years event. Thus, the increase in flow rate is about 1.4 m^3/s.

adoption of the above-mentioned devices and good practices, large particle size settleable solids and pollutants bound or adsorbed onto the particles, can be removed effectively and no adverse water quality impact will be anticipated.

Construction of Wetland Restoration Area

According to the current construction programme, the proposed WRA will be constructed first before the commencement of construction of residential portion. Details of construction activities are described below.

As the existing ponds within the Project Site will be converted into WRA, no dredging or pond filling activities will be required.

There are currently 4 ponds (Ponds 7, 8, 18 and 17) (Figure 8-2a and 8-2b refers) identified within the Project Site, which are located at the proposed WRA (Figure 8-5 refer). The concept of the WRA proposal is to follow the existing topography characteristic of the area. The area within the WRA will remain as wetland with various habitats, such as ponds and marsh area with various water levels. Details of construction of WRA are described in Section 2.10.2 as well as paragraph 4 in Section 8.11.2.1.

The establishment of WRA will involve the followings:

- Re-profiling of a number of selected bunds (A3, Area 9, and Ponds 7, 8, 17 & 18) to enhance feeding at the bunds;
- Development of emergent vegetation on selected areas (A1 , A2 and Area 40) for screenings;
- Provision of areas of shallow waters to enhance feeding and roosting of birds; and
- Provision of areas of wooded bund and grassy bund for birds.

The existing earth bund of these ponds will be re-profiled to create shallow slope as feasible according to the properties of the bund materials to provide various habitats, and may include partial filling and change of depth of the ponds. Minimum amount of small powered mechanical equipment such as mini excavator will be used for the re-profiling of the pond bunds and re-distributing the soil/ pond sediment to create gentle slopes and deep water areas. Additional fill materials may be required subject to the detailed design of the wetland.

To minimize disturbance to the rest of the Project Site, the re-profiling works will be carried out in succession and in a phased manner where water in one pond will be temporarily drained to other unaffected ponds and then drained back after completion of re-profiling, so that no draining of pond water is necessary during construction.

Good site practices stipulated in ProPECC Note PN 1/94 as listed in Sections 5.5.1 and 5.5.2 will be adopted in order to avoid any uncontrolled discharge and potential impacts on the nearby existing ponds at off-site locations. Treated construction site runoff will be discharged into NTMDC. With the adoption of these good practices, no adverse water quality impact will be anticipated.

Construction of Temporary Wetland Enhancement Area

Prior to the construction of WRA, a temporary wetland enhancement area will be constructed to provide temporary habitat for bird species (please refer to Figure 8-6 for the location and third paragraph in Section 8.11.1.4 for description). This temporary wetland enhancement area will be located at the south-western corner of the Project Site comprising shallow ponds and marsh which will be adapted from the existing farmland. This will be operated during the construction period of the WRA and will be fenced and maintained until completion of construction and planting works of the WRA.

Construction of this temporary wetland enhancement area will only involve excavation of shallow ponds. During its construction, appropriate temporary peripheral site drainage comprising precast concrete u-channels with sedimentation basins and sand traps will be provided surrounding the construction area to control and treat construction site runoff. Treated surface runoff is then diverted away for discharge into NTMDC after passing through sand traps, thus there will be no adverse water quality impact.

After the construction of temporary wetland enhancement area and before operation of the WRA, appropriate drainage as stated in Section 5.5.2.3 will be provided surrounding the concerned temporary enhancement area to divert construction site runoff away from this area so as to avoid any adverse water quality impact upon this area.

Once the WRA is in operation, the temporary wetland enhancement area will become part of the construction site of the residential portion, and will be filled up to the proposed site formation level. Remaining water in the shallow ponds will be by soakaway mechanism and no pond draining is expected.

5.4.1.2 Groundwater from Contaminated Area

As discussed in Section 7.3, there is no historic and / or existing land uses at the Project Site that would result in potential contamination of soil and underground water, thus land contamination at the Project Site is not expected. As such, contaminated underground water is not anticipated at the Project Site.

5.4.1.3 Sewage from Workforce

Water pollution due to temporary site facilities e.g. toilets could be source of pollution if appropriate measures are not implemented properly in respect of storage and discharge. Since portable chemical toilets will be provided, no adverse water quality impact is anticipated.

5.4.1.4 Alternation of Water Systems Arising from the Project

There will be no alternation of any natural watercourse arising from implementation of the Project.

As discussed in Section 5.3.1, there are two small irrigation channels within the Project Site, which will be removed during the construction. The concerned irrigation channels are of low ecological value (Section 8.8.6 refers). Appropriate drainage system will be constructed within the Project Site to collect surface runoff instead. Thus, no adverse water quality impact is expected.

5.4.2 Project Operational Phase

5.4.2.1 Sewage Discharge

Currently, the Project Site and the surrounding areas are not equipped with any public sewerage system. Sewage from the proposed development may cause pollution to the surrounding water bodies if there is uncontrolled discharge and lack of treatment.

Domestic wastewater will be a point-source of pollution. All domestic wastewater will be discharged into the planned public sewerage system via a terminal manhole located at the southern boundary of the Project Site when it is in operation, thus there will be no adverse impact during operation. Since there is a possibility that there will be no public sewer available at the time of occupation of the Project, an interim sewage treatment plant (STP) will be provided. The operation of the interim STP will cease once connection to the public sewer is available. The interim STP will comprise a combination of membrane bioreactor

(MBR) system and reverse osmosis (RO) system. The discharge requirement of the Project and the capacity of the existing sewerage system have been evaluated in Chapter 6 - Sewerage and Sewage Treatment.

As the Project Site is located in Deep Bay area, treated effluent from the proposed interim STP will need to follow the requirement of no net increase of pollution loading. Sewage and sewerage impact assessment can be found in Chapter 6 of this report. According to Table 6-8 in Chapter 6, compliance with the no net increase in pollution load requirement is demonstrated by the estimated existing pollution loading from the Project Site and that due to the proposed development.

Treated effluent from the interim STP will be discharged to the adjacent NTMDC, which is the engineered trained main drainage channel for the area. The concerned quantity of treated effluent discharge is estimated to be about 12 l/s (peak design flow) only according to the estimation provided in Section 6.4, which is negligible when compared with the capacity of the NTMDC (over 500m^3/s without overtopping the channel embankment under 1 in 200 year rainfall). There will be no adverse impact on NTMDC in terms of both the flow, quality, and quantity. To the further downstream, the existing Kam Tin River is also an engineered trained drainage channel with a width of about 130m (i.e. with a greater capacity than NTMDC, which is about 44m wide), thus the discharge from this Project will be negligible when compared with its capacity. As such, no adverse water quality impact to the downstream water body is therefore expected.

Precautionary measures have also been proposed in Sections 6.10 and 6.6 to address potential adverse water quality impact due to decommissioning of the interim sewage treatment plant; sewage overflow; emergency discharge; and change in flow regime, which is unlikely to occur. In addition, equalization tank will be provided for the STP for temporary storage of sewage in case of outage of the interim STP, and tank away will be provided for proper disposal at designated sewage treatment works to be assigned by DSD (Section 6.11 refers). Thus, there will be no discharge during decommissioning. With these precautionary measures sewage overflow and emergency discharge would be very unlikely and no adverse water quality impact is expected.

In addition, the wastewater discharge from the Project Site will be required to apply for a discharge licence under the WPCO, and the discharge shall comply with the terms and conditions of the licence and the discharge standards for effluent specified in the licence as well as the conditions specified in the Environmental Permit of this Project under the EIAO.

5.4.2.2 Storm Water Discharge

During operation, potential water quality impact would be the surface runoff during rainfall events which is known as non-point source of pollution. Substances such as vehicle dust, scraps and oil may be deposited on paved road surface. Fallen leaves, particles, litter from open areas/ landscape areas, which is a source of organic and nutrient pollutants, can be washed into the drainage system during heavy rainfall if it is not properly controlled. No fertilizers and pesticides will be routinely used for vegetation management. Pollutants contributed by non-point source are often bound or adsorbed onto particles, thus an effective stormwater management system will be the removal of pollution sources prior to rainstorm and the provision of degritting/ screening facilities that collect sediment. As particles settle out, the associated pollutants will also settle out (then removed from stormwater).

The following paragraphs evaluate potential impacts due to this proposed development. Evaluation of operational impact due to operation of the WRA is described in Section 5.4.2.4.

Under normal condition, runoff carrying pollutants will not be generated in low rainfall intensity, but increased runoff may occur during heavy rainfall condition. The first flush flow would carry most of the pollutants and the subsequent overland flow generated from

rainstorms is expected to be uncontaminated. Thus, prevention of "first flush" pollution in stormwater runoff will be an effective way in controlling pollution at source and to abate pollutants.

During operation, collected surface runoff will be discharged into Ngau Tam Mei Drainage Channel following the existing flow regime. The residential portion of the Project will be created by filling up the formed dry farmland. It is expected that the volume of surface runoff will increase in the developable area due to increase in paved areas. Collected surface runoff from the development site will be discharged into the Ngau Tam Mei Drainage Channel. Given the scale of this Project, the increase in surface runoff generated from the developable area after development should not be in significant amount (about 37m^3/day (or 0.43L/s), Appendix 5-2 refers.), which is negligible when compared with the capacity of the trained downstream Ngau Tam Mei Drainage Channel (over 500m^3/s). Moreover, the NTMDC has been designed to convey flows due to urbanization/ development inclusive of all its catchment areas. Given the design capacity of the NTMDC and the small amount of surface runoff from this Project, there will be no adverse water quality impact on the NTMDC and its downstream locations in terms of both the flow, quality, and quantity. Therefore, there will be no flooding or hydrology issue arising from the proposed development, and no adverse water quality impact on nearby water bodies during operation of the Project is anticipated.

Estimation on the potential pollution loading due to the surface runoff from the developable area is provided in **Appendix 5-2**, which is found to be a minor source and can be controlled with implementation of Best Management Practices (BMPs) described below.

It shall be noted that the current proposed WRA is to retain existing ponds within the Project Site. There is no difference in nature between the proposed WRA and that of the existing ponds within Project Site. Currently, overflow from these existing ponds will also be discharged into nearby drainage channels and NTMDC. Given there is no change to the nature of discharge before and after the development and the concerned pond areas, there will be no additional pollution loading from the WRA (i.e. no increase in pollution loading), which is basically stormwater.

5.4.2.3 BMPs for Stormwater Discharge

Surface runoff can be controlled by good drainage design and implementation of BMPs. The proposed development has adopted the following BMPs, which are also listed in Section 5.6.2.

Erosion Control

If uncontrolled, exposed surfaces may contribute to sediment laden in stormwater runoff and cause water pollution. The proposed development site is either hard paved or covered by landscaping area with appropriate planting species in order to eliminate any exposed surface.

The landscaped open area will be managed and maintained by the property management company (and its contractor) during operation.

Runoff Control

In the current layout, the paved area of development has been minimized by a simpler and more effective internal road layout, at which proposed houses are allocated on both sides of the road. Thus hard paved area of internal access road as well as increase in surface runoff, has been minimised.

The roadside channel along Yau Pok Road will be retained to maintain the original flow path. The drainage system will be designed to avoid any case of flooding based on the 1 in 50 year return period.

In addition, appropriate drainage system will be constructed for the proposed development in order to control its surface runoff. During detailed design, site drainage system of the development will be designed in such way that surface runoff from the residential area will be directed towards the internal access road, where appropriate drainage system with control facilities have been proposed. Additional paved U-channels with screening facilities are also provided along the edge of residential portion to avoid uncontrolled spillage of runoff. There will be no discharge of surface runoff into the sensitive areas such as the proposed WRA; ecological corridors; and Fairview Park Nullah.

Prevention of "First Flush" Pollution

As discussed above, prevention of "first flush" pollution will be an effective way in controlling pollution. This can be done by prevention of pollutants from entering the drainage system and by removal of pollutants by installation of appropriate devices as well as management measures.

Prevention of Pollution at Source

Tree planting has been introduced along both sides of the internal access road, which can help to reduce soil erosion and as a buffer zone between the residential area and the drainage system along roadside. With this planting area, it can help to minimize the amount of direct flushing of substances such as fallen leaves, soil particles, and rubbish into the drainage system.

Evergreen trees species, which in general generate relatively smaller amount of fallen leaves, should be selected as far as possible so as to minimize the amount which may enter the drainage system during heavy rainfall.

Fertilizer, which is a source of nutrient, will only be applied when needed. According to the "General Specification for Building (2012 edition)" published by Architectural Services Department, HKSAR Government, fertilizer is generally applied twice a year. If required, the fertilizer should be applied in early Spring and in later summer in order to avoid major rainy season as far as possible. Slow release fertilizer should be selected as far as possible to minimize the amount of nutrient to be washed out by rain. Application of fertilizer should not be arranged before forecasted heavy rainfall, and over-dosing should be avoided. Particles flushing out by rainfall (which may carry nutrient) would be removed by provisions of sand traps in the drainage system. The fertilizer application strategy is to be implemented by an experienced contractor through the property management company during operation.

Regular cleaning and sweeping of road surface/ open areas is suggested so as to minimize exposure of pollutants to stormwater. The road surface/ open area cleaning should also be carried out prior to occurrence of rainstorm.

With the above measures, the amount of pollutants at source has been largely reduced/ avoided as far as possible.

Devices for Removal of Pollutants

In addition to the above, screening facilities such as standard gully grating and trash grille, with spacing which is capable of screening off large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system as well as at upstream location of the u-channels. It is expected that most of the large substances in stormwater runoff would be removed with such devices so as to prevent it from entering the drainage system. Road

gullies with standard design and silt traps and oil interceptors should be incorporated during the detailed design to remove particles present in stormwater runoff. General speaking, device such as sand trap may achieve about 20% of removal efficiency as reported in other studies [13]. **Figure 5-3** shows the indicative site drainage conceptual layout during operational phase.

Drainage outlet of any covered car park should be connected to foul sewers via petrol interceptors or similar facilities.

In addition to the above, subject to detailed design, standard manholes with desilting opening/ sand trap designed for first flush flow (capable of providing at least 5 minutes' detention time[14]) can be provided at final discharge point before discharge into NTMDC. The feasibility of alternative measure such as Vortex grit separator [15] would also be considered during the detailed design stage.

In the event of emergency (e.g. car accident) where there is a major spillage of oil, chemical or fuel, dispersants or firefighting foam, etc., a system of contaminant bunding will be implemented as appropriate.

Management Measures

Good management measures such as regular cleaning and sweeping of road surface/ open areas is suggested. The road surface/ open area cleaning should also be carried out prior to occurrence of rainstorm.

Stormwater gullies and ditches provided among the residential development will be regularly inspected and cleaned by the property management company.

With the removal of pollutants, the pollution levels from stormwater would be much reduced, and given the stochastic nature of non-point source pollution and the proposed management measures, there will be no significant impact expected.

5.4.2.4 Operation of the WRA

Good maintenance of the Wetland Restoration Area is important and necessary during operation of the proposed development. A Wetland Restoration Plan has been prepared to determine management measures including but not limited to details of setting up of periphery fencing and trespassing controls. Details of the Wetland Restoration Area are provided in Appendix 8-10. It shall be noted that the WRA is not designed for pollution abatement but as ecological mitigation measures of the development.

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13 According to Appendix 5-2, in approved EIA report for "Agreement No. CE 61/2007 (CE) North East New Territories New Development Areas Planning and Engineering Study - Investigation".

14 Standard design for sand trap with detention time not less than 5 minutes (http://www.dsd.gov.hk/EN/Technical_Manuals/Standard_Drawings/index.html)

15 Vortex separators are high rate, rotary flow solids/liquid separation devices used worldwide for water treatment applications. Advanced hydrodynamic vortex separation is a complex hydraulic process that augments gravity separation with low-energy rotary forces. The flow modifying internal components used in the separator harness the energy from vortex flow and maximize the time for separation to occur while deflecting high scour velocities.

Polluted stormwater is introduced tangentially into the side of the precast vortex chamber to establish rotational flow. A cylindrical baffle with an inner center shaft creates spiraling column of flow and ensures maximum residence time for pollutant. Oil, trash and other floating pollutants are captured and stored on the surface of the spiraling column. Low energy vortex motion directs heavy particles (e.g. sand) into the protected sump region. Vortex grit separator is reportly to achieve 80% of removal efficiency of grits subject to the design.

All pond water of WRA will be obtained by direct rainfall and will be retained and re-circulated during drain-down periods as necessary. No surface or groundwater supplies will be used for WRA operations.

No fertilizers and pesticides will be routinely used for vegetation management in the WRA, hence avoiding the potential source of contamination into the adjacent watercourses which connect to the Deep Bay. As ponds within the WRA are converted from existing ponds on-site, pond sediment is expected to be clay or similar material, thus no seepage of water into underground is expected during operation.

Ponds in the Wetland Restoration Area will be designed in such a way that they are self-contained and there is no outlet connecting to nearby channel/inland water, thus there will be no discharge from the ponds within the WRA (Figure 8-5 refers). Surface runoff from the residential portion will be diverted away from the WRA by drainage channels in order to minimise the chance of overflow under extreme weather condition (e.g. heavy rainfall). During heavy rainfall, there may be overflow from ponds, however, it is expected to be relatively uncontaminated. In fact, there is no difference in nature between the proposed WRA and that of the existing ponds within Project Site.

The WRA will be designed in such a way that overflow will be diverted into proper drainage system of the development site before discharge into NTMDC. As such, there will be no adverse water quality impact on NTMDC and its downstream locations. Furthermore, during operation, under the management of Wetland Ecologist, who will advise on the management of wetland, pond water will be transferred between ponds within the WRA, in order to self-contain water within the WRA.

During the operational phase, water quality monitoring is only recommended as part of the ecological monitoring for the wetlands in WRA to ensure effectiveness of the water circulating system and the self-sustainable wetland. Details of which are already provided in the Wetland Restoration Plan in Appendix 8-10.

Given to the above, adverse water quality impact on nearby water bodies during operation of the Project, is not anticipated.

5.5 Recommended Mitigation Measures During Construction Phase

Control of potential water quality impact arising from the construction works shall be achieved based on the following principles:

- Minimisation of runoff;
- Prevention or minimisation of the likelihood of the identified pollutants being in contact with rain or runoff; and
- Measures to abate pollutants in the stormwater runoff.

The Contractor shall apply for a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence.

Contractor(s) of this Project will be required to submit a Construction Phase Drainage Management Plan with details of the design of the temporary site drainage system for the approval of the Engineers Representative (RE) and the Environmental Team in order to ensure that the above mitigation measures are in place.

Regular inspection (weekly) of the site drainage system and the implementation of the Plan shall be carried out by the Contractor(s), RE, and ET in order to ensure no off-site spillage of runoff and that the mitigation measures are effectively implemented. Any deficiencies identified shall be rectified by the Contractor(s).

5.5.1 General Requirements

5.5.1.1 Best Management Practices (BMPs)

The BMPs given in the ProPECC PN 1/94 shall be implemented in controlling water pollution during the whole construction phase. The main practices provided in the above-mentioned document (i.e. ProPECC PN 1/94) are also summarized in the following paragraphs which should be implemented by the contractor during the construction phase, where practicable:

- High loading of suspended solids (SS) in construction site runoff will be prevented through proper site management by the contractor;
- The boundary of critical work areas will be surrounded by ditches or embankment. Accidental release of soil or refuse into the adjoining lands should be prevented by the provision of site hoarding or earth bunds, etc. at the site boundary. These facilities should be constructed in advance of the site formation works and roadworks;
- Consideration will be given to plan construction activities to allow the use of natural topography of the Project Site as a barrier to minimize uncontrolled non-point discharge of construction runoff;
- Temporary ditches, earth bunds should be provided to facilitate controlled discharge of runoff into storm drains via sand/ silt removal facilities such as sand traps and sedimentation basins. Oil and grease removal facilities should also be provided where appropriate, for example, in area near plant workshop/ maintenance areas;
- Sedimentation basins and sand traps designed in accordance with the requirements of ProPECC Note PN 1/94 should be installed at the construction site for collecting surface runoff;

- Sand and silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly by the contractor, and at the onset of and after each rainstorm to ensure that these facilities are functioning properly;

- Slope exposure should be minimized where practicable especially during the wet season. Exposed soil surfaces should be protected from rainfall through covering the temporarily exposed slope surfaces or stockpiles with tarpaulin or the like;

- Haul roads should be protected by crushed rock, gravel or other granular materials (i.e. hard paved) to minimize discharge of contaminated runoff;

- Slow down water run-off flowing across exposed soil surfaces;

- Plant workshop/ maintenance areas should be bonded and constructed on a hard standing. Sediment traps and oil interceptors should be provided at appropriate locations;

- Manholes (including newly constructed ones) should be adequately covered or temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system;

- Construction works should be programmed to minimize soil excavation works where practicable during the rainy days;

- Chemical stores will be contained (bonded) to prevent any spills from contact with water bodies. All fuel tanks and/ or storage areas should be provided with locks and be sited on hard surface;

- Chemical waste arising from the Project Site should be properly stored, handled, treated and disposed of in compliance with the requirements stipulated under the Waste Disposal (Chemical Waste) (General) Regulation;

- Drainage facilities must be adequate for the controlled release of storm flows.

- During re-profiling of the existing bunds within the WRA, materials requiring temporary storage on-site will be securely stored and covered, if possible. Dried up mud materials can then be used for marshland formation.

- Vehicle wheel washing facilities should be provided at the site exit such that mud, debris, etc. attached to the vehicle wheels or body can be washed off before the vehicle leaves the work site;

- Section of the road between the wheel washing bay and the public road will be paved to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains.

- Bentonite slurries, if any to be generated, shall be reconditioned and reused as far as practicable. Spent bentonite should be kept in a separate slurry collection system for disposal at a marine spoil grounds subject to obtaining a marine dumping licence from EPD. If used bentonite slurry is to be disposed of through public drainage system, it should be treated to meet the respective applicable effluent standards for discharges into sewers, storm drains or the receiving waters.

5.5.1.2 Sewage from Workforce

- Sewage generated from the construction workforce should be contained in chemical toilets and be tanked away. Chemical toilets should be provided at a minimum rate of

about 1 per 50 workers. The facility should be serviced and cleaned by a specialist contractor at regular intervals;

5.5.1.3 Oils and Solvents

Spillage of fuel oils or other polluting fluids will be prevented at source. All stocks will be stored inside proper containers and sited on sealed areas, preferably surrounded by bunds.

5.5.2 Site Specific Measures

5.5.2.1 Construction of Residential Portion

In addition to the above and during construction of residential portion, temporary drains, peripheral site drainage comprising precast concrete u-channels, sedimentation basins, sand traps and similar facilities in accordance with the requirements of ProPECC Note PN 1/94 will be provided within the residential portion and along the edge of its boundary as per good practices in order to divert surface runoff away from WRA, temporary wetland enhancement area, ecological corridors, and nearby sensitive receivers such as Fairview Park Nullah before discharge into NTMDC after passing sand traps. **Figure 5-2** shows the indicative site drainage conceptual layout during construction phase.

5.5.2.2 Construction of WRA

During the construction of WRA of the Project Site, in order to minimize disturbance to the rest of the Project Site it is proposed that:

- Through transferring the pond water within ponds of the WRA, the need for discharging pond water into the surrounding water bodies during the construction of the Project will not be necessary.
- The major construction works involved in WRA relate to the re-profiling of the bunds. To minimize disturbance to the rest of the Project Site it is proposed that works are conducted on a pair of ponds at a time. Pond water will be drained to other neighbouring ponds for temporary storage, thus no discharge will be required.
- Surface runoff from the residential portion of the Project Site will be diverted away from the WRA by drainage channels in order to avoid overflow of the pond under extreme weather condition (e.g. heavy rainfall).
- Temporary peripheral site drainage system comprising precast concrete u-channels along site boundary with sedimentation basins, sand traps and similar facilities will be provided in accordance with the requirements stipulated in ProPECC PN 1/94.
- Given the proposed mitigation measures above, an EM&A programme is required to ensure the proper implementation of the recommended measures and provide a proactive system to rectify any problem identified.

There should be no discharge of surface runoff into Fairview Park Nullah; existing stream to the south of Palm Springs; and existing ponds at off-site locations. Treated surface runoff will be diverted away from these locations and discharged into NTMDC after passing through sand traps and sedimentation basins. **Figure 5-2** refers.

5.5.2.3 Construction of Temporary Wetland Enhancement Area

During construction of Temporary Wetland Enhancement Area, appropriate temporary peripheral site drainage should be provided which comprises precast concrete u-channels surrounding the construction area as part of the site drainage system mentioned in Section

5.5.1.1, surface runoff is diverted away from nearby existing drainage channels for discharge into NTMDC after passing through sand traps and sedimentation basins.

During operation of the temporary enhancement area, appropriate temporary drainage will also be provided surrounding the concerned enhancement area to divert surface runoff away from the enhancement area in order to avoid any adverse water quality impact on this area. **Figure 5-2** shows the indicative site drainage during construction phase.

Once the WRA is in operation, the temporary wetland enhancement area will become part of the construction site of the residential portion, and will be filled up to the proposed site formation level. Remaining water in the shallow ponds will be by soakaway mechanism and no pond draining is expected.

5.6 Recommended Mitigation Measures During Operational Phase

5.6.1 Sewage Discharge

Permanent Sewage Disposal

All domestic sewage generated will be discharged to the public sewerage system via a terminal manhole located at the southern boundary of the Project Site, which will be further connected to the planned public sewer at Yau Pok Road as described in Section 6.5.

The discharge from the club house and swimming pool shall apply for a discharge licence under the WPCO, and the discharge shall comply with the terms and conditions of a licence and the standards for effluents specified in the licence, as well as conditions in Environmental Permit.

Interim Sewage Disposal

An interim STP is proposed with discharge of the treated effluent to the adjacent NTMDC in case the public sewerage is not available when the Project is in operation. The design of the interim STP will follow the requirement of no net increase of pollution loading and details of which are shown in Section 6. A discharge licence under the WPCO will be obtained for the interim STP and, and the discharge shall comply with the terms and conditions of the licence and the discharge standards for effluents specified in the licence as well as the conditions specified in the Environmental Permit of this Project. Samples of treated effluent will be taken regularly and tested according to the discharge licence under the WPCO and the conditions in the Environmental Permit to ensure compliance with discharge standards.

Precautionary measures in Sections 6.10 and 6.6 should be implemented, so that adverse water quality impact due to sewage overflow, emergencies discharge, and change in flow regime is unlikely to occur. In addition, equalization tank will be provided in the STP for temporary storage of sewage in case of outage of the interim STP, and tank away will be provided for proper disposal at designated sewage treatment works to be assigned by DSD (Section 6.11 refers).

During Decommissioning of STP

During decommissioning, the interim sewerage system within the development area should be designed in such a way to facilitate the future connection to the planned Ngau Tam Mei sewerage system with the flow direction to be controlled by several flow control devices such as valves or stop-log, etc. Switching over from the interim system to the permanent system will be done by regulating the flow direction through the flow control devices and by abandoning the sewer which connects to the interim STP. Details of which are provided in Section 6.6 which should be implemented. Tank away will be provided for any remaining

small amount of sewage in the STP for proper disposal at designated sewage treatment works to be assigned by DSD.

The mitigation measures listed above will be implemented by the Project Proponent, which will be managed and maintained by the property management company and its contractors during operational phase.

5.6.2 Storm Water Discharge

Best Management Practices (BMPs) have been proposed for the development, which are summarised and grouped under the following categories :

Design Measures

- Exposed surface shall be avoided within the proposed development to minimize soil erosion. Development site shall be either hard paved or covered by landscaping area where appropriate.

- The landscaped open area should be managed and maintained by the property management company (and its contractor) during operation.

- Paved area of development has been minimized by a simpler and more effective internal road layout, at which proposed houses are allocated on both sides of the road. Thus hard paved area of internal access road as well as increase in surface runoff, can be minimised.

- The roadside channel along Yau Pok Road will be retained to maintain the original flow path. The drainage system will be designed to avoid any case of flooding based on the 1 in 50 year return period.

- **Figure 5-3** shows the indicative site drainage layout during operational phase. Detailed design of the drainage system will be carried out during detailed design stage. Drainage system of the development shall be designed in such a way that surface runoff from the residential area is directed towards the internal access road, where appropriate drainage system with control facilities have been proposed. Additional paved U-channels with screening facilities are also provided along the edge of residential portion to avoid uncontrolled spillage of runoff.

- There should be no discharge of surface runoff into the sensitive areas such as the proposed WRA; ecological corridors; and Fairview Park Nullah.

- Street level tree planting shall be introduced along both sides of the internal access road, which can help to reduce soil erosion and as a buffer zone between the residential area and the drainage system along roadside.

- Evergreen trees species, which in general generate relatively smaller amount of fallen leaves, should be selected where possible.

- Fertilizer will only be applied on landscape area when needed. If required, the fertilizer should be applied in early Spring and in later summer in order to avoid major rainy season as far as possible. Slow release fertilizer should be selected as far as possible to minimize the amount of nutrient to be washed out by rain. Application of fertilizer should not be arranged before forecasted heavy rainfall, and over dosing should be avoided. The fertilizer application strategy is to be implemented by an experienced contractor through the property management company during operation.

Devices/ Facilities to Control Pollution

In addition to the above, the following device/ facilities will be incorporated into the design:

- Screening facilities such as standard gully grating and trash grille, with spacing which is capable of screening off large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system as well as at upstream location of the u-channels.

- Road gullies with standard design and silt traps and oil interceptors should be incorporated during the detailed design to remove particles present in stormwater runoff.

- Drainage outlet of any covered car park should be connected to foul sewers via petrol interceptors or similar facilities.

In addition to the above, subject to detailed design, standard manholes with desilting opening/ sand trap designed for first flush flow (capable of providing at least 5 minutes' detention time) can be provided at final discharge point before discharge into NTMDC. The feasibility of alternative measure such as Vortex grit separator would also be considered during the detailed design stage.

In the event of emergency (e.g. car accident) where there is a major spillage of oil, chemical or fuel, dispersants or firefighting foam, etc., a system of contaminant bunding will be implemented as appropriate.

Specific Measures During Operation of the WRA

WRA is not designed for pollution abatement but as ecological mitigation measures of the development. All pond water of WRA will be obtained by direct rainfall and will be retained and re-circulated during drain-down periods as necessary. No surface or groundwater supplies will be used for WRA operations.

Ponds in the WRA will be designed in such a way that they are self-contained and there is no outlet connecting to nearby channel/inland water, thus there will be no discharge from the ponds within the WRA. Surface runoff from the residential portion will be diverted away from the WRA by drainage channels in order to avoid overflow of the pond under extreme weather condition (e.g. heavy rainfall).

No fertilizers and pesticides will be routinely used for vegetation management in the WRA, hence avoiding the potential source of contamination into the adjacent watercourses which connects to the Deep Bay.

The WRA will be designed in such a way that overflow will be diverted into proper drainage system of the development site before discharge into NTMDC through the proposed drainage system. During operation, under the management of Wetland Ecologist, who will advise on the management of wetland, pond water will be transferred between ponds within the WRA, in order to self-contain water within the WRA.

Administrative Measures

Good management measures such as regular cleaning and sweeping of road surface/ open areas is suggested. The road surface/ open area cleaning should also be carried out prior to occurrence of rainstorm.

Manholes, as well as stormwater gullies, ditches provided among the residential development will be regularly inspected and cleaned (e.g. monthly) by the property management company. Additional inspection and cleansing should be carried out before forecast heavy rainfall.

The mitigation measures listed in Section 5.6.2 will be implemented by the Project Proponent, which will be managed and maintained by the property management company/ Incorporated Owners during operational phase.

5.7 Cumulative Impacts

5.7.1 Identification of Cumulative Projects

As discussed in Section 1.9, a few works projects near the Project Site have been identified for cumulative impact assessment. Cumulative impacts of these projects are described in following paragraphs.

5.7.2 Evaluation of Cumulative Construction Phase Impacts

Approved Sewerage Project

The location of the proposed Ngau Tam Mei sewage pumping station and the public sewers are also shown in **Figure 1-2**. According to its approved EIA report, namely the "EIA and TIA Studies for the Stage 2 of PWP Item No. 215DS - Yuen Long and Kam Tin Sewerage and Sewage Disposal[4]", a sewage pumping station (SPS) (Ngau Tam Mei SPS), has been proposed at an offsite location about 206m southeast of the Project Site. Under the same project (current PWP Item 4235DS), a gravity trunk sewer will be constructed along Castle Peak Road between Ngau Tam Mei and San Tin, and a section of alignment will be constructed along the Ngau Tam Mei Channel in adjacent to this development Project.

According to the said EIA report (Section 10.6 of the concerned EIA report refers), potential water quality impacts of the sewerage works could arise as a result of surface runoff carrying sediment laden and water pollution due to site facilities such as toilets.

The EIA report has stated that all the construction works of that project will be carried out in short sections, and construction of each sections will last for a short period of time. It has also recommended in the same report that the construction works will be carried out in 50m segments (Section 8.5 of the same EIA report refers). Thus, the exposed surface at any one time will be much reduced and controllable during the construction phase. In addition, the construction programme of that project will also be arranged to minimize surface excavation during rainy seasons. Furthermore, various practicable mitigation measures have also been proposed in that EIA report to prevent the transportation of sediment away from the works area (section 10.6.2 of the same EIA report refers).

The contractor is also obliged to follow the procedures and requirements given in the Practice Notes for Professional Persons on "Construction Site Drainage" (*Pro PECC* PN 1/94). Efficient silt removal facilities will be installed, and channels, earth bunds or sand bag barriers will be provided to divert stormwater to silt removal facilities. For sewage generated from construction workforce, portable chemical toilets or sewage holding tanks will be provided. With the proposed mitigation measures, adverse water quality impacts on the nearby water environment are not anticipated. Most importantly, respective project specific Environmental Monitoring and Audit (EM&A) programme will be implemented for the said sewerage project to ensure and review the effectiveness of the mitigation measures implemented.

Approved Cycle Track Project

A cycle track will also be provided along the Castle Peak Road and the Yau Pok Road as part of the cycle track project between Tuen Mun and Sheung Shui under PWP Item 7259RS.

According to the concerned cycle track EIA report, the identified primary potential impacts to water quality of that project will be from pollutants from construction site run-off (suspended solids). Measures have been proposed in that EIA to control/ prevent impacts to the water sensitive receivers (e.g. Sections 6.5 and 6.6 of the cycle track EIA report). In particular, the contractor is also obliged to follow the procedures and requirements given in the *Pro PECC* PN 1/94. Surface run-off from the construction sites will be directed into storm drains via adequately designed wastewater treatment facilities such as sand traps, silt traps and sediment settling basins. Wastewater from temporary site facilities (such as toilets) will be discharged to foul sewer, or chemical toilets will be provided.

In addition, the cycle track project will be constructed in sections. Typically, the working area will be 40 m long by 4 m wide and no adjacent sections (200m between two neighbouring sections) will be constructed simultaneously. Thus, the exposed surface that may cause sediment laden runoff will be minimized and controlled during the construction phase. With the proposed control measures, stormwater runoff will be adequately controlled and the project will not cause unacceptable impact. Most importantly, respective project specific EM&A programme will be implemented for that project to ensure the effectiveness of the mitigation measures implemented.

Approved Planned "REC Site" Project

According to the approved EIA report of this Project under EIA-220/2014, the planned development project is for land-based development. Identified water quality impacts will be surface runoff with sediment laden, sewage generated from construction workforce, etc. during construction phase. With the appropriate mitigation measures such as those stipulated in ProPECC PN 1/94 and proper design of drainage system recommended in the approved EIA report, no adverse water quality impact is expected.

In addition, the site formation works of the current Project (which is a major source of construction site runoff, will be undertaken between December 2015 and April 2017) (Appendix 1-1 refers), which has avoided concurrent construction with the site formation works of the "REC Site" (to be commended in November 2017 after the site formation works of this Project). Thus, cumulative impact has been minimised.

Planned "RD Site" and "Kam Pok Road Site" Project

According to the EIA Study Brief of these two development projects (ESB - 204/2009 and ESB - 210/2009, respectively), the planned development sites are also for land-based development. It is expected that water quality impacts of these projects will be similar to the approved "REC Site" project. As mitigation measures will be recommended in the respective EIA report of these projects, which will need to be followed during construction, no adverse water quality impact is anticipated.

Evaluation of Cumulative Impacts

Appropriate mitigation measures such as those stipulated in ProPECC PN 1/94 and proper design of drainage system have been recommended in the respective EIA report of the above-mentioned projects, it is expected that cumulative impact of construction site runoff will be controlled through implementation of mitigation measures described in this report as well as those committed for the other projects.

In addition, appropriate Environmental Monitoring and Audit (EM&A) programme will need to be implemented by each of these Projects in order to closely monitor the effectiveness of the proposed mitigation measures and to comply with the Environmental Permit (EP) conditions of the respective EIA projects. As such, adverse water quality impacts are not expected.

5.7.3 Evaluation of Cumulative Operational Phase Impacts

Approved Sewerage Project

The planned public sewerage project is to convey collected sewage to DSD's sewage treatment plant for treatment. As the sewer will be laid underneath existing road surface, there will be no additional surface runoff due to this project.

There will be no sewage discharge from that project, thus there will be no operational impact.

Approved Cycle Track Project

According to the EIA report of the planned cycle track (Section 6.1.2 of that EIA report refers), the proposed cycle track does not require any sewerage provisions. Thus, there will be no adverse water quality impacts during its operation.

No significant surface runoff is expected due to the cycle track during its operation.

Approved Planned "REC Site" Project

Based on the approved EIA report of that project (Section 5.8.1 of the approved EIA report refers), the concerned development will not have population intake until the commissioning of the planned local public sewerage works. As the sewage generated from the development will be discharged into public sewerage system, there will be no adverse water quality impact due to this Project.

There is no estimation on the amount of surface runoff in the approved EIA report for the "REC Site" project. Since the proposed development is similar to this Project (i.e. land based development comprising small houses development), it is expected that the concerned surface runoff should not be in significant amount. With the proposed mitigation measures in its EIA report, no adverse impact is anticipated.

Planned "RD Site" Project

Best available information has been referenced regarding this development project. It is found that similar to the planned "REC Site" project, the approved planning application of this planned development site under the planning application no. A/YL-MP/205 has assumed no population intake until the commissioning of the planned local public sewerage system. As such, there will be no adverse water quality impact due to this Project.

There is no available information regarding the amount of surface runoff to be generated by this development project. Since the proposed development is similar to this Project (i.e. land based development comprising small houses development), it is expected that the concerned surface runoff should not be in significant amount. Mitigation measures would be recommended in its EIA report and controlled under the EIAO process, it is expected that there will be no adverse impact.

Planned "Kam Pok Road Site" Project

Best available information has been referenced regarding this development project. According to the approved planning application of this development site under the planning application no. A/YL-MP/202, the estimated peak Average Dry Weather Flow (ADWF) due to

domestic sewage discharge of that project is 383 m^3/day (or 4.4 L/s), which will be treated by an interim sewage treatment plant. The development is also expected to comply with the no net increase in pollution loading requirement in Deep Bay. Thus, no adverse water quality impact is expected.

There is no available information regarding the amount of surface runoff to be generated by this development project. Since the proposed development is similar to this Project (i.e. land based development comprising small houses development), the concerned surface runoff should not be in significant amount. Mitigation measures would be recommended in its EIA report and controlled under the EIAO process, it is expected that there will be no adverse water quality impact.

Evaluation of Cumulative Impact

Sewage Discharge

As mentioned above, there will be no adverse water quality impact due to the approved public sewerage project and approved cycle track project. With regard to the approved "REC Site" project as well as planned "RD Site" project mentioned above, sewage generated from these projects will be discharged into public sewer and there will be no direct discharge of sewage from these projects. Thus, there will be no adverse impact on water quality. As such, the planned "Kam Pok Road Site" will be the only project which may contribute to cumulative impact of this Project.

According to Section 6.4 of this EIA report, the estimated peak ADWF from STP of this development Project was about 12 L/s. Thus, the cumulative total peak ADWF of the two projects should be 16.4 L/s, which is negligible when compared with the capacity of the NTMDC (over 500m^3/s without overtopping the channel embankment under 1 in 200 year rainfall).

Given the two projects has demonstrated compliance with the no net increase in pollution loading requirement in their respective planning application/ EIA studies, and there will be no impact both in term of quantity and quality, thus no adverse cumulative impact is anticipated and no further mitigation measures are required.

Stormwater Discharge

As discussed above, it is not expected that the approved public sewerage project as well as cycle track will contribute to any significant increase in surface runoff during its operation. The estimated increase in surface runoff due to developable area of this Project is about 37 m^3/day (or 0.43 L/s) as a result of the transformation from existing unpaved area into a hard-paved low-density and low-rise residential development (**Appendix 5-2A** refers).

For the remaining 3 private development sites (i.e. approved "REC Site", planned "RD Site" and planned "Kam Pok Road Site"), there is no readily available information regarding the estimated increase in surface runoff of these projects. Reference has been made to the approved EIA report of the "REC Site", and the approved planning application documents of the planned "RD Site" and the planned "Kam Pok Road Site". According to the layout plans of these development projects, the approved "REC Site" is divided into two portions. The Southern Portion (about 50% of total site area) is proposed for residential development while the Northern Portion (remaining 50%) is proposed mainly for landscaping and recreational uses only. While for the planned "Kam Pok Road Site" and planned "RD Site", they are proposed for residential development only. The planned "RD Site" is currently unpaved while the "Kam Pok Road Site" project is partially paved. It is expected that the increase in surface runoff due to residential area of these projects will be in similar magnitude or smaller when compared with this project given to the fact that the proposed residential

developments of these projects are of similar nature to this Project (i.e. for hard-paved low-density and low-rise residential development).

For the planned "RD Site" and the Southern Portion of the approved "REC Site", the project site of these projects will be transformed from unpaved area into paved area (i.e. similar case to the developable area of this project). For the Northern Portion of the approved "REC Site", the increase in surface runoff will not be in significant amount as the project site will be mainly unpaved before and after its development. While, for the planned "Kam Pok Road Site" the increase in surface runoff is expected to be small since the project site is already partially paved.

In order to take a conservative approach, it has been assumed that the whole site area covered by the above-mentioned development projects is unpaved before the development, which will be converted into paved area. Estimation of increase in surface runoff of these projects is based on the estimated increase in surface runoff due to the developable area of this Project (i.e. the change from unpaved area to paved area). Calculation is based on pro rata basis for the purpose of this assessment and is presented in **Appendix 5-2B**. According to the estimation, the estimated total increase in surface runoff due to the above-mentioned planned development projects is about 203 m^3/day (or 2.4 L/s), which is negligible when compared with the capacity of the NTMDC (over 500m^3/s).

It shall be noted that all these planned development projects will be required to comply with EIAO requirements. The concerned surface runoff will be controlled through committed mitigation measures described in the respective EIA reports of those projects as well as those recommended in this Project. It is therefore expected that there will be no adverse water quality impact during the operation.

5.8 Environmental Monitoring and Audit

The water quality assessment in the EIA indicated that there would be no adverse impacts on water quality from the construction of the Project with proper implementation of the recommended mitigation measures. However, in order to ensure proper implementation of mitigation measures, regular water quality monitoring and site audit programme shall be implemented. The proposed monitoring and audit details are given in the EM&A Manual. For the EM&A requirements during operation of the proposed interim STP, please refer to Chapter 6.

5.9 Conclusion

5.9.1 Summary of Impacts

The major impacts during construction of the Project will be construction site surface runoff and soil erosion associated with exposed surfaces. Standard best practices as well as site specific measures have been recommended in order to avoid and minimise potential impacts. Peripheral site drainage system comprising precast concrete u-channels, sedimentation basins, sand traps and similar facilities together with those good site practices stipulated in ProPECC Note PN 1/94, have been recommended. Construction site runoff will be collected, and pre-treated effluent will be discharged into the NTMDC following the existing flow regime. By adopting good site management practices and proposed mitigation measures, adverse water quality impact is not expected. The Contractor will be required to apply for a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence.

During the operation of the Project, sewage generated will be discharge to the planned public sewerage system under the permanent sewage disposal scheme, thus there will be no adverse water quality impact. An interim sewage treatment plant (STP) will be provided for treatment of sewage generated from the proposed development site until the public

sewerage system becomes available. The STP has been designed in such a way to comply with the no net increase in pollution loading requirement in Deep Bay. The effluent discharge issue has been addressed in Chapter 6 of the EIA report. The discharge from the STP is also subject to a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence as well as the conditions specified in the Environmental Permit of this Project. Thus, no adverse water quality impact is expected.

Surface runoff from the development site will be discharged to the NTMDC. Pollutants, if any, will be pre-treated and settled before discharge. It was estimated that the increase in surface runoff due to this Project is negligible when compared with the design capacity of the NTMDC. Best Management Practices have been proposed in order to abate first flush pollution in stormwater runoff such as design measures to minimise soil erosion; minimizing paved area; proper managed landscape area; proper site drainage design/control; provision of devices/ facilities to control pollution and to remove pollution source; minimizing the use of fertilizers; and administrative measures for maintenance issues. Screening facilities such as gully grating, trash frille, and road gullies with silt traps and oil interceptor will be incorporated into the drainage design to control pollution. In addition, manhole with sand trap will be incorporated before final discharge.

Specific measures have also been recommended for the design, operation, and management of the WRA such as the operation is self-contained; overflow to be discharged into proper drainage system; and the discharge from residential area is to be diverted away from the WRA. With the recommended measures, there will be no unacceptable impacts to the water quality in the Deep Bay.

5.9.2 Cumulative Impacts

Potential cumulative impacts due to concurrent construction of nearby approved designated projects as well as planned development sites, have been assessed. Since all those projects will implement their own mitigation measures to ensure discharge from the construction sites can comply with the relevant WPCO as well as EIA requirements, it is expected that there will not be any unacceptable cumulative construction phase water quality impact.

It is expected that the approved public sewerage project and the cycle track project will not contribute to significant increase in surface runoff. It is expected that the scale and nature of nearby planned development sites will be similar to this Project which will be controlled through the implementation of committed measures described in the respective EIA reports of those projects as well as those recommended in this Project. No adverse cumulative impact on water quality during operational phase is therefore expected.

5.9.3 Residual Impacts

With proper implementation of the recommended environmental mitigation measures, no adverse water quality impacts would be expected from the construction and operational phase. Thus, no adverse residual impact is anticipated during the construction and operation of the Project.

6. SEWERAGE AND SEWAGE TREATMENT

6.1 Summary

The proposed Project is for comprehensive development and wetland protection near Yau Mei San Tsuen. Detailed elements of the proposed development and the MLP are discussed in Section 1.3, while the project construction programme is provided in Section 1.8 and Appendix 1-1.

This Sewerage Impact Assessment (SIA) has been carried out to give a brief discussion on the current environmental legislation and standards and assess the impacts arising from the proposed development. Recommendations of mitigation measures have been made if there is any adverse effect induced by the proposed development. Moreover, this assessment has identified the alternative sewage disposal arrangements to temporarily handle the sewage to be generated from the Project during the interim period before completion of the planned Ngau Tam Mei trunk sewerage system.

6.2 Existing and Planned Sewerage Infrastructures

The proposed site for the comprehensive development and wetland protection near Yau Mei San Tsuen, consisting of about 70 houses, is located adjacent to the Castle Peak Road and the San Tin Highways as shown in Figure 6-1. The site currently falls within the Yuen Long / Kam Tin sewerage catchment and is classified as an unsewered area under the Yuen Long /Kam Tin Sewerage Master Plan (YLKT SMP). This means that there is no existing public sewerage system serving the Project Site.

Under PWP Item No. 4235DS for Yuen Long and Kam Tin Sewerage and Sewage Disposal, a section of trunk sewer (i.e. the Ngau Tam Mei trunk sewerage system) is originally proposed to be constructed along the Castle Peak Road for commissioning in 2013. After commissioning, sewage generated from the Project can then be discharged into this trunk sewer for subsequent treatment centrally in the Yuen Long Sewage Treatment Works.

However, the proposed Ngau Tam Mei trunk sewerage under PWP No. 4235DS is still at design and consultation stage. The completion date of the proposed trunk sewerage is hinged on the support of local communities such as Rural Committee and the availability of funding such that it cannot be ascertained at this stage. On-site sewage treatment facility mentioned in Section 3.9.4 of the EIA Study Brief, should therefore be provided.

6.3 Assessment Methodology and Assumptions

An analysis of the capacity of the sewage pipe, pumping station and sewage treatment plant has been carried out to evaluate the adequacy of the proposed sewerage system. The design assumptions and basis are shown in Table 6-1:

Table 6-1 Design Assumption and Basis

Items	Values
Design Standard	DSD Sewerage Design Manual, Part 1 & 2
Flow Formula Used	Colebrook White Formula
Roughness Assumed, Ks	1.5 mm
Unit Flow Factor	EPD Guideline for Estimating Sewage Flows for Sewage Infrastructure Planning (GESF) 0.37m^3/d/head (Domestic, Private R4) 0.28 m^3/d/head (Commercial, J11)

Items	Values
	0.15 m^3/d/head (Traditional Village / Temporary and Non-domestic type)

6.4 Estimation of Sewage Flow

The sewage flow to be generated from the projected residential population, as well as activities at the clubhouse and the associated facilities has been estimated following "EPD Guideline for Estimating Sewage Flows for Sewage Infrastructure Planning". Major contributions of sewage flow from the comprehensive development include projected residential population of 315 persons, plus employee for managing the developments and operation of the clubhouse and backwash from the swimming pools. The estimated sewage flow is shown in Appendix 6-1 and summarised in Table 6-2 below.

Table 6-2 Estimated Sewage Flow from the Proposed Development

Items	Units	Resident	Employee	Swimming Pool	Total
Overall Design Average Dry Weather Flow (ADWF)	m^3/d	116.55	8.40	22.67	147.62
Overall Design Peak Flow	m^3/d	932.40	67.20	22.67	1022.27
	l/s	10.79	0.77	0.26	11.82

The peak flow from the Project Area will be about 12 l/s. This flow will be used to calculate the adequacy of the proposed sewerage system.

6.5 Sewage Impact Assessment for Ultimate Scenario

Under PWP No. 4235DS, the following sewerage components as shown in Figure 6-2 are being designed and constructed:

- 525 mm diameter gravity sewer at Yau Pok Road to Ngau Tam Mei Sewage Pumping Station;
- Ngau Tam Mei Sewage Pumping Station and its associated rising main;
- 900 mm diameter gravity sewer connecting the rising main to Nam Sang Wai Sewage Pumping Station.

Under PWP No. 4215DS, the Nam Sang Wai Sewage Pumping Station and its associated rising main to the existing Yuen Long Sewage Treatment Works as shown in Figure 6-3 will also be constructed.

The sewage generated from the Project Area will be conveyed to a terminal manhole located at the southern boundary of the Project Area which will further connect to the 525 mm diameter proposed public sewer at Yau Pok Road. The tentative location of terminal manhole is shown in Figure 6-2.

Flow estimated for the Project Area as indicated in Table 6-3 is adopted in this assessment.

Table 6-3 Summary of Projected Sewage Flow at Different Locations in Year 2030

Location	Design Capacity (l/s) [A]	Projected Peak Flow + Flow from the Project Area (l/s)[2] [B]	% Usage [B]/[A] (%)
525mm pipe	249	204	82
Ngau Tam Mei SPS	566	468	83
900 mm pipe	730	416	57
Nam San Wai SPS	1476	949	64

Note:

The project sewage in the public sewerage is based on the population at year 2030 from the interim version of the HK2030 Planning Data (reference Scenario) which is in line with the approach adopted in Ngau Tam Mei Trunk Sewerage under Agreement No. CE30/2006(DS).

As the projected population at 2030 is well beyond the population intake year of the project, this sewerage impact assessment is considered as a very conservative approach. As shown in Table 6-3, the overall sewage generated in year 2030 will utilize less than 82% of the capacity of the sewerage network therefore, capacity of proposed sewers and pumping stations are adequate to handle additional sewage generated from the Project Area.

Yuen Long Sewage Treatment Works (YLSTW) lies at the most downstream of the sewerage system. The design dry weather flow (DWF) of the existing YLSTW is 70,000 m^3/day with design capacity at 3 x DWF 210,000 m^3/day. It is anticipated that the capacity of YLSTW would be exceeded in around 2024 due to the development of Yuen Long and Kam Tin area. There is plan from EPD to upgrade the treatment level of YLSTW from secondary treatment to tertiary treatment, and the design DWF will be changed from 70,000 m^3/day to about 150,000 m^3/day with a peaking factor of 2.4 (i.e. design capacity = 4,167 l/s). The sewage to be generated by the proposed development of 148 m^3/day is equivalent to less than 1% of the flow of YLSTW after upgrade only. Therefore it is considered that sewage generated by the proposed development would not cause any significant impact to YLSTW.

6.6 Needs of Interim Sewerage Treatment

As mentioned in Section 6.2 above, it is understood that series of public consultations under PWP Item No.4235DS have been conducted by the Government in the past few years to seek the support from the public on the construction of public trunk sewerage system, which is one of the pre-requisite procedures to obtain the necessary funding for the project. It is noted that there have been some objections from the public to the provision of Ngau Tam Mei trunk sewer and therefore, the implementation programme of the Ngau Tam Mei trunk sewer is still uncertain. Due to the delay, it is estimated that the Ngau Tam Mei trunk sewer will not be available before Year 2016.

In this connection, the timing which the sewerage system of the development could only be connected to the public sewerage system is uncertain. Therefore, it is necessary to consider the provision of the on-site sewage treatment facility, as mentioned in Section 3.9.4 of the EIA - Study Brief as an interim measure to handle the sewage generated from the development until connection to public sewerage by DSD is available.

It should also be pointed out that the on-site sewage treatment plant is for temporary use during the interim period only in case the public sewerage cannot be commenced on time. The sewerage system within the development area will be designed to facilitate the future connection to the planned Ngau Tam Mei sewerage system with the flow direction to be controlled by several flow control devices such as valves or stop-log, etc. Switching over from the interim system to the permanent system will be done by regulating the flow direction

through operations of the flow control devices and abandoning the sewer leading to the interim STP. Residual sewage left in the interim STP would be tanked away and the abandoned STP and downstream sewers will be filled up with soil and concrete. Therefore, there should be no discharge of sewage discharge into the nearby water body during decommissioning of the interim STP. To minimize disturbance to the residents, all sewers for connection to the public system within the development will also be constructed at the initial stage.

The interim sewage treatment plant (STP) will be provided by the Project Proponent while the operation and maintenance will be responsible by the property management office of the development and its contractors. The Project Proponent will also be responsible for connecting the sewerage system of the development to the public system when available and decommission the interim STP.

6.7 Interim Scheme of Local Discharge after On-Site Sewage Treatment

The estimated average dry weather flow (ADWF) due to the development is about 148m^3/day (Table 6-2 refers). Previous experience revealed that the use of temporary sewage storage for tankering away this quantity of sewage continuously to the YLSTW is unlikely feasible, due to the associated odour problems and the high demand, if not impossible, of tanker.

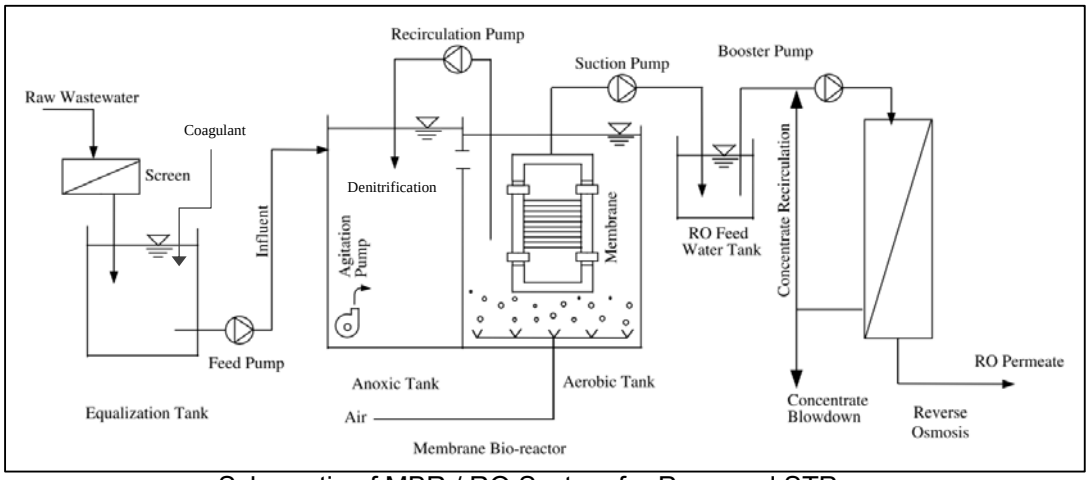
It is therefore necessary to consider the provision of on-site STP as an interim scheme to handle the sewage generated from the Project. The on-site STP will be designed to handle an average dry weather flow of 148m^3/day (see Section 6.6 for details).

The treated effluent will be discharged into the adjacent Ngau Tam Mei Channel, flows westward from the southern side of the Site, discharging into Kam Tin River as shown in Figure 6-4 and finally to the Deep Bay WCZ. The on-site sewage treatment facility will be decommissioned when the planned trunk sewer becomes available.

According to Section 3.9.4 of the EIA Study Brief for this project (No. ESB – 182/2008), any proposed sewerage system and/or on-site sewage treatment facility should be designed to meet the current government standards and requirements.

Currently, the protection and control of water quality in Hong Kong is governed by the Water Pollution Control Ordinances (WPCO) (Cap.358). With reference to Table 5 of the Technical Memorandum (TM) on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters under the WPCO, Group C of inland water discharge standard (with flow rate in the range of 100-500m^3/d) is relevant to the discharge. The relevant Group C inland water discharge standard and coastal discharge standard are tabulated in Table 6-4.

In this regard, membrane bioreactor (MBR) plus reverse osmosis (RO) supplement with denitrification process and coagulation by metal salt to precipitate soluble phosphorus is proposed for the on-site treatment facility. The process schematic for the proposed interim STP is presented in the figure below.



Schematic of MBR / RO System for Proposed STP

MBR is a combined system of biological treatment and microfiltration process. It is a proven technology, which is capable to generate high-quality effluent in terms of low turbidity, BOD, TSS, nitrogen, and bacteria. In Hong Kong, MBR plants with similar capacity to the proposed system have been used for sewage treatment of many different types of facilities such as Tai Lam Correctional Institute (340 m^3/d) and Siu Lam Hospital (96 m^3/d). The typical MBR effluent quality is able to meet the stringent Group C inland discharge and coastal discharge standard of Deep Bay WCZ, as shown in Table 6-4. In addition, it is understood there is no denitrification and effluent disinfection process at YLSTW currently whilst nutrient and bacterial requirements are not specified under the current discharge license. Nonetheless, it is proposed to include denitrification process within the anoxic tank prior to the MBR reactor. In addition, it is also proposed to add metal salt prior to MBR to precipitate soluble phosphorus. The MBR effluent is therefore anticipated to have superior water quality than effluent at YLSTW.

Table 6-4 Comparison of Typical MBR Effluent Quality, Group C Inland Discharge Standard, and Coastal Discharge Standard of Deep Bay WCZ

Key Parameters	Typical MBR Effluent Quality (Average)[(1)]	Group C Inland Discharge Standard (for flow in the range of 100-500 m^3/d)	Coastal Discharge Standard of Deep Bay WCZ (for flow in the range of 10 - 200m^3/d)
BOD_5 (mg/L)	<5	<15	<20
TSS (mg/L)	≤2	<10	<50
NH_3 -N (mg/L)	<5	<2	Not Specified
TN-N (mg/L)	<10	Not Specified	<100
E.*coli* (no/100mL)	<100	<1000	<1000
TP (mg/L)	<0.3[(3)]	<10	<10

Remark:-

(1) Table 3-14 of Water Reuse - Issues, Technologies, and Applications, Metcalf & Eddy, AECOM (2007)
(2) All figures are upper limits unless otherwise indicated.
(3) *With coagulant addition.*

At the downstream of MBR system, Reverse Osmosis (RO) system is proposed to further polish the MBR effluent and eliminate the residual pollution loads of the interim STP. RO system is a proven membrane technology used for the removal of dissolved constituents.

RO membrane module with pore sizes from 0.1 to 1nm can act as a barrier to all dissolved salts, inorganic molecules as well as organic molecules with a molecular weight greater than approximately 300 under the high operating pressures up to 100 bars. This treatment technology is well-established for drinking water treatment, wastewater reuse, seawater desalination, and other industrial applications.

RO technology is currently adopted for wastewater reuse under the NEWater project in Singapore. The RO permeate of NEWater plant has been approved and is safe for potable use based on the comprehensive physical, chemical, and microbiological analysis under the Singapore Water Reclamation Study in 2002. The quality of the RO permeate in NEWater Plant is also identified to be consistently able to meet the latest requirement of the U.S. Environmental Protection Agency's National Primary and Secondary Drinking Water Standards, and World Health Organisation's Drinking Water Quality Guidelines.

In Hong Kong, Drainage Services Department (DSD) has completed a pilot trial for testing the integral MBR/RO system for wastewater treatment and reuse at Shek Wu Hui Sewage Treatment Works (SWHSTW) in 2005. The capacity of the pilot plant was 40 m^3/d. The objective of the pilot trial was to evaluate the quality of the RO permeate and explore the feasibility of wastewater reuse. MBR/RO system has excellent and stable performance to treat local municipal wastewater. The testing results from the physical, chemical, and microbiological aspects confirmed that the RO permeate also meets the USEPA and WHO drinking water qualities. As such, DSD has also proposed recently the installation of MBR/RO system as the new water reclamation facilities at 8 local sewage pumping stations/ sewage treatment works (e.g. Stonecutters Island STW), which showed the local acceptance and maturity of the MBR/RO technologies. The reclaimed water has been planned for use in non-potable applications such as facility washing, toilet flushing, chemical preparation, and landscape irrigation. For this comprehensive development treated effluent reuse is not considered at this stage as this would involve complication management and public health issues in particular how to prevent misused of the treated effluent.

6.8 Compliance with Town Planning Board Guidelines

In addition to the provision in WPCO, it is noted that there are concerns regarding the disposal of effluent to the Deep Bay WCZ. It is necessary to demonstrate that the interim sewage disposal scheme would not pose a net increase of pollution loads to the Deep Bay WCZ, in accordance with the Town Planning Board (TPB) Guidelines, i.e. TPB PG-No.12C.

Once the government public sewerage system becomes available, the on-site STP will be decommissioned. Nevertheless, it can still be demonstrated that the proposed development near Yau Mei San Tsuen will not cause net increase in pollution load to Deep Bay at all stages of the Project.

According to the approved North East New Territories New Development Areas Environmental Impact Assessment Report (EIA-213/2013), the three key pollutant parameters namely 5-day biological oxygen demand (BOD_5), total nitrogen (TN) and total phosphorous (TP) are bounded by the "no net increase in pollutant load" requirement. Under this project, it is proposed to assess the net change of the suspended solids (SS), ammonia nitrogen (NH_3-N), and E.coli. on top of the three parameters, in order to have better understanding on the variations of pollution loads to the Deep Bay arisen from the proposed development.

6.9 Existing Pollution Loads from the Development Area

Based on the site inspection in 2010 there were 19 structures identified within the site and 15 (including 10 houses, 2 toilets and 3 storages) of them were identified to be occupied as illustrated in Appendix 6-2.

As mentioned above, there is no existing public sewerage system near the site, the generated sewage from most of these houses discharged directly into the existing ponds, fields and watercourses without any treatment and while the others are treated by septic tanks as illustrated in Appendix 6-2.

The baseline sewage from houses within the site is 3.0 m^3/day with calculations shown in Appendix 6-3 and the existing pollution loads are tabulated in Table 6-5.

Table 6-5 The Current Pollutant Load of the Existing Village Houses within the Site Area to the Deep Bay WCZ

Pollutant	Values
BOD	0.718 kg BOD/day
TSS	0.664 kg TSS/day
NH_3-N	0.093 kg NH_3-N/day
TN-N	0.149 kg TN-N/day
E.coli.	$6.88x10^{11}$ count E.coli/day
TP	0.027 kg P/day

The pollution load of the existing village houses to Deep Bay WCZ will not be reduced or improvement without the proposed Project unless the Ngau Tam Mei Trunk Sewer is constructed by DSD. However, its implementation programme is still uncertain after years of public consultations.

Residual Pollution Loads from the On-Site Sewage Treatment Plant

With reference to the design and local pilot testing experience of MBR/RO system, the RO permeate quality for this Project was determined as listed in the Table 6-6.

Table 6-6 Typical Quality of MBR Effluent and RO Permeate

Parameters	Typical MBR Effluent Quality[1]	Typical RO Treatment Removal Efficiency[2]		Typical RO Permeate Quality		Proposed RO Permeate Quality for Offsetting in this Project[7]
		Average (%)	Lower Limit (%)	Average	Upper Limit	
BOD (mg/L)	5	40	30	3	3.5	3.5
TSS (mg/L)	2	99	95	0.02	0.1	2
NH_3-N (mg/L)	5	96	90	0.2	0.5	0.5
TN-N (mg/L)	10	N/A	N/A	≤1[4]		1.0
E.coli. (no/100mL)	100	4-log[3]	7-log[3]	~0	~0	0
TP (mg/L)	0.3[5]	N/A	N/A	≤0.067[6]		0.1

Remark:

(1) Table 3-14 of Water Reuse - Issues, Technologies, and Applications, Metcalf & Eddy, AECOM (2007)

(2) Table 11-27 of Wastewater Engineering Treatment and Reuse 4th Edition, Metcalf & Eddy (2003)
(3) Table 9-6 of Water Reuse - Issues, Technologies, and Applications, Metcalf & Eddy, AECOM (2007)
(4) Table 3-14 of Water Reuse - Issues, Technologies, and Applications, Metcalf & Eddy, AECOM (2007)
(5) Phosphorous are removed by MBR with chemical coagulant.
(6) Strategies for Meeting Ultra-Low Phosphorus Limits: State of the Art Technologies and Case Studies, Black& Veatch Corporation (2009)
(7) As a conservative approach, the higher of the upper limit of RO Permeate quality or the values would be adopted in the calculation of the pollution loading offsetting in this project.

Based on the design RO permeate quality, the residual BOD, TSS, NH_3-N, TN, E.*coli* and TP loads of the RO permeate from the on-site sewage treatment plant are estimated and tabulated in Table 6-7.

Table 6-7 Future Pollution Loads from Development Area

Item	**(A)** **Proposed RO Permeate Concentration**	**(B) = (A) x 147.62 X 1000 /1000000** **Total Future Pollution Loads**
BOD	3.5 mg/L	0.517 kg BOD/day
TSS	2 mg/L	0.295 kg TSS/day
NH_3-N	0.5 mg/L	0.074 kg NH_3-N/day
TN-N	1.0 mg/L	0.148 kg TN-N/day
E.*coli.*	0 no/100mL	0 count E.*coli.*/day
TP	0.1 mg/L	0.015 kg P/day

Considering all the existing village houses and associated septic tanks within the site area will be vacated and demolished for the purpose of the proposed development, the residual pollution loads of the on-site sewage treatment plant will be reduced by offsetting the current pollution loads from the existing village houses after the completion of the proposed development, as shown in Table 6-8. It is therefore evident that the proposed development will not cause net increase of pollution load to the Deep Bay WCZ in adhering with the pollution loads requirement under the TPB guidelines.

Table 6-8 Comparison of Total Existing and Future Pollution Loads from Development Area

Item	Total Existing Pollution Loads from Table 6-5	Total Future Pollution Loads from Table 6-7	Reduction of Pollution Loads at Deep Bay WCZ
BOD (kg/d)	0.718	0.517	0.201
TSS (kg/d)	0.664	0.295	0.369
NH_3-N (kg/d)	0.093	0.074	0.019
TN-N (kg/d)	0.149	0.148	0.001
E.*coli.* (count/day)	$6.88x10^{11}$	0	$6.88x10^{11}$
TP (kg/d)	0.027	0.015	0.012

6.10 Operation and Maintenance of Interim Sewage Treatment Plant

Proper operation and maintenance of interim sewage treatment plant is essential to safeguard the quality of discharge effluent, subject to the following aspects:

(i) Only competent technicians to be employed by the property management office to operate the STP. They are to be fully conversant with the operating procedures as stipulated in the operation and maintenance manuals.

(ii) The proposed STP only serves the proposed development and thus the operation and maintenance (O&M) cost would be borne by the future management office of the development. The Project Proponent will ensure the design of STP is cost-effective such that the O&M cost imposed is reasonable.

(iii) The STP is to be kept in a tidy state. This includes regular hosing down, scraping of the walkways, whitewashing the walls, cleaning and painting the metalwork, and maintaining adequate lighting and ventilation.

(iv) Where parts of the STP are sited beneath ground, forced ventilation will be provided.

(v) An easily accessible sampling point will be provided for taking samples of the treated effluent.

(vi) Samples of treated effluent will be taken regularly and tested according to the discharge licence under the Water Pollution Control Ordinance as well as the conditions specified in the Environmental Permit of this Project under the EIAO, in order to ensure compliance with discharge standards which should be same as the proposed RO Permeate concentration as stated in Table 6-7.

(vii) The production of sludge is estimated to be $6m^3/d$ and RO concentrate generated is estimated to be 20% of the RO which is $32m^3/d$.

(viii) Based on reference to other similar projects, the dewatered sludge will be collected by a licensed collector at regular intervals and disposed at the landfill. As an alternative to on-site dewatering of sludge, sludge could be transferred by tankers to Government's STW for off-site treatment due to its small quantity. Provided that the handling, storage and disposal of the wastes are properly managed and accidental release to the surrounding environment does not occur, adverse environmental impacts are not expected. In any case our sludge handling arrangement will be in compliance with requirements of the Water Pollution Control Ordinance (WPCO). Such approach for

sludge disposal has also been adopted for some other projects, such as "Liantang / Heung Yuen Wai Boundary Control Point and Associated Works", "Redeveloped Lo Wu Correctional Institution" and "CLP Black Point Power Station".

(ix) The Project Proponent will be responsible for the future sewer connection to public sewers upon its available in the future and STP decommissioning with connection details subject to agreement of DSD. Appropriate conditions could be imposed in the Environmental Permit (EP) to ensure the EP holder to take up the responsibility to ensure connection to public sewer when trunk sewer is ready.

(x) The obsolete STP and the connecting sewer will be filled up by soil and concrete once decommissioned.

Apart from ensuring the sewerage discharge quality, the STP with also be fitted with measures to avoid other nuisance to the residents. For example deodourizers will be provided to mitigate odour impact. The odour control unit consists of 2 parallel activated carbon units, each rated at 50% of the foul air flow. The arrangement would allow treatment of air even when one activated carbon unit is being replaced. Odour treatment is designed to treat 20 ppm with a 99.5% odour removal. Also the major noise impact during the operational phase of the STP, would include the operation of pumps and ventilation equipment. To prevent noise nuisance to nearby residential buildings, the odour control fans will be enclosed or located at the underground level. With the implementation of proper mitigation measures, the STP should be a complete enclosure with minimal openings fitted with acoustic louvers the expected noise impacts would be minimal and should not exceed the relevant limits under the Hong Kong Planning Standards and Guidelines.

Monitoring Requirements

The discharge of treated effluent from the interim STP and its monitoring should follow the licence requirements under the WPCO as well as the conditions specified in the Environmental Permit of this Project under the EIAO. Samples of treated effluent will be taken regularly and tested by a HOKLAS or other internationally accredited laboratory according to the above-mentioned requirements to ensure compliance with discharge standards. Details of the above are specified in the EM&A Manual.

6.11 Mitigation Measures to Minimize Adverse Impact due to Potential Sewage Overflow

The following measures will be adopted in order to eliminate adverse impact due to potential sewage overflow, emergencies discharge and change in flow regime beyond the expectation of this assessment:

(i) Adequate spare parts for the plant will have to be made readily available by storage.

(ii) Qualified personnel will be hired to inspect the condition and maintain the plant on a regular basis.

(iii) Regular test, maintenance and replacement of membranes, plants and equipment will be carried out in accordance to the recommendations from manufacturers or as recommended by the qualified personnel after inspection.

(iv) Equalization tank with capacity of 443 m^3 (i.e. 3 x ADWF) will be provided to withhold the sewage temporarily in case of outage or overflow of the interim STP.

(v) Tank away will be provided for prolonged outage of the interim STP, for disposal of sewage at designated sewage treatment works to be assigned by DSD.

With the above measures in place, the likelihood of emergencies discharge would be very low and in case of several incidents occurring concurrently (including failure of both normal and backup power supply; incoming of sewage flow above 3 x ADWF for longer than 24 hours continuously; unavailable of tanker truck, etc). As such it is considered that the proposed interim scheme of local discharge after on-site sewage treatment would not cause net increase of pollution load to the Deep Bay WCZ.

Also in case substandard effluent is detected from water sampling, discharge of treated effluent will be suspended and all sewage will be diverted to the equalization tank for temporary storage until the problem is rectified. And if prolonged outage of the interim STP is anticipated, tankers will be arranged to transport the sewage for disposal as designated sewage treatment works to be assigned by DSD.

6.12 Conclusions

The proposed residential development area will be located near the Yau Mei San Tsuen Village. There is no existing public sewerage system in the vicinity serving the Development. The Project Site, with a maximum of 345 people (resident and staff) will generate a peak flow of 12 l/s additional sewage peak flow to the future public sewerage network under PWP Nos. 4215DS and 4235DS, as permanent measure.

Hydraulic analysis shows that the future public sewerage and pumping stations have sufficient spare capacity for conveying the overall sewage generated at 2030 which includes the additional sewage from the Project Site. The hydraulic analysis also revealed that both the existing and the potential future upgraded YLSTW have adequate capacity for the overall sewage generated in year 2030.

Considering that the current implementation programme of the Ngau Tam Mei Sewerage under PWP 4235DSD is still very tentative and is uncertain due to public objection. It is necessary to consider the provision of an on-site sewage treatment facility as an interim measure to handle the sewage generated from the development. The interim on-site sewage treatment facility with the enhanced tertiary treatment process of MBR/RO system will treat the 148m^3/day sewage to achieve the Group C Inland and Costal Discharge Standard of Deep Bay WCZ. Also, it is understood that there is no denitrification and effluent disinfection process at the YLSTW currently, whilst nutrient and bacterial requirements are not specified under the current discharge license. The MBR/RO effluent will give better water quality than the discharge effluent at YLSTW.

Furthermore, it is aware that the interim sewage treatment plant will need to fulfil the requirement of no net increase of pollution loads to the Deep Bay under the Town Planning Board (TPB) Guidelines, i.e. TPB PG-No.12C. Considering that all the existing village houses and associated septic tanks within the site area will be vacated and demolished for the purpose of the proposed development, the residual pollution loads of the on-site sewage treatment plant will be reduced by offsetting the current pollution loads from the existing village houses after the completion of the proposed development. It is therefore evident that the proposed development will not cause a net increase of pollution load to the Deep Bay WCZ in adhere with the pollution loads requirement under the TPB guidelines. At the same time the provision of the interim onsite sewage treatment facilities will have positive impact on the pollution load to Deep Bay WCZ comparing to the existing condition and do nothing scenario.

Furthermore, the sewerage system within the development area will be designed to facilitate the future connection to the Government sewerage system at Yau Pok Road. The proposed

sewerage system for the Development will be connected to Ngau Tam Mei sewerage system once it has become available.

Adverse short-term and long-term environmental impacts in respect of water quality, ecological, public health and safety arising from both the long term and interim sewerage scheme are not anticipated.

In addition, continuing the current situation, the quality of discharges to Deep Bay from the proposed site is not expected to improve in the future until the trunk sewer is constructed by DSD. But upon completion of the Project with the provision of on-site treatment facility the total pollution loads to Deep Bay could be reduced.

To conclude, the operation and maintenance requirements as well as decommissioning requirements have been proposed accordingly. With these measures in place, no adverse sewerage impact will be incurred as a result of the development.

No adverse sewerage impact will be incurred as a result of the development.

7. WASTE MANAGEMENT

7.1 Summary

This section identifies the quantity, quality and timing of wastes arising as a result of construction and operation of the Project. In case there is pond filling activities, the potential biogas problem arising from leaving pond mud in place will also be assessed. The waste management implications and the associated environmental impacts are evaluated and assessed in accordance with the criteria and guidelines given in Annexes 7 and 15 of the EIAO TM. Clause 3.9.5 of the EIA Study Brief sets out the scope and requirement of the assessment.

The statutory approved planning intention for the Project Area is to allow the consideration of comprehensive low-density residential development or redevelopment, provided that all the existing continuous and contiguous fish ponds within the zone are protected and conserved. “No-net-loss in wetland” principle is adopted. No pond filling and no decline in wetland function of the fish ponds are also the key considerations required to be taken into account for any development. Any new development should be located on the formed land and as far away from the existing contiguous fish pond area within the Project Area.

In view of the above-mentioned planning intention, the construction method mainly involve the following procedures: site clearance to remove the surface vegetation, construction of peripheral retaining wall with piling, installation of vertical drains, import of inert filling material, removal of the residual inert fill materials after completion of pre-loading, and construction of infrastructure and superstructure. Foundation of the superstructure will likely to be carried out through pilling. The appropriate disposal method for each type of waste generated from the above mentioned construction method was identified. Opportunities for reducing construction waste generation and maximizing re-use on-site were evaluated. The potential impacts arising from handling, collection, and disposal of wastes and the environmental mitigation measures required to mitigate these environmental impacts were identified and recommended. In addition, the Project Area was used for farmland (proposed residential portion) and pond (proposed wetland restoration area). No potential contamination activities / operations are found; i.e. no land contamination issue for the Subject Site.

Due to the low-density nature of the proposed residential development, the operation of the development will generate limited amount of domestic wastes. The handling and disposal of this small quantity of waste during the operational phase will follow the usual approach of collection by refuse collection vehicles (RCV) as it is managed in other parts of Hong Kong. This will therefore unlikely to cause any significant environmental impact. The waste management implication during the operation of the residential development is therefore not evaluated in this EIA study.

7.2 Environmental Legislation and Standards

The principle legislation governing waste management in Hong Kong is the Waste Disposal Ordinance (Cap. 354) (WDO), and its subsidiary regulations. The Ordinance, enacted in 1980, generally encompasses all stages of waste management, from place of arising to final disposal point of waste. The Waste Disposal (Chemical Waste) (General) Regulation, enacted under the WDO in 1992, provides controls on all aspects of chemical waste disposal, including storage, collection, transport, treatment and final disposal.

In addition to the WDO and its subsidiary regulation, the following legislations have some bearing on the handling, treatment and disposal of wastes in Hong Kong, viz.:

- Dumping at Sea Ordinance (1995);

- Land (Miscellaneous Provisions) Ordinance (Cap. 28);
- Public Health and Municipal Services Ordinance (Cap. 132) Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws;
- Dangerous Goods Ordinance; and
- Air Pollution Control (Open Burning) Regulation.

There are also various guidelines which are relevant to waste management in Hong Kong such as:

- Waste Disposal Plan for Hong Kong (December 1989), Planning, Environmental and Lands Branch Government Secretariat;
- New Disposal Arrangements for Construction Waste (1992), Environmental Protection Department & Civil Engineering Department;
- A Guide to the Registration of Chemical Waste Producers, Environmental Protection Department, Hong Kong;
- A Guide to the Chemical Waste Control Scheme, Environmental Protection Department, Hong Kong;
- Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992), Environmental Protection Department;
- Works Branch Technical Circular No. 12/2000, Fill Management;
- Works Branch Technical Circular No. 2/93, Public Dumps;
- Works Branch Technical Circular No. 2/93B, Public Filling Facilities;
- Work Branch Technical circular No. 16/96, Wet Soil in Public Dumps;
- Works Bureau Technical Circular No. 25/99, Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers;
- Works Bureau Technical Circular No. 4/98, Use of Public Fill in Reclamation & Earth Filling Projects;
- Works Bureau Technical Circular No.19/2001, Metallic Site Hoardings and Signboards; and
- ETWB TC(W) No. 33/2002, Management of Construction/Demolition Materials including Rocks;
- DEVB TC(W) No. 6/2010, Trip Ticket System for Disposal of Construction and Demolition Materials; and
- ETWB TC(W) No. 19/2005, Environmental Management on Construction Sites
- ADV 21, Management Framework for Disposal of Dredged/ Excavated Sediment, published by Buildings Department (Note: there is also ETWB TC(W) No. 34/2002, Management of Dredged/Excavated Sediment)

7.3 Potential Land Contamination Due to Historic Land Use

7.3.1 Approach and Scope of Assessment

The following approach was used for the land contamination assessment:

- Desktop study to review the current and historical land uses. The objective is to identify any potential contaminative land uses within the Study Area; and

- Site reconnaissance to identify the existing land uses and to confirm the general environmental conditions associated with each of the identified sites. This is a non-intrusive approach for making an initial determination of the likely nature of any potential contamination, and, where identified, to evaluate whether there were any significant land contamination concerns associated with these properties.

In addition, other sources of information such as historical aerial photos, historical Hong Kong survey maps, previous applications for planning permission at the Town Planning Board, records and photographs taken from site visits, have also been collated and reviewed.

There are also previously approved EIA projects in adjacent to the Project Site. This include the construction of public sewers and a pumping station along the existing Ngau Tam Mei Drainage Channel (NTMDC)[16] and construction of a cycle track[17] immediately adjacent to the Project Site. Information in these approved EIA reports was also reviewed.

7.3.2 Potential Impacts

In case any contaminated land uses as stated in Sections 3.1 and 3.2 of Annex 19 in the EIAO-TM is identified, a land contamination assessment as detailed in the EIA-TM will be required.

If any potential contaminated soil is identified within the Project boundary due to either current or historic land uses, further investigation in accordance with above-mentioned EIAO-TM will be required. The major potential impacts from contaminated soil are considered to be the following:

- health risks to site workers;
- disposal of contaminated soils, where encountered; and
- Potential health risks to future users of the cycle tracks.

7.3.3 Historic and Current Land Uses

The Project Site is zoned for "Other Specified Uses" annotated "Comprehensive Development and Wetland Protection Area" (OU(CDWPA)) on the Approved Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/6 (the OZP). It is understood that lands near Fairview Park was previously farmland before the construction of residential development at Fairview Park. There was no known historic land uses such as factory or any industrial operations which may result in potential land contamination. In addition, there were no historic activities relating to chemicals and hazardous substances in the area. A desktop review of historic information indicates that the Project Site has been used for agricultural activities only in the past. Change of land use status in the area was only observed around year 2001/2002 due to commencement of construction of the existing Ngau Tam Mei Drainage Channel. As such, land use status since year 2002 has been selected for further review. Historic aerial photos taken in 2002, 2005 and 2010 were presented in **Appendix 7-1** showing the land use status. There was no historic land contamination issues identified.

Asides from the above information, information from the nearby approved EIA projects have also been reviewed. They concern a proposed cycle track project and a public sewer project

16 Agreement No. CE 66/2001(EP), EIA and TIA Studies for the Stage 2 of PWP Item No. 215DS - Yuen Long and Kam Tin Sewerage and Sewage Disposal (YLKTSSD), Environmental Impact Assessment (Final).

17 Construction of Cycle Tracks and the Associated Supporting Facilities From Sha Po Tsuen to Shek Sheung River" (EIA Application No. EIA-159/2008).

along the existing Ngau Tam Mei Drainage Channel (Section 1.9 of this report refers). The Project Site is immediately adjacent to a section of the proposed public sewer as well as the proposed cycle track alignment. The locations of the concerned nearby planned projects are also shown in **Figure 1-2**. The EIA reports[15 & 16] of both the proposed public sewer project as well as the proposed cycle track project have already obtained approval under the EIAO.

The approved public sewer EIA report[15] has identified potential land contamination sites on both sides of the proposed sewers through site reconnaissance visits and review of historic land use information including aerial photos in 1990s' and in early 2000s'. According to the concerned EIA report, there was no site of potential land contamination identified within or immediate adjacent to the Project Site.

In addition, according to findings in the approved cycle track EIA report[16], the reported land uses along the Ngau Tam Mei Drainage Channel (where the Project Site is located) was mainly farmland with scattered village houses. There was also low density residential areas such as Fairview Park and Man Yuen Chuen located in the middle section of Ngau Tam Mei Drainage Channel. Other than that, the approved cycle track EIA report did not identify any site of potential land contamination within or immediately adjacent to the Project Site.

Based on the information reviewed, the Project Site was previously farmland and has never been used by land uses that may result in potential land contamination. According to the EIA report of nearby approved EIA projects, which cover historic land use information before year 2002, there was no site of potential land contamination within or immediate adjacent to the Project Site. Thus, there is no concern of land contamination issue at the Project Site. Change of land use status near the Project Site was observed around year 2001/2002 due to commencement of construction of the existing Ngau Tam Mei Drainage Channel, thus historic aerial photos since year 2002 have been reviewed. Since no historic land contamination uses were identified at the Project Site, potential land contamination issue due to historic land uses is not expected.

A preliminary desktop review and site reconnaissance have identified the current land uses within and adjacent to the Project Site. Currently, the Project Site comprises of inactive agricultural land and inactive/ abandoned ponds. Site reconnaissance visit was undertaken in February 2009, May 2009 and in October 2011 to identify existing land uses. Based on the site visit, no vehicle repairing activity or any activity stated in Sections 3.1 and 3.2 of Annex 19 of the EIAO-TM, that would likely result in land contamination has been identified on-site. No trace of potential land contamination was identified during the site reconnaissance visit. There is no change in land use status at the Project Site to date.

The surrounding area of the Project Site is characterized by a mixture of rural landscape and low-rise residential developments. There are no factories or industrial operations that are likely to result in land contamination in close vicinity to the Project Site. The western boundary of the Project Site is occupied by the large-scale residential development known as Fairview Park. The Project Site is also bounded by the existing Ngau Tam Mei Drainage Channel and Yau Pok Road to the south, and the existing residential development Palm Springs to the north. Farmland and existing Yau Mei San Tsuen is located to the ease of the Project Site.

According to the current proposal, the existing site levels within the Developable Area are to be raised by about 3 m to the proposed general site formation level +5.5 mPD. Thus, significant excavation will unlikely be involved. Instead, the existing ground level will need to be raised to the proposed site formation level by imported filling materials. Given that significant excavation is not required for this Project and that future users will unlikely have direct contact with soil materials, potential land contamination problem is unlikely.

Since there is no historic and/ or existing land uses at the Project Site that would result in potential contamination of soil and underground water, land contamination at the Project Site is not expected. Thus, further assessment on this aspect is not required.

7.4 Waste Generation during Construction Phase

The majority of waste generating activities are expected to take place during the construction phase of the project.

The construction activities to be carried out during the Site Formation will result in generation of a variety of waste which may include:

- Site clearance waste:
- Excavated materials;
- Construction and demolition (C&D) materials;
- Chemical waste; and
- General refuse.

The potential environmental impact arising from the handling, storage, transport and disposal of these different categories of wastes are described below. The nature of each of these wastes and the recommended waste management measures are identified.

7.4.1 Site Clearance Waste

Most of the Developable Area is currently agricultural lands. Surface vegetation in these areas will be removed at the start of the project and set aside for reuse.

The amount of site clearance works within the Developable Area will be limited to the removal of a thin layer of vegetation. Approximately 105,000 m^3 will be generated. The excavated material should be sorted on-site and could be reused as part of the filled material, or for the landscape area or the formation of vegetation bund within the Wetland Restoration Area given the quality of these materials should suffice the required uses, and is subject to detailed design stage. The remaining inert portion and non-inert portion of C&D waste will be disposed of at public fill facility and landfill site, respectively, where necessary. It should be noted that landfill disposal shall only be considered as the last resort.

7.4.2 Construction and Demolition Waste

The Project Area is topographically flat, rural in character, and primarily occupied by farmland. Ponds would be identified in the northern and eastern part of the Project Area. According to planning intention of the Project Area, any new development should be located on the formed land, which is currently farmland. The developable area will be filled with inert material from the existing level of about +2 mPD in average to +5.5 mPD. Therefore, construction works required for the Project will unlikely result in generation of a large quantity of C&D materials as extensive excavation activities will not be required. In addition, the Project Area was used for farmland (proposed residential portion) and pond (proposed wetland restoration area). No potential contamination activities / operations are found; i.e. no land contamination issue for the Subject Site.

Demolition material would be generated from clearance of a small number of huts on-site. A “selective demolition” approach should be adopted so that reusable material such as wood, metal, and steel can be segregated for reuse or recycling as far as practicable. Inert building debris such as concrete and brick can also be reused on-site as lining or fill material. The remaining part comprising of degradable waste should be properly disposed of at landfills.

During site formation, construction waste comprises unwanted materials generated during construction, including rejected structures and materials which have been over ordered or are surplus to requirements, and material which have been used and discarded. Construction waste will mainly arise from the construction of earth retaining structures and other maintenance activities carried out by the Contractor, which may include:

- Wood from formwork and falsework;
- Equipment and vehicle maintenance parts;
- Materials and equipment wrappings;
- Unusable/surplus concrete/grouting mixes; and
- Damaged/contaminated/surplus construction materials.

Approximately 2500 m^3 construction waste is predicted to be generated during the course of site formation works; however, the actual figure will be dependent on the operating procedure and site practices. At this stage, it is not possible to estimate accurately the amount of construction waste that will be generated. The volume of demolition waste should be very low as no major demolition work is required.

Nevertheless, the generation of wastes from these materials should be minimized as far as practicable through recovery, reuse and/ or recycling. Whenever practicable, the production of construction waste due to over-ordering or as “side-products” of construction activities should be minimized by the contractor through careful design, planning, good site management, control of ordering procedures, segregation and reuse of materials. These measures will also assist the contractor in minimising costs associated with the construction works. Prefabricated building construction elements could be used as appropriate to avoid generation of surplus construction materials.

For examples, wooden boards can be reused on-site or off-site, though the reusability and quantity of final waste will depend on the quality, size and shape of the boards. Those timbers which cannot be reused again shall be sorted and stored separately from all inert waste before disposed of at landfills.

Should construction site hoarding be erected, metal fencing or building panels, which are more durable than wooden panels, are recommended to be used as far as practicable. Opportunity shall also be sought to re-use any wooden boards used in site fencing on-site or off-site. Concrete and masonry can be crushed and used as fill material if practicable. On-site incineration of wooden waste is prohibited.

Cross contamination of inert C&D materials by other waste categories shall be minimized as far as practicable through provision of storage facilities for different categories of waste. Inert material including soil, rock, concrete, brick, cement plaster/ mortar, inert building debris, aggregates and asphalt should be segregated from and stored separate from other waste categories to ensure proper handling and reuse. The on-site temporary facilities should be equipped with dust control measures where necessary.

By reducing the quantity of C&D materials requiring off-site disposal through the reuse on-site, the potential for traffic impacts during the transportation of material will be reduced. The additional traffic flow due to the transportation of construction material from vehicle movements in and out of Project Area is considered insignificant.

In order to avoid dust, odour and erosion impacts, all stockpile areas at the Project Area should be covered with tarpaulin or impermeable sheets. Any vehicle carrying C&D waste should have their load covered when leaving the works area. Vehicles should be routed as far as possible to avoid sensitive receivers in the area. The potential air and runoff impacts

caused by handling of excavated materials are presented in the Sections of Air Impact Assessment and Water Impact Assessment respectively.

7.4.2.1 Excavated Materials / Imported Filling Material for Construction of Developable Area

For the Developable Area, which is currently farmland, excavated materials will be generated during the formation of the peripheral retaining wall where the surface soils/materials need to be removed. As the retaining walls will be constructed on farmland and no ponds will be affected, there will be no pond sediment involved and the excavated materials will be mostly top soil from farmland. As such, the excavated material should be sorted on-site and could be reused as part of the filled material, or for the landscape area or the formation of vegetation bund within the Wetland Restoration Area given the quality of these materials should suffice the concerned uses. In case there is any surplus excavated material or the concerned material is found not suitable for re-use on-site, this will be disposed of at public fill facility. Landfilling will only be the last resort in any case. For the periphery retaining wall with a total length of about 1000 m and base width of 5 m, the approximate quantity of excavated material will be about 22,000 m^3 with temporary cut slope angle at 1 in 3.

The existing site levels within the Developable Area are to be raised by about 3 m to the proposed general site formation level +5.5 mPD. Pre-loading in combination with vertical drains may be adopted to increase the rate of consolidation of the soft clay layer and settlement of fill. Bulk import of inert fill material would be required for these site formation, pre-loading and future landscaping works.

Approximately 253,000 m^3 of inert soil will be imported to bring the Project Area up to the required ground level and for pre-loading, among which about 105,000 m^3 will be removed after completion of pre-loading. Quantity of construction waste involved and disposal method is summarised in the table below.

Table 7-1 Summary Table of Estimated Construction Waste and Disposal Method

Waste Material Type	Generated from works item	Total Quantity Generated	Quantity to be disposed off-site	Disposal Route
C&D Material	Site formation, and retaining wall, etc.	277,500 m^3	129,500 m^3	Inert soil to be reused on-site for formation and pre-loading (148,000 m^3) The remaining inert C&D waste of approximate 127,000m^3 cannot be reused or recycled, to be disposed to public filling area in Tuen Mun Area 38 (to be confirmed) The non-inert C&D waste of approximate 2,500m^3, cannot be reused or recycled, to be disposed of at NENT landfill to be confirmed)
General Refuse	Food waste, waste paper, empty container generated from workforce	117kg/day (preliminary estimate)	117kg per day	Refuse station for compaction and containerisation and then dispose of at NENT landfill
Chemical Waste	Cleansing fluids, solvent, lubrication oil and fuel from construction plants and equipment	Less than few cubic meters/month (preliminary estimate)	Less than few cubic meters/month	Chemical Waste Treatment Centre

7.4.2.2 Excavated Materials from / Imported Filling Materials for Construction of Wetland Enhancement and Protection Area

The design of the Wetland Restoration Area is, in general, to modify the existing ponds to have various slope profiles or to have vegetation bund in the pond. Therefore, it is expected that there will not have any major excavation works or excavation of pond sediment involved; in other words, fill material will be imported for the formation of the wetland area. As

discussed in Section 7.3, the Project Site has been used for agricultural uses. The will be no pond filling carried out in this project.

7.4.2.3 Chemical Waste

As defined under the Waste Disposal (Chemical Waste) (General) Regulation, chemical waste includes any substance being scrap material or unwanted substances specified under Schedule 1 of the Regulation. Chemical waste that could be generated from construction works would primarily arise from chemicals used in operation and maintenance of on-site equipment.

Chemical waste may include fuel, oil, lubricants, cleaning fluids, and solvents arising from leakage or maintenance of on-site equipment and vehicles. Chemical generated from daily operation of the construction works shall be recycled/ reused on-site as far as practicable.

The amount of chemical waste that will be generated from the construction works will depend on the contractor's on-site maintenance intention, age and number of plant and vehicles used. Nevertheless, chemical wastes such as lubricating oil or solvent generated by workers are not expected to be in large quantity. The likely chemical waste types are readily accepted at the chemical waste treatment centre at Tsing Yi or other licensed waste oil recycling facilities in Hong Kong.

If off-site disposal of chemical waste is required, they should be collected and delivered by licensed contractors to Tsing Yi Chemical Waste Treatment Facility and be disposed of in strict accordance with the Waste Disposal (Chemical Waste) (General) Regulation. Contractors shall register with EPD as chemical waste producers when disposal of chemical waste is anticipated to be required. Chemical waste materials have to be stored on-site with suitable containers and away from water bodies so that leakage or spillage is prevented during the handling, storage, and subsequent transportation.

Provided that the handling, storage and disposal of chemical wastes are in accordance with the Waste Disposal (Chemical Waste) (General) Regulation and the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes, this will unlikely cause an unacceptable environmental impact.

The Contractor shall prevent fuel and lubricating oil leakage from plant and storage sites from contaminating the construction site. All compounds in work areas shall be positioned on areas with hard paving and served by drainage facility. Sand/ silt traps and oil interceptors shall be provided at appropriate locations prior to the discharge points.

7.4.2.4 General Refuse

Throughout the construction phase, the workforce on the construction site will generate a variety of general refuse requiring disposal. These refuse will mainly consist of food wastes, aluminium cans, and waste paper, etc. No information regarding the number of workers on-site would be available at this early project stage. Nevertheless, estimates of general refuse generated from the Site Formation works are dependent on the number of workers. It is assumed that about 180 workers in average will work on the Developable Area during site formation at any one time. Based on a generation rate of 0.65 kg per worker per day, the daily arising of general refuse during site formation would be approximately 117 kg.

General refuse generated at the construction site should be stored separately from construction and chemical wastes to avoid cross contamination. A reliable waste collector shall be employed by the Contractor to remove general refuse from the construction site on a daily basis where appropriate to minimize the potential odour, pest and litter impacts.

Open burning for the disposal of construction waste or the clearance of the Project Area in preparation for construction work is prohibited under the Air Pollution Control (Open Burning) Regulation.

7.4.3 Excavation

The construction method of the Project would not involve any dredging of the pond mud or sediment. Therefore, it is expected that there would not be any environmental impacts relating to dredging. In addition, the excavated top soil material during the construction of the periphery retaining wall will be reused on-site for the site formation of developable area, formation of landscape area within the developable area or the construction of the wetland area, whereas imported materials are required. Therefore, it is expected that there will not be any disposal of the excavated material except the top soil. In case there is any surplus excavated material or the concerned material is found not suitable for re-use on-site, this will be disposed of at public fill facility. Landfilling will only be the last resort in any case. However, the quality of the top soil will be reviewed during the detailed design stage to check whether they can be re-used for landscape area.

7.4.4 Disposal of Dredging/ Excavated Sediments

No dredging activities will be required, and the construction of the Wetland Restoration Area will only involve slope profiles of existing ponds and bunds. The construction of peripheral retaining walls will be on farmland and no ponds will be affected. Therefore, no disposal of dredged materials/ pond sediment will be required.

7.4.5 Construction Waste Management Measures

To ensure the appropriate handling of the C&D materials, it is recommended that a Waste Management Plan (WMP) shall be developed by the contractor and incorporated in the Environmental Management Plan (EMP) in accordance with ETWB TCW No. 19/2005 – Environmental Management on Construction Sites at the commencement of the construction works. The EMP should be developed taking into account the recommended control measures given in this section where appropriate. The EMP shall be submitted to the Engineer at the commencement of the project for approval and to be implemented throughout the Project. The potential for recycling or reuse should be explored and opportunities taken if waste generation is unavoidable.

The EMP should provide recommendations for appropriate disposal routes if waste cannot be recycled. The EMP should include the method statement for demolition and transportation of the excavated materials and other construction wastes. The EMP should be approved before the commencement of construction. All mitigation measures arising from the approved EMP should be fully implemented. The project proponent will ensure that the day-to-day operations comply with the approved EMP. According to the EMP, the project proponent shall control the disposal of public fill, C&D materials and C&D waste to public fill reception facilities, sorting facilities and landfills respectively through a trip-ticket system. The project proponent shall require the contractor to separate public fill from C&D waste for disposal at appropriate facilities. In addition, the project proponent shall record the disposal, reuse and recycling of C&D materials for monitoring purposes.

In formulating the EMP in respect to waste management, the following hierarchy should be considered:

- Avoidance and minimization to reduce the potential quantity of C&D materials generated;
- Reuse of materials as practical as possible;

- Recovery and Recycling as practical as possible;
- Proper treatment and disposal in respect to relevant laws, guidelines and good practice; and
- Landfill disposal shall only be considered as the last resort.

Based on the above waste management options, a good management and control plan would be formulated. Good management and control can prevent the generation of significant amount of waste. On-site sorting of construction wastes will be recommended. Secondary on-site sorting can be achieved by avoiding the generation of "mixed waste" through good site control. Construction wastes shall be sorted to remove contaminants, with the inert materials broken up into small pieces before being transported to landfill sites.

The demolition and construction work shall be considered in the planning and design stages to reduce the generation of C&D waste where possible. Landfill disposal shall only be considered as the last resort.

Construction methods with minimum waste generation quantity and other environmental impacts shall be considered in the detailed design.

In addition, the contractor(s) shall be required to reuse inert C&D materials (e.g. excavated soil) or in other suitable construction sites as far as possible, in order to minimize the disposal of C&D materials to public fill reception facilities. The project proponent shall encourage the contractor to maximize the use of recycled or recyclable C&D materials, as well as the use of non-timber formwork to further minimize the generation of construction waste.

The following additional control/ mitigation measures are recommended to be followed by the Contractor:

- Storage of different waste types – different types of waste should be segregated and stored in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal. An on-site temporary storage area equipped with required control measures (e.g. dust) should be provided;
- Trip-ticket system – in order to monitor the proper disposal of non-inert C&D waste to landfills and to control fly-tipping, a trip-ticket system should be included as one of the contractual requirements and audited by the Environmental Team;
- Records of Wastes – a recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be proposed;
- Training – The contractor should provide his workers with proper training of appropriate waste management procedure to achieve waste reduction as far as practicable and cost-effective through recovery, reuse and recycling and avoid contamination of reusable C&D materials;
- Incorporate the "Recommended Pollution Control Clauses for Construction Contracts" in respect to removal of waste material from the construction site into the contract of the contractor.

The relevant construction waste pollution clauses for construction contracts include the following information.

No excavation of pond sediment is expected due to the Project works, however, in case such pond sediment is encountered during construction, testing and disposal of excavated

sediment shall follow the requirements in PNAP ADV-21[18], where appropriate. The stockpiled malodorous materials should be covered entirely by plastic tarpaulin sheets and removed from Project Area as soon as possible within 24 hours. Disposal of excavated sediment shall follow the requirements stated in Buildings Department's PNAP ADV-21 for "Management Framework for Disposal of Dredged/ Excavated Sediment".

7.4.5.1 Waste Minimisation

The Contractor shall submit to the Engineer for approval a waste management plan with appropriate mitigation measures including the allocation of an area for waste segregation and shall ensure that the day-to-day site operations comply with the approved waste management plan.

The Contractor shall minimize the generation of waste from his work. Avoidance and minimisation of waste generation can be achieved through changing or improving design and practices, careful planning and good site management.

The Contractor shall ensure that different types of wastes are segregated on-site and stored in different containers, skips or stockpiles to facilitate reuse/recycling of waste and, as the last resort, disposal at different outlets as appropriate.

Excavated top soil materials due to retaining wall construction shall be reused on-site for the site formation of developable area, formation of landscape area within the developable area or the construction of the wetland area. Therefore, it is expected that there will not be any disposal of the excavated material. In case there is any surplus excavated material or the concerned material is found not suitable for re-use on-site, this will be disposed of at public fill facility. Landfilling will only be the last resort in any case.

The reuse and recycling of waste shall be practised as far as possible. The recycled materials shall include paper/cardboard, timber and metal etc.

The Contractor shall ensure that Construction and Demolition (C&D) materials are sorted into public fill (inert portion) and C&D waste (non-inert portion). The public fill which comprises soil, rock, concrete, brick, cement plaster/mortar, inert building debris, aggregates and asphalt shall be reused in earth filling, reclamation or site formation works. The C&D waste which comprises metal, timber, paper, glass, junk and general garbage shall be reused or recycled and, as the last resort, disposal of at landfills.

The Contractor shall record the amount of wastes generated, recycled and disposed of (including the disposal sites).

The Contractor shall use a trip ticket system for the disposal of C&D materials to any designated public filling facility and/or landfill.

Training shall be provided for workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.

Spent bentonite slurries, if any, will be handled and disposed of properly in accordance with the requirements set out in the Practice Note for Professional Persons (PN1/94) Construction Site Drainage.

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18 PNAP ADV-21, Management framework for disposal of dredged/ excavated sediment, April 2007 version, published by Buildings Departments.

7.4.5.2 Waste Nuisance Control

The Contractor shall not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the Project Area onto any adjoining land or allow any waste matter [or refuse] which is not part of the final product from waste processing plants to be deposited anywhere within the Project Area [or onto any adjoining land]. He shall arrange removal of such matter from the Project Area [or any building erected or to be erected thereon] in a proper manner to the satisfaction of the Engineer in consultation with the Director of Environmental Protection.

7.4.5.3 Chemical Waste Control

The Contractor shall observe and comply with the Waste Disposal (Chemical Waste) (General) Regulation.

The Contractor shall apply for registration as chemical waste producer under the Waste Disposal (Chemical Waste) (General) Regulation when chemical waste is produced. All chemical waste shall be properly stored, labelled, packaged and collected in accordance with the Regulation.

7.5 Waste Generation during Operational Phase

The proposed residential development will accommodate a residential population around 315 and another 30 staff after full occupation. With reference to the Data from Monitoring in Solid Waste in Hong Kong 1999, the capita generation rates of domestic waste will be 1.48 kg/day in 2016. Under such assumption, the estimated quantity of wastes generated from the Development will be about 511 kg/day.

Refuse collection points (RCP) will be provided for the residential development. In order to comply with Building Regulation, mechanical ventilation will be provided. The odour nuisance to the public can be minimized by incorporating the odour absorption system. With proper management and maintenance of the waste facilities, possible leachate impact from the RCP is not anticipated.

It is also recommended that collection bins for used aluminium cans, waste paper and glass bottles should be provided at strategic locations of the residential development area to promote and encourage recycling by residents during the operational phase.

7.6 Potential Biogas

Biogas comprises mainly of methane and carbon dioxide and is generated as a result of anaerobic degradation of organic matters buried under reclaimed land. The potential risk would be migration of methane and carbon dioxide, which are flammable and asphyxiating.

As shown in the habitat map in section 8, there is no reclaimed land identified in the Project Area. Therefore, there will not have any biogas generation at the Project Area due to the anaerobic degradation of organic matters buried under reclaimed land. The future residential development is all located on the formed land, i.e. no pond filling will be involved.

7.7 Impacts Summary

7.7.1 Construction and Demolition Material

The waste streams that would be generated during the construction of the proposed Project near Yau Mei San Tsuen were identified and evaluated in terms of their nature, type, quality, quantity, and associated environmental impacts. Opportunities for reduction in waste generation through recovery, reuse or recycling are identified.

The waste management implications and potential environmental impacts associated with the handling, transport, and disposal of the identified waste types are evaluated and addressed. An EM&A programme is recommended to be in place during the construction phase to check that the waste generated from the construction site are being managed in the accordance with the recommended procedures.

Provided that the recommendations set out in this section are implemented, no waste related regulatory non-compliance and unacceptable environmental impacts are expected to arise from the handling, storage, transport and disposal of construction waste arising from the proposed residential and wetland nature reserve development.

The Project Area was used for farmland (proposed residential portion) and pond (proposed wetland restoration area). No potential contamination activities / operations are found; i.e. no land contamination issue for the Subject Site.

7.7.2 Potential Biogas

No potential biogas problem is anticipated as no pond filling work is anticipated.

7.7.3 Potential Contamination

No potential land contamination is anticipated as the Project Area has been used for farmland and fish pond for decades. No contaminating activities / operations are identified in the site. Therefore, it is not anticipated that there would be any land contamination found within the site.

7.8 Conclusion

7.8.1 Site Construction Waste

The waste streams that would be generated during the construction phase of the Project include site clearance, excavated soil, C&D materials, and chemical waste from the maintenance of construction plant and equipment and general refuse from the workforce. Opportunities for reduction in waste generation through recovery, reuse or recycling are identified in the assessment. The Project Area was used for farmland (proposed residential portion) and pond (proposed wetland restoration area). No potential contamination activities / operations are found; i.e. no land contamination issue for the Subject Site.

Provided that the recommendations set out in this section are implemented, no waste related regulatory non-compliance and unacceptable environmental impacts are expected to arise from the handling, storage, transport and disposal of construction waste arising from the proposed residential and wetland nature reserve development.

The nature of the historical uses of the Project Area confirms that land contamination should not be a concern.

7.8.2 Potential Biogas

No potential biogas problem is anticipated, as no pond filling work is anticipated.

7.8.3 Waste Generation During Operation

During operation, refuse collection points will be provided for the residential development with mechanical ventilation and odour absorption system. With proper management and maintenance of the waste facilities, possible leachate impact from the RCP is not anticipated. Collection bins are also recommended to be provided at strategic locations of the residential development area to encourage recycling by residents.

8. ECOLOGY

8.1 Summary

The requirements for the Ecological Impact Assessment are set out in Section 3.9.6 of the Study Brief. The Ecological Assessment considered the Project Area itself, all areas falling within 500 m of its boundary and beyond this if potentially impacted (the Assessment Area) and any sensitive receivers abutting or relating to the Project Area. Ecological baseline surveys were conducted between September 2007 and August 2008 to describe habitats present in the Project Area and the Assessment Area, and wildlife use of these habitats. Habitat condition was further supplemented with site visits undertaken in December 2012, February 2013, January 2014, and December 2014. A total of 3.0 ha of wetland habitat (ponds, marsh, reedbed and seasonally wet grassland) is present in the Project Area. An area of 4.9 ha of agricultural land is currently used as dry agriculture. Loss of existing wetland habitats to development may have subsequent impacts to the availability of foraging habitat for large waterbirds and disrupt the continuity and integrity of the adjoining Deep Bay wetland system. Accordingly, this potential habitat loss is mitigated by provision of a Wetland Restoration Area, with 3.8 ha of enhanced wetland habitats, on the northern part of the Project Area. The design of this restored wetland provides additional wetland area to buffer the adjacent wetlands outside the Project Area. Species of conservation importance and other species potentially impacted by the proposed development will benefit from the provision of suitable wetland habitats managed to have enhanced ecological functions and habitat quality. Other potential impacts have been considered, and appropriate mitigation measures adopted where necessary. The proposed mitigation measures are considered to reduce impacts of the development to such a degree that residual impacts are considered to be of no significance and thus are ecologically acceptable.

8.2 Introduction

The Project Area mainly comprises agricultural land and fish ponds which are largely inactive or overgrown with vegetation; some ponds may have a low level of management for provision of limited fish stock for self-consumption by villagers. The Project Area as a whole is on the landward fringe of the Deep Bay Area, surrounded by residential development of varying ages and scales. In view of its marginal location and degraded nature of the major habitats, the Project Area is not expected to be of significant value in a Deep Bay context.

Since the Project Area falls within the Deep Bay Area, an ecologically sensitive area of international importance, it is covered by Town Planning Board (TPB) Guideline TPB PG-No. 12C: “Application for Developments within Deep Bay Area under Section 16 of the Town Planning Ordinance”. The north of the Project Area (containing fish ponds and agricultural land) is continuous with the Deep Bay Wetland System. It lies within the Wetland Conservation Area (WCA) and the fish ponds in the northern portion constitute a part of a priority site for enhanced conservation under the New Nature Conservation Policy implemented in 2004 (Deep Bay Wetland outside Ramsar Site, ranked as 9 out of the 12 listed priority sites). The New Nature Conservation Policy aims to “regulate, protect and manage natural resources that are important for the conservation of biological diversity of Hong Kong in a sustainable manner, taking into account social and economic considerations, for the benefit and enjoyment of the present and future generations of the community”.

The central and southern portions of the Project Area lie within the Wetland Buffer Area (WBA) (Figure 8-1). The Project Area is within the area covered by the Approved Mai Po and Fairview Park Outline Zoning Plan (OZP) No. S/YL-MP/6 and is zoned “Other Specified Uses annotated “Comprehensive Development and Wetland Protection Area” (“OU(CDWPA)”), for which the planning intention is ‘to allow the consideration of comprehensive low-density residential development or redevelopment provided that all the

existing continuous and contiguous fish ponds within the zone are protected and conserved. The “no-net-loss in wetland” principle is adopted for any change in use within the zone. Development or redevelopment within this zone should involve no pond filling and no decline in wetland function of the fish ponds. Any new development should be located on the formed land and as far away from the existing fish ponds within the development site”.

Since the Project Area falls within the Deep Bay Area, the relevant TPB Guideline requires a 12-month ecological baseline survey. Such an ecological baseline survey was conducted between September 2007 and August 2008, including detailed surveys of the habitat characteristics and wildlife utilization within the Project Area and the 500m Assessment Area, and evaluation of the potential direct and/or indirect impacts/disturbances on habitats, flora, fauna and any ecologically sensitive receivers.

8.3 Assessment Area

The Assessment Area for all aspects of the project falls within 500 m of the boundary of the Project Area, together with any area outside this where there is potential for significant ecological impacts arising from the Project (Figure 8-1). This area includes three large-scale residential developments (Fairview Park to the west and Palm Springs and Royal Palms to the north) and scattered small village housing in nearby Yau Mei San Tsuen and Chuk Yuen Tsuen. An area of continuous and contiguous ponds, which were once used as ponds for aquaculture of edible fish farming and are now inactive or overgrown with vegetation, extends northwest from the Project Area to connect with the extensive fish pond areas in the Deep Bay wetland system. These fish ponds to the northwest of the Assessment Area are contained within one of the priority sites for enhanced conservation under the New Nature Conservation Policy (Deep Bay Wetland outside Ramsar Site). To the southwest of the Project Area is an extensive mosaic of shrubland and grassland and a few scattered overgrown ponds. A channelized river is located to the south and southeast of the Project Area; beyond this within the Assessment Area are agricultural lands mostly managed for dry crops, some small and isolated ponds, an extensive mosaic of shrubland and grassland, seasonally wet grassland and a small natural stream. A smaller low-rise residential area (Casa Paradizo), a few scattered village areas, a small hillside plantation and secondary woodland are located to the east of the San Tin Highway and Castle Peak Road. Due to the barrier effect of the San Tin Highway, these areas are not ecologically linked with the Deep Bay wetland systems.

8.4 Sites of Conservation Importance in the Area

There are a number of sites of ecological importance surrounding the Project Area. Any development in the area should consider the potential impacts to these highlighted sites.

8.4.1 Mai Po Inner Deep Bay Ramsar Site

In 1995, Mai Po Inner Deep Bay area was designated as a “Wetland of International Importance” under the Ramsar Convention. This Ramsar Site includes extensive natural inter-tidal mudflats, gei wai, dwarf mangroves and fish ponds, covering an area of about 1,500 ha in the north western New Territories.

The Ramsar Site is located on the East Asian-Australasian Flyway and serves as an important staging site for migratory birds, as well as supporting approximately 70,000 – 80,000 waterbirds during the winter. The Project Area is 865 m from the closest part of the Ramsar Site. In addition, the ponds in the Project Area are contiguous with the larger Inner Deep Bay wetland system and hence the Ramsar Site itself, though the connection is constrained by the close proximity of the Fairview Park and Palm Springs residential developments.

8.4.2 Mai Po Nature Reserve

Mai Po Nature Reserve is located approximately 1 km from the Project Area. The Nature Reserve is managed for the Hong Kong SAR Government by WWFHK with support from the HKSAR Government. It contains Mai Po Marshes SSSI, Inner Deep Bay SSSI and habitats such as dwarf mangroves and gei wai that provide important roosting and foraging habitats for internationally important species of waterbirds, including globally-threatened species.

8.4.3 Wetland Conservation Area (WCA)

The Wetland Conservation Area (WCA) was designated by the TPB to conserve the ecological value of the fish ponds in the Deep Bay wetland ecosystem (TPB Guideline No. 12C). The WCA includes existing active and inactive fish ponds within the Deep Bay wetland system continuous with the Mai Po Inner Deep Bay Ramsar Site, and aims to conserve the ecological value and functions of the fish ponds as an integral part of the system. Other than permitted essential conservation or infrastructural works, no developments involving pond filling or other works detrimental to the ecological function of the wetland are allowed within the WCA. Any essential works conducted within the WCA should comply with the "No-Net-Loss in Wetland" principle. The northern part of the Project Area lies within the WCA, therefore mitigation measures and/or compensation for any loss of area and ecological function of wetland within WCA would be necessary.

8.4.4 Wetland Buffer Area (WBA)

The WBA is a buffer zone of approximately 500 m width along the landward boundary of the WCA. The planning intention is to protect the ecological integrity of wetland habitats within the WCA (TPB Guideline No. 12C). Any works within the WBA causing negative impacts on the ecological value of the WCA should be avoided unless appropriate mitigation measures are implemented. However, residential or recreational development may be allowed with appropriate conditions where undesirable open storage area is removed and wetlands are restored. Again, such development should satisfy the "No-Net-Loss in Wetland" principle.

8.4.5 Sites of Specific Scientific Interest (SSSIs)

Sites of Special Scientific Interest (SSSIs) are either land based or marine sites which have flora, fauna, geographical or geological features of special interest. Any development should consider the potential impacts or disturbance on the flora and fauna species found in these sites. Three SSSIs lie in the vicinity of the Project Area, namely Mai Po Village, Mai Po Marshes and Inner Deep Bay.

Mai Po Village SSSI was designated in 1979 to protect a fung shui wood which supported the Mai Po Village egretry. Since the designation of the SSSI, however, the egretry has moved to trees outside the SSSI boundary. The SSSI is located approximately 1.6 km from the Project Area.

Mai Po Marshes SSSI was designated in 1976. It holds an important area of dwarf mangrove as well as the largest reedbeds and (semi-) tidal open water habitats derived from gei wai shrimp ponds. The productive seral community and man-made gei wai provide important foraging sites for both resident and migratory birds as well as supporting an important and diverse fauna and flora. The SSSI is located entirely within the Ramsar Site. This SSSI is located approximately 1.0 km from the Project Area.

Inner Deep Bay SSSI was designated in 1986. Inner Deep Bay contains the largest and the most important dwarf mangrove communities in Hong Kong and extensive natural inter-tidal mudflats. Both the dwarf mangroves and mudflats provide an important feeding and resting ground for waterbirds. The SSSI is located entirely within the Ramsar Site, and is approximately 1.9 km from the Project Area.

8.4.6 Egretries

The following egretries are located within approximately 3.5 km of the Project Area. This distance is considered to reflect the foraging range of breeding egrets (Young 1993). Because of their relative location to the Project Area and because the Project Area is located on the fringe of the Deep Bay wetland system, no impacts to flight lines are predicted.

The Mai Po Village egretry was formerly located in the Mai Po Village SSSI, but has subsequently moved outside of the SSSI to roadside trees to the east of the SSSI boundary. In 2007, 34 nests were present, increasing to 55 nests in 2008, 143 nests in 2009, 128 nests in 2010, 148 nests in 2011, 154 nests in 2012, 146 nests in 2013 and 202 nests in 2014 including 80 nests of Little Egret *Egretta garzetta* and 122 nests of Chinese Pond Heron *Ardeola bacchus* (Anon 2007, 2008, 2009, 2010, 2011, 2012, 2013 and 2014). In 2014 this was the largest egretry in Hong Kong (21.0% of total nests) (Anon 2014).

Mai Po Lung Village egretry held a total of 49 nests in 2007, including 18 nests of Little Egret and 31 nests of Chinese Pond Heron, then, declined in importance in 2008 (21 nests), 2009 (6 nests), 2010 (7 nests), 2011 (5 nests), presumably because birds moved to the Mai Po Village egretry (Anon 2007, 2008, 2009, 2010 and 2011). But the numbers of nests have risen in recent years; there were 12 nests recorded in the egretry in 2012, 12 nests in 2013 and 36 nests in 2014 (Anon 2012, 2013 and 2014).

Tam Kon Chau egretry supported 26 nests of Chinese Pond Heron in the 2007 breeding season and 23 nests of this species in 2008 but has been abandoned since 2009, probably because of disturbance by public toilet attendants (Anon 2007, 2008, 2009). This was the only remaining egretry within the boundary of the Mai Po Inner Deep Bay Ramsar Site.

8.5 Literature Review

Existing information regarding areas on the landward fringe of the Deep Bay Area is available due to a number of proposed developments in the area for which an EIA report is required under the EIAO. These include:

- EIA-144/2008 Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
- EIA-159/2008 Construction of Cycle Tracks and the Associated Supporting Facilities from Sha Po Tsuen to Shek Sheung River
- EIA-205/2012 Construction of Cycle Tracks and the associated Supporting Facilities at Nam Sang Wai, Yuen Long
- EIA-220/2014 Proposed Residential Cum Passive Recreation Development within “Recreation” Zone and “Residential (Group C)” Zone at Various Lots in DD 104, Yuen Long, N.T
- ESB-204/2009 Proposed residential development within ‘Residential (Group D)’ Zone at various lots in DD104, Yuen Long, N.T.
- ESB-210/2009 Proposed low-density residential development at various lots and their adjoining government land in D.D. 104, east of Kam Pok Road, Mai Po, Yuen Long

Of the available EIAs above, the cycle track which runs from Sha Po Tsuen to Shek Sheung River passes through Kam Pok Road, and is of most relevance to the current Project. However, data specific to the section relevant to the Project is not available. In addition, the surveys were undertaken in 2005-06, which predates the change in hydrological regime at the Ngau Tam Mei Drainage Channel and can no longer reflect the current ecological value of the NTMDC. In addition, survey data was obtained from CEDD on bird usage of the NTMDC in 2008 and 2009 (CEDD unpublished data). The Proposed Residential Cum Passive Recreation Development within “Recreation” Zone and “Residential (Group C)” Zone at Various Lots in DD 104, Yuen Long, N.T. is also highly relevant as it directly adjoins the boundary of the current Project to the west.

8.6 Survey Methodologies

Table 8-1 outlines the survey schedules of all fauna and flora groups during the twelve-month survey period. All methodologies followed the ecological survey methodologies recommended in EIAO Guidance Notes No. 7/2010 and 10/2010 of the EIA Ordinance. Methodologies for each group are detailed below.

Table 8-1 Survey schedules for flora, birds, mammals, herpetofauna, butterflies, dragonflies, fishes and aquatic invertebrates during the twelve-month survey period (September 2007 to August 2008) and the flight path survey (October to November 2009 and April to June 2011) within the Project Area and Assessment Area.

	2007				2008								2009		2011		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Nov	Apr	May	Jun
Flora																	
Bird																	
Mammal																	
Herpeto-fauna																	
Butterfly																	
Dragonfly																	
Fish																	
Flight Lines																	

8.6.1 Habitats

Habitats within the Project Area and Assessment Area were identified and surveyed. A habitat map (Figures 8-2a and 8-2b) was produced based on aerial photograph (23 July 2006), detailed ground-truthing covering both the dry and wet seasons in 2007/2008, and further ground-truthing within the Project Area in February 2013. Further site visits were undertaken in January 2014, and December 2014 to verify the habitat condition, and it was confirmed that the condition of this area was unchanged from that in 2008.

8.6.2 Flora

Flora surveys were conducted during December 2007 and August 2008 to characterise vegetation in the dry and wet seasons. All plant species observed were recorded and their relative abundance were noted. General characteristics of the flora community present in each habitat were noted for use in habitat description and evaluation.

8.6.3 Birds

Monthly transect surveys for birds were conducted within the Project Area and Assessment Area during the twelve-month period from September 2007 to August 2008. The transects covered all accessible habitats within the Project Area (Figures 8-3a and 8-3b). In order to avoid damage to crops, bird surveys mostly followed accessible paths and binoculars were used for recording birds at a distance. Ponds 25 – 39, which are located approximately 300 – 500m from the proposed residential development within the Project Area, are covered by dense vegetation and are mostly inaccessible. However, direct or indirect impact to birds that are utilizing these ponds are most unlikely; hence less survey effort was allocated in these ponds. Habitats to the east of the San Tin Highway were not surveyed since they have of little or no ecological corridor with the Project Area.

All twelve transect surveys were conducted in the early morning so as to match the peak period for bird activity. All bird species seen or heard were recorded, and species of conservation importance were enumerated at the level of habitats in which they were observed.

In addition to the transect surveys, egret flight line surveys were also conducted. Four surveys were conducted at the Ngau Tam Mei Drainage Channel (two at high tide when the channel was full and two at low tide when flow was restricted to the low flow channel) during October and November 2009 to investigate egret flight lines to and from the channel during the non-breeding season. Four additional egret flight line surveys were conducted from April to June 2011 to investigate the importance of the Project Area as a foraging area for breeding ardeids from the Mai Po Village Egretry. Surveys were conducted with one observer positioned close to the egretry to record the direction taken by birds leaving the egretry; birds seen leaving the egretry were observed for as long as possible to determine the direction of flight and foraging location when possible. A second observer was positioned at Ngau Tam Mei Drainage Channel to observe the behaviour of birds around the site, as in the non-breeding season surveys. All flight-line surveys were conducted for a period of two hours, starting shortly after dawn.

8.6.4 Mammals

Transect surveys for mammals were conducted in conjunction with the herpetofauna surveys during September to October 2007, and March to August 2008. In addition to any observations of mammals, suitable locations were searched for evidence of mammal activity (footprints, scats, burrows or food remains). Since mammals are difficult to observe in the field, sightings of mammals (including bats) during surveys for other faunal groups have also been included in the current assessment.

8.6.5 Herpetofauna (Amphibians and Reptiles)

Herpetofauna transect surveys were conducted in the wet season during September to October 2007 and March to August 2008, to coincide with the seasonal period in activity of amphibian and reptile groups. The transects followed for herpetofauna surveys were the same as those for bird surveys (Figures 8-3a and 8-3b). As with the bird surveys, only accessible habitats and paths within the Project Area were followed; however this is likely to have made little difference to the thoroughness of surveys as most amphibian detections were made by way of vocalizations, while most reptile detections were as the result of active searching. Less survey effort was made in the densely vegetated Ponds 25 – 39 as direct or indirect impact to herpetofauna utilizing these ponds is unlikely. Eight daytime surveys and four night-time surveys were conducted during the survey period. All reptiles and amphibians seen or heard during the surveys were identified, enumerated where possible or their relative abundance noted (for heard amphibians). Active searching was carried out in micro-habitats that herpetofauna might use as refuges. Hand or head torches were used as necessary during the night-time surveys.

8.6.6 Butterflies and Dragonflies

Eight butterfly and eight dragonfly surveys were conducted during September to October 2007 and March to August 2008. The transects followed for these two groups were the same as for other faunal groups. For practical reasons of accessibility and avoidance of damage to crops, only accessible habitats and paths within the Project Area were followed, however, binoculars were utilized to aid in surveying distant individuals. Less survey effort was put into surveying the densely vegetated Ponds 25 – 39 due to their distance from the proposed residential development. All butterflies and dragonflies seen during the survey were identified and enumerated for each habitat.

8.6.7 Fish

Fish surveys were conducted in the irrigation ditch running across the agricultural land within the Project Area and in all accessible fish ponds. Fish within the irrigation ditch were surveyed by direct observation from the banks. Kick-sampling at selected sampling points was undertaken to reveal any small or bottom-dwelling fish species. The surveyed ponds included Ponds 1-16, 18-24, 27, 31 and 40. Fish from the accessible ponds, which are largely abandoned or inactive, were surveyed by consulting local residents and by observation (aided by binoculars) from the pond bund. No invasive methods, such as netting, were used for pond surveys as the ponds were on private land. The stream south of Palm Springs was not surveyed as it is grossly polluted. Surveys in the irrigation ditch and ponds were conducted in September 2007 and August 2008 under favourable weather conditions, with the aid of binoculars where necessary. All fish species observed were identified.

Supplementary information regarding fish cultivated in the ponds was also obtained by consulting with local residents. Literature review on species potentially present within the ponds has been used to supplement survey data and to make allowance for any under estimation of small or bottom-dwelling fish species.

8.7 Survey Findings

8.7.1 Habitats/ Vegetation Present within the Assessment and Project Areas

Sixteen habitats were identified in the Assessment Area; the area of each of these is given in **Table 8-2**. Six habitats (agricultural land, pond, marsh, reedbed, seasonally wet grassland and grassland/shrubland) were identified within the Project Area. All habitats support a low diversity of plant species, all of which are common to very common in the territory. The continuous active management of agricultural land and colonization by aggressive exotic species contribute to the low floristic diversity of these habitats. Appendix 8-1 shows the major habitats and Appendix 8-2 shows the plant species recorded between September 2007 and August 2008 within the Project Area and the 500 m Assessment Area. Most of the Assessment Area comprises developed area (including residential estates and public facilities), village area and ponds. The floristic diversity in these human-dominated habitats is low and is dominated by ornamental plants.

Table 8-2 Habitats present in the Project Area and the Assessment Area

Habitat types	Project Area		Assessment Area (excluding project area)	
	ha	%	ha	%
Agricultural land	4.9	60.1	4.8	3.3
Pond	1.2	14.9	22.6	15.8
Marsh	0.9	11.6	0.5	0.3
Reedbed	0.2	2.4	0.4	0.3
Seasonally wet grassland	0.7	8.7	4.1	2.8
Grassland/shrubland	0.2	2.3	14.0	9.8
Reed bed/marsh	-	-	1.3	0.9
Stream	-	-	0.6	0.4
Drainage channel	-	-	6.3	4.4
Secondary woodland	-	-	0.6	0.4
Plantation	-	-	4.6	3.2
Village area	-	-	9.9	6.9
Wasteground	-	-	0.5	0.4
Developed area	-	-	60.3	42.0

Habitat types	Project Area		Assessment Area (excluding project area)	
	ha	%	ha	%
Road	-	-	10.2	7.1
Open storage	-	-	2.9	2.0
Total	8.1	100	143.6	100

Note:

- Figures above are rounded to the nearest decimal place. Hence, figures may not add to the total value.
- Figures presented to describe habitat areas within the Assessment Area exclude the areas of the same habitat categories found in the Project Area.

8.7.2 Birds

8.7.2.1 Literature Review

As noted in **Section 8.5** above, two EIA studies are highly relevant to the current Project: the Proposed Residential Cum Passive Recreation Development within "Recreation" Zone and "Residential (Group C)" Zone at Various Lots in DD 104, Yuen Long, N.T. and the EIA undertaken for the Sha Po Tsuen to Shek Sheung River cycle track in 2005-06 (EIA 159/2008). None of the other EIAs covered the Project Area or the Assessment Area. However, the study period of the cycle track (Sha Po Tsuen to Shek Sheung River) predates the change in hydrological regime of the Ngau Tam Mei Drainage Channel such that the data observed for that channel is no longer valid. In addition, the data on the NTMDC was presented together with that of Kam Tin River. The latter watercourse is a much larger watercourse which comprises both natural and semi-natural sections, and is known for its importance for waterbirds in the migratory and wintering season. Hence, the information from these EIAs does not assist in establishing the ecological baseline for the current Assessment Area.

With regard to the Proposed Residential Cum Passive Recreation Development within "Recreation" Zone and "Residential (Group C)" Zone at Various Lots in DD 104, Yuen Long, N.T.; field surveys for this EIA were undertaken between January and July 2009 and between August 2010 and January 2011. According to this EIA, 35 bird species of conservation significance were recorded within that project site and assessment area. With the exception of two migrant species (i.e. Blunt-winged Warbler *Acrocephalus concinens* and Bright-capped Cisticola *Cisticola exilis*), all of these species were recorded in surveys conducted under the current study. Findings indicated that the agricultural land at the current Project Site supported moderate bird diversity (43 species including 22 bird species of interest) but in low abundance (max. counts: one Great Egret, one Black-crownd Night Heron, two Little Egret, one Grey Heron, five Chinese Pond Heron, one White-breasted Waterhen, four Common Moorhen, five Eurasian Teal, three Yellow Wagtail, seven Red-throated Pipit, two Green Sandpiper, one Wood Sandpiper, four Common Sandpiper, four Pintail Snipe/Swinhoe's Snipe, one Bright-capped Cisticola, one Zitting Cisticola, one White-throated Kingfisher, three Greater Painted-snipe, five Little Ringed Plover, three Greater Coucal, four Common Kingisher and one Collared Crow). Findings also indicated that the ponds between Fairview Park and Palm Springs northwest of the current Project Site supported moderate bird diversity in moderate abundance (a total of 34 bird species including 16 of interest recorded), and likewise, the Ngau Tam Mei Drainage Channel, which supported low to moderate bird diversity (28 species including 17 of interest) in high abundance for some species (moderate numbers of Grey Heron (max 81), Great Egret (65) and Little Egret (101) were recorded in the survey period (Jan – Jul 2009 and Aug – Dec 2010).

Unpublished Data on Ngau Tam Mei Drainage Channel

Birds surveys conducted for CEDD involved wet and dry season transects conducted along three sections of the channel. In general, findings from these surveys were similar to those

obtained during surveys untaken for the current Project, namely that the channel supports some wetland dependent species and species of conservation importance but numbers are small and insignificant in a Deep Bay context. It should be noted, however, that numbers of Little Egret were markedly higher in December 2008, reflecting the increased use of the channel by this species, in particular, since the management regime in the channel was changed. Conversely, there is a suggestion that the consequence of the flooding of the channel has resulted in its being less attractive to Little Ringed Plover, a species which often utilizes concrete or other non-vegetated areas close to water. However, despite the higher numbers of Little Egrets noted in December 2008, this effect did not persist in March/April 2009, perhaps reflecting the fact that the channel is not sufficiently close to any egretry to be utilized to a significant extent by breeding birds.

Table 8-3 Mean numbers(1) of wetland dependent species and species of conservation importance(2) recorded on transect surveys along Ngau Tam Mei Drainage Channel (Source: CEDD unpublished data).

Species	Feb/Mar 2006	Mar/Apr 2006	Jan/Feb 2007	Apr 2007	Dec/Jan 2007/08	Mar/Apr 2008	Dec 2008	Mar/Apr 2009
Grey Heron *Ardea cinerea*	-	0.33	1.00	-	0.67	-	0.33	-
Great Egret *Egretta alba*	-	-	-	-	-	-	1.00	1.33
Little Egret *Egretta garzetta*	1.33	0.33	1.67	0.33	0.33	0.33	38.33	2.00
Chinese Pond Heron *Ardeola bacchus*	-	-	-	0.67	0.33	-	1.67	2.67
Black Kite *Milvus migrans*	-	-	-	-	-	-	-	0.33
Little Ringed Plover *Charadrius dubius*	1.00	1.67	2.00	1.67	4.67	0.67	-	-
Common Sandpiper *Actitis hypoleucos*	1.00	0.33	-	0.67	-	-	-	-
Common Kingfisher *Alcedo atthis*	-	0.33	0.33	-	0.33	-	0.33	-
White-throated Kingfisher *Halcyon smyrnensis*	-	-	-	-	-	-	-	0.33
Red-throated Pipit *Anthus cervinus*	-	1.67	-	-	-	-	-	-
Yellow Wagtail *Motacilla flava*	0.67	1.00	0.67	-	-	-	-	-
Grey Wagtail *Motacilla cinerea*	1.00	0.33	0.33	-	0.33	-	-	-
Red-billed Starling *Sturnus sericeus*	1.00	-	0.67	-	2.67	-	0.33	-

(1) Mean of three transects.
(2) See Table 8-3 above for definitions of conservation status.

8.7.2.2 Findings from Transect Survey

A total of 52 bird species was recorded from within the Project Area during surveys conducted under the current study between September 2007 and August 2008. A further 43 species were recorded outside the Project Area, giving a total of 95 species for the

Assessment Area as a whole. This includes 35 species which are considered by Fellowes *et al.* (2002) to be of conservation concern in Hong Kong.

Of the 52 species recorded within the Project Area, 18 species are of conservation importance and another nine species are wetland-dependent. However, the majority of the bird species recorded within the Project Area are common and widespread species of anthropogenic habitats and are not restricted to farmland or wetland (Carey *et al*. 2001, Leven 1998). Most of the species were recorded in very low to low numbers in relation to the Deep Bay population. Notable records of bird species of conservation importance pertinent to the Project are highlighted below.

Red-throated Pipit *Anthus cervinus*, a species largely associated with bare ground or short vegetation in wet agricultural fields or fish pond habitats in Hong Kong, was recorded regularly during the winter within the Project Area. Between 19 and 30 individuals of this species were recorded between November 2007 and March 2008, with smaller numbers present in October 2007 and April 2008.

A single male Greater Painted-snipe *Rostratula benghalensis* was recorded in an inactive wet agricultural field containing *Ipomoea aquatica* during the bird survey in June 2008 and a pair was seen in a similar area during a dragonfly survey in late June. This species has a restricted distribution in Hong Kong and is generally associated with wet agriculture or freshwater marsh and it is possible that small numbers breed in the Assessment Area, though probably not in the Project Area itself due to the limited area of suitable habitat and high level of human activity. However, although Greater Painted-snipe has a restricted distribution in Hong Kong (both geographically and because of its specialized habitat requirements), this species is known to move up to 9km between suitable habitat areas (HKBWS 1998); accordingly, so long as suitable habitat is (re-) provided it is likely to (re-) colonise readily.

Moderate numbers of Little Ringed Plover *Charadrius dubius* (up to 25 individuals) were recorded in the agricultural fields during September – October 2007 and during June to August 2008. This is another species which favours bare ground or short vegetation and is common in Deep Bay during winter in fish pond habitats where wet muddy margins or exposed pond bottoms are available. It is also a breeding species in Hong Kong, though there is no evidence indicating that the species breeds at Yau Mei San Tsuen.

Ardeids (mostly Little Egret *Egretta garzetta* and Chinese Pond Heron *Ardeola bacchus*) were recorded around wet fields at the beginning and end of the breeding season (up to 18 Little Egrets *Egretta garzetta* were recorded in late July 2008 and up to nine Chinese Pond Herons *Ardeola bacchus* in March 2008) as well as outside the breeding season (with up to nine Chinese Pond Herons *Ardeola bacchus* in December 2007); the number of individuals recorded was small relative to the Deep Bay population.

Other species typical of wet agricultural land recorded included Yellow Wagtail *Motacilla flava* and Zitting Cisticola *Cisticola juncidis*; these were recorded in very small numbers.

Of the total of 95 bird species recorded in the Project Area and the Assessment Area together, 90 species were recorded in the Assessment Area; only five species (Greater Painted-snipe, Richard's Pipit, Blue Rock Thrush, Daurian Starling and Common Myna) were recorded in the Project Area but not the wider Assessment Area. These five species include one introduced species of no conservation significance (Common Myna) and three non-wetland migrant passerines (Richard's Pipit, Blue Rock Thrush and Daurian Starling), only Greater Painted-snipe (discussed above) is either a wetland species and/or of conservation importance. Of the remaining 90 species, 32 species are of conservation importance and another 14 species are wetland-dependent. All of the species were recorded in small numbers relative to the Deep Bay population. The pond complex contiguous and continuous with the Deep Bay wetland system holds the highest bird diversity and

abundance. Birds present in this area included a number of large waterbirds which are sensitive to disturbance from human activity, especially Great Cormorant *Phalacrocorax carbo*, ardeids, Black-faced Spoonbill *Platalea minor* and ducks. Chinese Penduline Tit *Remix consobrinus* was recorded in reeds during January 2008; it is likely that this species occurs regularly in the extensive reedbeds surrounding the inaccessible ponds further from the Project Area.

Other parts of the Assessment Area (including village land, agricultural land, grassland/shrubland and drainage channels) supported relatively few birds. Although only moderate numbers of common wetland-dependent species were present in the Ngau Tam Mei Drainage Channel south of the Project Area during the twelve month survey period, this channel has become more important for wetland birds since the water management regime changed since the 2008 wet season and it now provides important foraging habitat for ardeids (see below). Agricultural land south of the drainage channel supported species similar to those recorded within the Project Area. **Appendix 8-3** shows the bird species recorded between September 2007 and August 2008 within the Project Area and the Assessment Area.

Table 8-4 Birds recorded during transect surveys in the Project Area and the Assessment Area (excluding the Project Area) between September 2007 and August 2008, and their respective number of surveys recorded, mean and maximum count.

Species	Conservation Status in HK[1]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No. [2]	Max. No. [2]	No. of surveys	Mean No. [2]	Max. No. [2]
Northern Shoveler *Anas clypeata*	RC	-	-	-	3	2.33	16
Garganey *Anas querquedula*	-	-	-	-	1	0.17	2
Eurasian Teal *Anas crecca*	RC	-	-	-	2	0.67	5
Little Grebe *Tachybaptus ruficollis*	LC	-	-	-	4	0.33	1
Black-faced Spoonbill *Platalea minor*	PGC	-	-	-	3	1.5	10
Yellow Bittern *Ixobrychus sinensis*	(LC)	1	0.08	1	4	0.42	2
Cinnamon Bittern *Ixobrychus cinnamomeus*	LC	-	-	-	1	0.08	1
Black-crowned Night Heron *Nycticorax nycticorax*	(LC)	1	0.08	1	8	2.17	8
Striated Heron *Butorides striatus*	(LC)	-	-	-	2	0.42	3
Chinese Pond Heron *Ardeola bacchus*	PRC(RC)	8	3.58	9	10	4.58	15
Grey Heron *Ardea cinerea*	PRC	2	0.25	2	6	5.08	16
Purple Heron	RC	-	-	-	1	0.08	1

Species	Conservation Status in HK[1]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No. [2]	Max. No. [2]	No. of surveys	Mean No. [2]	Max. No. [2]
Ardea purpurea							
Great Egret *Ardea abla*	PRC(RC)	4	0.33	1	11	1.83	5
Intermediate Egret *Egretta intermedia*	RC	-	-	-	2	0.17	1
Little Egret *Egretta garzetta*	PRC(RC)	9	2.75	18	11	3.67	10
Great Cormorant *Phalacrocorax carbo*	PRC	-	-	-	5	14.58	56
Black Kite *Milvus migrans*	(RC)	-	-	-	1	0.08	1
Common Buzzard *Buteo japonicus*	-	-	-	-	1	n/a	n/a
White-breasted Waterhen *Amaurornis phoenicurus*	-	6	0.75	3	12	5.58	15
Common Moorhen *Gallinula chloropus*	-	-	-	-	7	3.42	12
Black-winged Stilt *Himantopus himantopus*	RC	-	-	-	2	1.67	19
Little Ringed Plover *Charadrius dubius*	(LC)	5	6.58	25	9	4.75	16
Greater Painted-snipe *Rostratula benghalensis*	LC	1	0.08	1	-	-	-
Common Snipe *Gallinago gallinago*	-	-	-	-	5	0.42	1
Pin-tailed/Swinhoe's Snipe [3] *Gallinago stenura/megala*	LC	2	0.42	3	1	0.08	1
Common Greenshank *Tringa nebularia*	RC	-	-	-	1	0.08	1
Green Sandpiper *Tringa ochropus*	-	2	0.17	1	6	0.92	5
Wood Sandpiper *Tringa glareola*	LC	2	0.25	2	3	0.5	4
Common Sandpiper *Actitis hypoleucos*	-	3	0.33	2	7	0.83	2
Oriental Turtle Dove *Streptopelia orientalis*	-	-	-	-	3	n/a	n/a
Red Turtle Dove *Streptopelia tranquebarica*	-	-	-	-	1	n/a	n/a
Spotted Dove *Spilopelia chinensis*	-	6	n/a	n/a	12	n/a	n/a

Species	Conservation Status in HK[1]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No. [2]	Max. No. [2]	No. of surveys	Mean No. [2]	Max. No. [2]
Greater Coucal *Centropus sinensis*	-	1	n/a	n/a	10	n/a	n/a
Asian Koel *Eudynamys scolopaceus*	-	4	n/a	n/a	11	n/a	n/a
Plaintive Cuckoo *Cacomantis merulinus*	-	-	-	-	3	n/a	n/a
Indian Cuckoo *Cuculus micropterus*	-	-	-	-	1	n/a	n/a
Little Swift *Apus affinis*	-	-	-	-	1	n/a	n/a
White-throated Kingfisher *Halcyon smyrnensis*	(LC)	4	0.33	1	6	0.92	3
Common Kingfisher *Alcedo atthis*	-	4	0.42	2	8	1.75	8
Pied Kingfisher *Ceryle rudis*	(LC)	-	-	-	4	0.5	2
Eurasian Wryneck *Jynx torquilla*	-	1	0.08	n/a	3	n/a	n/a
Brown Shrike *Lanius cristatus*	-	1	n/a	n/a	1	n/a	n/a
Long-tailed Shrike *Lanius schach*	-	3	n/a	n/a	8	n/a	n/a
Black Drongo *Dicrurus macrocercus*	-	1	n/a	n/a	3	n/a	n/a
Hair-crested Drongo *Dicrurus hottentottus*	-	-	-	-	1	n/a	n/a
Eurasian Magpie *Pica pica*	-	4	n/a	n/a	9	n/a	n/a
Collared Crow *Corvus torquatus*	LC	-	-	-	2	0.25	2
Large-billed Crow *Corvus macrorhynchos*	-	-	-	-	1	n/a	n/a
Cinereous Tit *Parus cinereous*	-	-	-	-	4	n/a	n/a
Chinese Penduline Tit *Remiz consobrinus*	RC	-	-	-	1	0.17	2
Red-whiskered Bulbul *Pycnonotus jocosus*	-	2	n/a	n/a	12	n/a	n/a
Light-vented Bulbul *Pycnonotus sinensis*	-	8	n/a	n/a	12	n/a	n/a
Sooty-headed Bulbul	-	-	-	-	6	n/a	n/a

Species	Conservation Status in HK[1]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No. [2]	Max. No. [2]	No. of surveys	Mean No. [2]	Max. No. [2]
Pycnonotus aurigaster							
Barn Swallow *Hirundo rustica*	-	6	n/a	n/a	8	n/a	n/a
Japanese Bush Warbler *Horornis diphone*	-	-	-	-	3	n/a	n/a
Dusky Warbler *Phylloscopus fuscatus*	-	3	n/a	n/a	7	n/a	n/a
Yellow-browed Warbler *Phylloscopus inornatus*	-	-	-	-	5	n/a	n/a
Arctic Warbler *Phylloscopus borealis*	-	-	-	-	1	n/a	n/a
Oriental Reed Warbler *Acrocephalus orientalis*	-	-	-	-	3	0.5	3
Black-browed Reed Warbler *Acrocephalus bistrigiceps*	-	-	-	-	2	0.58	4
Pallas's Grasshopper Warbler *Locustella certhiola*	LC	-	-	-	1	0.17	2
Zitting Cisticola *Cisticola juncidis*	LC	2	0.42	4	4	0.42	2
Yellow-bellied Prinia *Prinia flaviventris*	-	3	n/a	n/a	12	n/a	n/a
Plain Prinia *Prinia inornata*	-	-	-	-	12	n/a	n/a
Common Tailorbird *Orthotomus sutorius*	-	1	n/a	n/a	8	n/a	n/a
Masked Laughingthrush *Garrulax perspicillatus*	-	1	n/a	n/a	11	n/a	n/a
Japanese White-eye *Zosterops japonicus*	-	2	n/a	n/a	12	n/a	n/a
Crested Myna *Acridotheres cristatellus*	-	6	n/a	n/a	11	n/a	n/a
Common Myna *Acridotheres tristis*	-	2	n/a	n/a	-	-	-
Red-billed Starling *Spodiopsar sericeus*	GC[4]	1	0.42	5	4	8.08	45
White-cheeked Starling *Spodiopsar cineraceus*	PRC	1	0.08	1	1	0.42	5
Black-collared Starling *Gracupica nigricollis*	-	6	n/a	n/a	12	n/a	n/a
Daurian Starling *Agropsar sturninus*	LC	1	0.08	1	-	-	-

Species	Conservation Status in HK[1]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No. [2]	Max. No. [2]	No. of surveys	Mean No. [2]	Max. No. [2]
White-shouldered Starling *Sturnia sinensis*	(LC)	1	1	12	2	0.42	4
Grey-backed Thrush *Turdus hortulorum*	-	-	-	-	1	n/a	n/a
Common Blackbird *Turdus merula*	-	-	-	-	5	0.67	n/a
Bluethroat *Luscinia svecica*	LC	-	-	-	1	0.08	1
Siberian Rubythroat *Luscinia calliope*	-	-	-	-	5	n/a	n/a
Oriental Magpie-Robin *Copsychus saularis*	-	12	n/a	n/a	12	n/a	n/a
Daurian Redstart *Phoenicurus auroreus*	-	-	-	-	1	n/a	n/a
Stejneger's Stonechat *Saxicola stejnegeri*	-	6	n/a	n/a	7	n/a	n/a
Blue Rock Thrush *Monticola solitarius*	-	1	n/a	n/a	-	-	-
Asian Brown Flycatcher *Muscicapa latirostris*	-	1	n/a	n/a	1	n/a	n/a
Fork-tailed Sunbird *Aethopyga christinae*	-	-	-	-	1	n/a	n/a
Eurasian Tree Sparrow *Passer montanus*	-	6	n/a	n/a	12	n/a	n/a
Eastern Yellow Wagtail *Motacilla tschutschensis*	-	8	2.58	6	7	0.83	2
Grey Wagtail *Motacilla cinerea*	-	3	0.25	1	4	0.33	1
White Wagtail *Motacilla alba*	-	11	n/a	n/a	11	n/a	n/a
Richard's Pipit *Anthus richardi*	-	1	n/a	n/a	-	-	-
Olive-backed Pipit *Anthus hodgsoni*	-	3	n/a	n/a	6	n/a	n/a
Red-throated Pipit *Anthus cervinus*	LC	7	10.08	30	2	0.25	2
Chinese Grosbeak *Eophona migratoria*	LC	1	0.08	1	2	0.42	3
Little Bunting *Emberiza pusilla*	-	-	-	-	1	n/a	n/a
Black-faced Bunting	-	-	-	-	6	n/a	n/a

Species	Conservation Status in HK[1]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No. [2]	Max. No. [2]	No. of surveys	Mean No. [2]	Max. No. [2]
Emberiza spodocephala							
Scaly-breasted Munia *Lonchura punctulata*	-	2	n/a	n/a	10	n/a	n/a

(1) Conservation Status follows Fellowes *et al.* (2002): GC = Global Concern, PRC = Potential Regional Concern, RC = Regional Concern, LC = Local Concern. Status in parentheses indicates that this evaluation is based on communal roosting/breeding populations;

(2) Means and maximum counts are shown for birds of conservation importance and species of wetland-dependent only;

(3) Pintail and Swinhoe's snipe are considered to be inseparable in the field. Only Swinhoe's Snipe is listed by Fellowes *et al.* (2002); and

(4) Red-billed Starling is considered by Fellowes *et al.* (2002) to be of Global Concern. Since publication, however, the global population estimate has been revised and the species is not now considered globally threatened (BirdLife International 2007). A listing of Regional Concern (RC), based on the importance of the large roosts present near Deep Bay, is considered to be more appropriate.

As is noted above and in paragraph 8.2.6.9, there has been a change in the water management regime in the Ngau Tam Mei Drainage Channel since the Survey Period; and this channel is now permitted to flood according to the tidal cycle. As a consequence of this change, the channel is now of considerably greater importance for ardeids than during the survey period. In recognition of this change, unpublished survey findings from Civil Engineering and Development Department (CEDD) were consulted and bird survey data was supplemented by flight line surveys conducted in October to November 2009 and April to June 2011.

8.7.2.3 Findings from Bird Flight Line Survey

As noted above, in order to further investigate the importance of the channel for egrets during the winter months following the change in water management regime, and to determine whether egrets moving between the channel and the main Deep Bay wetlands were traversing the Project Area, flight line surveys were conducted in October and November 2009.

Detailed results of each flight line path and evaluation of the flight line survey are presented in **Appendix 8-4**. **Table 8-5** and **Table 8-6** summarize and compare the flight line paths across the Assessment Area and the Project Area to the Deep Bay wetlands.

In summary, flight line surveys confirmed that the Ngau Tam Mei Drainage Channel is of significance for non-breeding ardeids and linkages between the Channel and the wider Deep Bay wetlands through the Assessment Area are confirmed, with 61.7% of observed movements being along Flight Lines 1, 3 and 4. Overall, it would appear that most birds utilize the most direct available route between the Channel and the Deep Bay wetlands and are not deterred by the presence of Fairview Park, with 25% of birds flying over Fairview Park at high tide and 20% at low tide. With only 11.3% of birds flying over the Project Area itself, it is apparent that this (Flight Line 4) is not the main movement corridor with Flight Lines 1 and 3 being of more significance. Flight Line 3, though utilized by similar numbers of birds in total as Flight Line 1, is of particular importance for Little Egrets and Chinese Pond Herons.

Table 8-5 Non-breeding season flight-lines counts: All birds

Flight line number shown	Number of birds recorded in high tide counts	Percentage of total	Number of birds recorded in low tide counts	Percentage of total
1	42	24.6	67	20.1
2	49	28.7	132	39.6
3	56	32.7	89	26.7
4	13	7.6	44	13.2
5	11	6.4	1	0.3
Total	**171**	**100**	**333**	**100**

Table 8-6 Comparison of the importance of non-breeding season flight lines across the Assessment Area and the Project Area to the Deep Bay wetlands; along the Ngau Tam Mei Channel and elsewhere

Route	Number of birds recorded in high tide counts	Number of birds recorded in low tide counts	Number of birds recorded in all counts	Percent-age of total in all counts
Across the Assessment Area to/from Deep Bay (Flight Lines 1 and 3) (1)	98	156	254	50.4
Across the Project Area to/from Deep Bay (Flight Line 4)	13	44	57	11.3
Along the Ngau Tam Mei Drainage Channel (Flight Line 2)	49	132	181	35.9
Between the Channel and areas to the south (Flight Line 5)	11	1	12	2.4
Totals	**171**	**333**	**504**	**100**

(1) Assessment Area excluding Project Area.

Note: Figures above are rounded to the nearest decimal place. Hence, figures may not add up.

In order to investigate the importance of the Project Area to serve as a foraging area to breeding ardeids, egretry flight line surveys were carried out from April to June 2011. These found that most birds departing the egretry flew west towards wetland areas around Mai Po or Tam Kon Chau. Fewer birds flew over or past Royal Palms towards the Project Area. Surveys at Ngau Tam Mei Channel found some birds flying over the Project Area, but most flew along San Tin Highway to the east of the Project Area to forage in the Ngau Tam Mei channel or beyond. Full results from the flight-line surveys can be found in **Appendix 8-4** and a summary is provided in Table 8-7.

Table 8-7 Summary of results from breeding season flight-line counts at Mai Po Village egretry and at Project Area

Flight Route	Little Egret	Chinese Pond Heron
Observations at Mai Po Village egretry		
From egretry in direction of Project Area	12	25
From egretry to other directions	89	256
Observations at Project Area		
From direction of egretry, landing north of Ngau Tam Mei channel	5	3
From direction of egretry, flying into or beyond Ngau Tam Mei Channel	2	17

Flight Route	Little Egret	Chinese Pond Heron
From north of Ngau Tam Mei Channel, flying towards egretry	0	0
From Ngau Tam Mei Channel or further south, flying towards egretry	3	17
Other routes	2	17

8.7.3 Mammals

8.7.3.1 Literature Review

A total of 10 mammal species, including a species of conservation importance (i.e. Lesser Yellow Bat in WSW EIA) and four protected species (i.e. three bat species and Small Asian Mongoose) were recorded in the previous EIAs. However, as noted in **Section 8.7.2.1** above, the information from these EIAs does not assist in establishing the ecological baseline for the current Assessment Area, with the exception of the adjacent Proposed Residential Cum Passive Recreation Development within "Recreation" Zone and "Residential (Group C)" Zone at Various Lots in DD 104, Yuen Long. Two mammal species, Japanese Pipistrelle *Pipistrellus abramus* and Small Asian Mongoose *Herpestes javanicus*, were recorded in low numbers during field surveys conducted for that EIA.

8.7.3.2 Findings from Current Study

No mammals were recorded in the Project Area and the Assessment Area in the survey period. Small numbers of Short-nosed Fruit Bats *Cynopterus sphinx* and Japanese Pipistrelle are known to roost at Palm Springs (AEC unpublished data); although these bat species were not recorded during any faunal surveys. Both are common and widespread species in Hong Kong.

8.7.4 Reptiles

8.7.4.1 Literature Review

No herpetofauna species of conservation importance were recorded in the previous EIAs. Totals of eight, four and three species of herpetofauna species were recorded in the WSW, Proposed Residential Cum Passive Recreation Development within "Recreation" Zone and "Residential (Group C)" Zone at Various Lots in DD 104, Yuen Long and Sha Po Tsuen to Shek Sheung River Cycle Track EIAs respectively. Findings from the WSW and Cycle Track report are considered irrelevant to our current study due to distance and the vagility of the group, while species recorded in the EIA of the adjacent site involved only common and widespread species of little conservation concern in low numbers (i.e. Chinese Gecko *Gekko chinensis*, Bowring's Gecko *Hemidactylus bowringii*, Chinese Skink *Eumeces chinensis*, and Reeves' Smooth Skink *Scincella reevesii*).

8.7.4.2 Findings from Current Study

Six species of reptile were observed during the survey period, including Bowring's Gecko *Hemidactylus bowringii*, Changeable Lizard *Calotes versicolor*, Checkered Keelback *Xenochrophis piscator*, Chinese Skink *Eumeces chinensis*, Many-banded Krait *Bungarus multicinctus* and Red-eared Slider *Trachemys scripta*. Three of these species (Changeable Lizard, Checkered Keelback and Many-banded Krait) were observed within the Project Area, including one species of conservation importance (Many-banded Krait); while five species were recorded in the Assessment Area. Many-banded Krait was observed in active agricultural land within the Project Area during a night-time survey. This species is regarded as Vulnerable in China (Zhao 1998) and is of Potential Regional Concern by Fellowes *et al.*

(2002), despite being relatively widespread and common in a variety of habitats in Hong Kong (Karsen *et al.* 1998, Chan *et al.*, 2005). Other species recorded are considered as widespread in the territory (Karsen *et al.* 1998) and are of low conservation concern. **Appendix 8-5** shows the reptile species recorded between September 2007 and August 2008 within the Project Area and the Assessment Area.

Table 8-8 Reptiles recorded during daytime transect surveys in the Project Area and the Assessment Area (excluding the Project Area) in the wet season 2007/2008, and their respective number of surveys recorded, mean and maximum count

Species	Conservation Status in HK[1]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No.	Max. no.	No. of surveys	Mean No.	Max. no.
Red-eared Slider[2] *Trachemys scripta*	-	-	-	-	1	0.38	3
Changeable Lizard *Calotes versicolor*	-	1	0.13	1	1	0.13	1
Chinese Skink *Eumeces chinensis*	-	-	-	-	1	0.25	2
Checkered Keelback *Xenochrophis piscator*	-	1	0.13	1	1	0.13	1

(1) Conservation Status follows Fellowes *et al.* (2002): GC = Global Concern, PRC = Potential Regional Concern, RC = Regional Concern, LC = Local Concern. Status in parentheses indicates that this evaluation is based on communal roosting/breeding populations;

(2) Red-eared Slider is an aggressive exotic species in Hong Kong.

Table 8-9 Reptiles recorded during night-time transect surveys in the Project Area and the Assessment Area (excluding the Project Area) in the wet season 2007/2008, and their respective number of surveys recorded, mean and maximum count.

Species	Conservation Status in HK[1]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No.	Max. No.	No. of surveys	Mean No.	Max. No.
Bowring's Gecko *Hemidactylus bowringii*	-	-	-	-	1	0.5	2
Many-banded Krait *Bungarus multicinctus*	PRC	1	0.25	1	-	-	-

(1) Conservation Status follows Fellowes *et al.* (2002): GC = Global Concern, PRC = Potential Regional Concern, RC = Regional Concern, LC = Local Concern. Status in parentheses indicates that this evaluation is based on communal roosting/breeding populations.

8.7.5 Amphibians

8.7.5.1 Literature Review

Eight amphibian species, all of which are common and widespread in Hong Kong, were found in surveys for the Proposed Residential Cum Passive Recreation Development within "Recreation" Zone and "Residential (Group C)" Zone at Various Lots in DD 104, Yuen Long EIA Study. As noted in **Section 8.7.2.1** above, the information from these EIAs does not assist in establishing the ecological baseline for the current Assessment Area.

8.7.5.2 Findings from Current Study

A total of nine amphibian species were recorded in the survey period, eight of which were found within the Project Area. None of these species is of conservation concern, and all are common and widespread in the New Territories (Chan *et al.* 2005). Abandoned or actively cultivated, lower-lying fields retain water in the wet season and are suitable breeding

grounds for amphibian species. Amphibians are known to be most active in favourable weather conditions and usually around dusk and dawn. Hence, most records were obtained from the night-time surveys. During the night time surveys, seven amphibian species were recorded during the wet season within the Project Area, while a total of seven species were recorded within the Assessment Area. Moderate numbers of Ornate Pigmy Frog and Paddy Frog *Fejervarya limnocharis* were recorded during the wet season night-time surveys in the wet agricultural fields within the Project Area. During the day time surveys, a maximum of two individuals of Spotted Narrow-mouthed Frog *Kalophrynus interlineatus* was recorded within the Project Area, and three amphibian species (Asian Common Toad *Bufo melanostictus*, Ornate Pigmy Frog *Microhyla ornate* and Günther's Frog *Rana guentheri*) were recorded within the Assessment Area. **Appendix 8-5** shows the amphibian species recorded between September 2007 and August 2008 within the Project Area and the Assessment Area.

Table 8-10 Amphibians recorded during daytime transect surveys in the Project Area and the Assessment Area (excluding the Project Area) in the wet season 2007/2008, and their respective number of surveys recorded, mean and maximum count.

Species	Conservation Status in HK(1)	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No.	Max. no.	No. of surveys	Mean No.	Max. no.
Asian Common Toad *Bufo melanostictus*	-	-	-	-	1	0.13	1
Spotted Narrow-mouthed Frog *Kalophrynus interlineatus*	-	1	0.25	2	-	-	-
Ornate Pigmy Frog *Microhyla ornate*	-	-	-	-	1	0.38	3
Günther's Frog *Rana guentheri*	-	-	-	-	4	1.75	6

(1) Conservation Status follows Fellowes *et al.* (2002): GC = Global Concern, PRC = Potential Regional Concern, RC = Regional Concern, LC = Local Concern. Status in parentheses indicates that this evaluation is based on communal roosting/breeding populations.

Table 8-11 Amphibians recorded during night-time transect surveys in the Project Area and the Assessment Area (excluding the Project Area) in the wet season 2007/2008, and their respective number of surveys recorded, mean and maximum count.

Species	Conservation Status in HK[(1)]	Project Area			Assessment Area (Excl. Project Area)		
		No. of surveys	Mean No.	Max. no.	No. of surveys	Mean No.	Max. no.
Asian Common Toad *Bufo melanostictus*	-	4	4	7	4	3	4
Asiatic Painted Frog *Kaloula pulchra*	-	1	0.75	3	-	-	-
Butler's Pigmy Frog *Microhyla butleri*	-	-	-	-	2	2	5
Ornate Pigmy Frog *Microhyla ornate*	-	4	19.5	> 50	4	18.25	> 50
Marbled Pigmy Frog *Microhyla pulchra*	-	2	1.75	6	2	0.75	2
Paddy Frog *Fejervarya limnocharis*	-	4	9.75	20	3	3.25	11
Günther's Frog *Rana guentheri*	-	1	0.25	1	2	2	5
Brown Tree Frog *Polypedates megacephalus*	-	4	2.25	4	4	6.25	14

(1) Conservation Status follows Fellowes *et al.* (2002): GC = Global Concern, PRC = Potential Regional Concern, RC = Regional Concern, LC = Local Concern. Status in parentheses indicates that this evaluation is based on communal roosting/breeding populations.

8.7.6 Butterflies

8.7.6.1 Literature Review

A total of 43 butterfly species including one species of conservation concern (Danaid Egg-fly; WSW EIA) and two other uncommon butterfly species (i.e. Yellow Orange Tip; WSW EIA and Blue Pansy; NSW Cycle Track EIA). All species of conservation concern/interest were recorded in very low numbers (maximum 1 individual). However, as noted in **Section 8.7.2.1** above, the information from these EIAs does not assist in establishing the ecological baseline for the current Assessment Area. Of more relevance are the 34 butterfly species found in surveys for the Proposed Residential Cum Passive Recreation Development within "Recreation" Zone and "Residential (Group C)" Zone at Various Lots in DD 104, Yuen Long EIA Study. These included two species of conservation significance, Pale Palm Dart *Telicota colon* and Danaid Egg-fly *Hypolimnas misippus*. The first of these was found within the current Project Area. This species is listed as of Local Concern by Fellowes *et al.* (2002) and is considered to be rare locally (Chan *et al*. 2011). All butterfly species observed in this EIA were recorded in low numbers.

8.7.6.2 Findings from Current Study

A total of 38 butterfly species was recorded in the survey period from September to October 2007 and March to August 2008. Most species recorded are common or very common in the territory, although five species are considered to be uncommon (Plain Hedge Blue *Celastrina lavendularis*, Painted Jezebel *Delias hyparete*, Common Jay *Graphium doson*, Danaid Egg-fly *Hypolimnas misippus* and Swallowtail *Papilio xuthus* (Young and Yiu 2002). The greatest diversity and abundance of butterfly species occurred in the contiguous fish ponds to the northwest of the Project Area. Fifteen butterfly species were recorded within the Project Area.

Two species, Plain Hedge Blue (*Celastrina lavendularis*) and Danaid Egg-fly (*Hypolimnas misippus*), are listed as species of Local Concern in Fellowes *et al.* (2002Single Danaid Egg-flies were found within the Project Area in Pond 7 and agricultural land to the east, and the species was also recorded in the contiguous fish ponds in the northwest of the Assessment Area. A single Plain Hedge Blue was recorded in agricultural land south of the Ngau Tam Mei Drainage Channel. Since publication of Fellowes *et al.* (2002) there has been an increase in knowledge and/or a genuine increase in population for both species, and both are now known to occur throughout the territory (Lo 2005), though these species are considered "very rare" and "uncommon" by AFCD (AFCD Biodiversity Databline). **Appendix 8-6** shows the butterfly species recorded between September 2007 and August 2008 within the Project Area and the Assessment Area.

Table 8-12 Butterflies recorded during transect surveys in the Project Area and the Assessment Area (excluding the Project Area) in the wet season 2007/2008, and their respective number of surveys recorded, mean and maximum count.

Species	Conservation status in HK[(1)]	Project Area			Assessment Area (Excl. Project Area)		
		No. of surveys	Mean No.	Max. No.	No. of surveys	Mean No.	Max. No.
Indian Palm Bob *Suastus gremius*	-	-	-	-	1	0.13	1
Banana Skipper *Erionota torus*	-	-	-	-	2	0.25	1
Oriental Straight Swift *Parnara bada*	-	-	-	-	1	0.13	1
Formosan Swift *Borbo cinnara*	-	-	-	-	2	0.38	2
Common Bluebottle *Graphium sarpedon*	-	1	0.13	1	6	1.38	3
Common Jay *Graphium doson*	-	-	-	-	2	0.25	1
Swallowtail *Papilio xuthus*	-	-	-	-	1	0.13	1
Lime Butterfly *Papilio demoleus*	-	1	0.13	1	-	-	-
Common Mormon *Papilio polytes*	-	4	0.75	1	7	3.50	3
Spangle *Papilio protenor*	-	1	0.13	1	2	0.38	2
Paris Peacock *Papilio paris*	-	-	-	-	3	0.50	1
Painted Jezebel *Delias hyparete*	-	-	-	-	1	0.13	1
Indian Cabbage White *Pieris canidia*	-	3	6.88	31	6	27.13	24
Common Gull *Cepora nerissa*	-	-	-	-	1	0.13	1
Great Orange Tip *Hebomoia glaucippe*	-	1	0.13	1	3	1.88	4
Mottled Emigrant *Catopsilia pyranthe*	-	3	0.38	1	2	0.75	4
Lemon Emigrant *Catopsilia pomona*	-	3	1.63	7	5	10.88	24

Species	Conservation status in HK[(1)]	Project Area			Assessment Area (Excl. Project Area)		
		No. of surveys	Mean No.	Max. No.	No. of surveys	Mean No.	Max. No.
Common Grass Yellow *Eurema hecabe*	-	-	-	-	7	5.38	5
Pale Grass Blue *Zizeeria maha*	-	1	0.38	3	4	4.50	9
Lesser Grass Blue *Zizina otis*	-	-	-	-	3	1.63	8
Common Hedge Blue *Acytolepis puspa*	-	1	0.13	1	5	1.88	3
Plain Hedge Blue *Celastrina lavendularis*	LC	-	-	-	1	0.13	1
Gram Blue *Euchrysops cnejus*	-	-	-	-	1	0.13	1
Dark Evening Brown *Melanitis phedima*	-	-	-	-	1	0.13	1
Common Palmfly *Elymnias hypermnestra*	-	-	-	-	3	1.13	4
Dark-brand Bush Brown *Mycalesis mineus*	-	1	0.25	2	7	3.38	3
South China Bush Brown *Mycalesis zonata*	-	-	-	-	1	0.13	1
Common Five-ring *Ypthima baldus*	-	-	-	-	3	0.63	2
Angled Castor *Ariadne ariadne*	-	1	0.13	1	6	2.50	10
Grey Pansy *Junonia atlites*	-	1	0.13	1	2	0.75	2
Great Egg-fly *Hypolimnas bolina*	-	-	-	-	4	1.13	3
Danaid Egg-fly *Hypolimnas misippus*	LC	2	0.25	1	2	1.63	3
Common Sailer *Neptis hylas*	-	-	-	-	2	0.25	1
White-edged Blue Baron *Euthalia phemius*	-	1	0.13	1	1	0.13	1
Common Mapwing *Cyrestis thyodamas*	-	-	-	-	2	0.25	1
Red Ring Skirt *Hestina assimlis*	-	-	-	-	2	0.50	1
Blue-spotted Crow *Euploea midamus*	-	-	-	-	1	0.13	1
Common Indian Crow *Euploea core*	-	-	-	-	1	0.13	1

(1) Conservation Status follows Fellowes *et al.* (2002): GC = Global Concern, PRC = Potential Regional Concern, RC = Regional Concern, LC = Local Concern. Status in parentheses indicates that this is based on communal roosting/breeding populations.

8.7.7 Dragonflies

8.7.7.1 Literature Review

A total of 26 dragonfly species including three unidentified Blue Skimmer sp. (WSW EIA) were recorded in the previous EIAs. Of these, four species of Local Concern were recorded

(Eastern Lilysquatter, Ruby Darter, Sapphire Flutterer and Scarlet Basker, all from NSW EIA). All species of conservation concern/interest were recorded in very low numbers (1-3 individuals). However, as noted in **Section 8.7.2.1** above, the information from these EIAs does not assist in establishing the ecological baseline for the current Assessment Area. Of more relevance are the 22 dragonfly species found in surveys for the Proposed Residential Cum Passive Recreation Development within "Recreation" Zone and "Residential (Group C)" Zone at Various Lots in DD 104, Yuen Long EIA Study. These include Coastal Glider *Macrodiplax cora* and Scarlet Basker *Urothemis signata*. Both of these were found in the current Study, while the former was recorded within the Project Area. Both species are listed as of Local Concern by Fellowes *et al.* (2002) and both are considered to be common (AFCD Biodiversity Database). All dragonfly species observed in this EIA were recorded in low numbers.

8.7.7.2 Findings from Current Study

A total of 25 dragonfly and damselfly species was recorded in the survey period from September to October 2007 and March to August 2008; half of these (12 species) were also recorded in the Project Area. Most species are common and widespread in the territory. Of these, two species, Coastal Glider *Macrodiplax cora* and Scarlet Basker *Urothemis signata*, are listed as species of Local Concern (Fellowes *et al.* 2002). Wilson (2004), however, considered that Scarlet Basker is a common species in the territory as its population has rapidly increased since late 1990s. During the survey period, all Scarlet Baskers recorded were seen in abandoned fish ponds adjacent to the Project Area which were rich in emergent and floating vegetation, a favourable habitat for this species (Wilson 2004). A single Coastal Glider individual was seen flying over farmland within the Project Area in September 2007. Although it has been listed as a species of Local Concern by Fellowes *et al.* (2002), this species is also one of the most abundant and widespread dragonfly species in the world (Wilson 2004), and both species are considered "common" by AFCD (AFCD Biodiversity Database). Other species recorded are common in Hong Kong (Wilson 2004).

The relatively low number of species recorded within the Project Area (only 12 odonate species compared with 24 species within the Assessment Area) is considered to be a result of the lack of suitable habitats on-site (most areas within the Project Area are dry or lack open water). Appendix 8-7 shows the dragonfly species recorded between September 2007 and August 2008 within the Project Area and the Assessment Area.

Table 8-13 Dragonflies recorded during transect surveys in the Project Area and the Assessment Area (excluding the Project Area) in the wet season 2007/2008, and their respective number of surveys recorded, mean and maximum count.

Species	Conservation Status in HK[(1)]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No.	Max. No.	No. of surveys	Mean No.	Max. No.
Wandering Midget *Agriocnemis pygmaea*	-	-	-	-	1	0.13	1
Orange-tailed Sprite *Ceriagrion auranticum*	-	-	-	-	6	7.13	39
Common Bluetail *Ischnura senegalensis*	-	2	0.63	3	3	2.50	15
Orange-faced Sprite *Pseudagrion rubriceps*	-	-	-	-	5	1.63	4
Yellow Featherlegs *Copera marginipes*	-	-	-	-	3	1.13	5
Pale-spotted Emperor *Anax guttatus*	-	1	0.13	1	1	0.50	4

Species	Conservation Status in HK[(1)]	Project Area			Assessment Area (Excluding Project Area)		
		No. of surveys	Mean No.	Max. No.	No. of surveys	Mean No.	Max. No.
Lesser Emperor *Anax parthenope*	-	-	-	-	1	0.25	2
Common Flangetail *Ictinogomphus pertinax*	-	1	0.13	1	2	0.75	3
Regal Pond Cruiser *Epopthalmia elegans*	-	2	0.25	1	1	0.13	1
Asian Pintail *Acisoma panorpoides*	-	-	-	-	2	0.38	2
Blue Dasher *Brachydiplax chalybea*	-	-	-	-	2	1.13	8
Asian Amberwing *Brachythemis contaminata*	-	6	3.5	10	6	2.63	11
Crimson Darter *Crocothemis servilia*	-	1	0.25	2	3	1.00	4
Blue Percher *Diplacodes trivialis*	-	2	0.38	2	1	0.13	1
Amber-winged Glider *Hydrobasileus croceus*	-	-	-	-	1	1.00	8
Coastal Glider *Macrodiplax cora*	LC	1	0.13	1	-	-	-
Pied Percher *Neurothemis tullia*	-	-	-	-	3	1.00	4
Common Red Skimmer *Orthetrum pruinosum*	-	-	-	-	5	1.38	4
Green Skimmer *Orthetrum sabina*	-	4	2.75	13	6	4.13	11
Wandering Glider *Pantala flavescens*	-	3	8.38	45	4	80.25	437
Pied Skimmer *Pseudothemis zonata*	-	2	0.25	1	3	2.00	8
Variegated Flutterer *Rhyothemis variegata*	-	3	2.13	13	6	9.25	20
Saddlebag Glider *Tramea virginia*	-	-	-	-	4	0.75	3
Crimson Dropwing *Trithemis aurora*	-	-	-	-	1	0.25	2
Scarlet Basker *Urothemis signata*	LC	-	-	-	6	3.50	11

(1) Conservation Status follows Fellowes *et al.* (2002): GC = Global Concern, PRC = Potential Regional Concern, RC = Regional Concern, LC = Local Concern. Status in parentheses indicates that this evaluation is based on communal roosting/breeding populations.

8.7.8 Fish

8.7.8.1 Literature Review

No fish survey was undertaken in the EIAs under review.

8.7.8.2 Findings from Current Study

Small numbers of pollution-tolerant fish species such as Edible Goldfish *Carassius auratus* and the exotic Mosquito Fish *Gambusia affinis*, Nile Tilapia *Oreochromis niloticus*, North

African Catfish *Clarias gareipinus* and Snakehead Murrel *Channa striata* were observed in channels in the Project Area and the Assessment Area. Higher numbers of some of these pollution-tolerant fish species (i.e. Mosquito Fish and Tilapia) occurred upstream of the irrigation ditch within the Project Area where water quality is better.

Fish surveys in the pond areas within the Project Area and the Assessment Area revealed that the pond areas support low numbers of fish species, including Bighead Carp *Aristichthys nobilis*, Grass Carp *Ctenopharyngodon idellus*, Mosquito Fish, Tilapia and some ornamental Common Carp *Cyprinus carpio*. These fish species were observed either in the ponds for ornamental purposes or for self-consumption. A limited number of fish species (Bighead Carp, Grass Carp, Mosquito Fish and Tilapia) was observed in inactive/abandoned ponds.

8.8 Ecological Value of Habitats in the Project Area and within the Assessment Area

8.8.1 Approach to habitat evaluation

Habitats within the Project Area and Assessment Area were assessed following the criteria for habitat evaluation set out in the Technical Memorandum to the EIAO. This evaluation also includes a qualitative assessment of the habitat, potential changes to the habitat in the future in the absence of the proposed development, site abandonment and any other site management (such as potential for enhancement and management for wildlife).

8.8.2 Agricultural Land

The major habitat type within the Project Area is agricultural land, which covers an area of 4.9 ha. During the ecological surveys in 2007/08, most of the agricultural land was active dry farmland used for cultivation of Lettuce *Lactuca sativa* and Chinese White Cabbage *Brassica chinensis*. Being an actively managed area, agricultural land is a dynamic habitat and the conditions are dependent on farming practices; thus ecological conditions (including vegetation present) may change rapidly if fields are left fallow and/or are allowed to flood seasonally such that the wet and dry conditions of the agricultural land vary, and any survey thus provides a 'snapshot' of conditions at one point in time. As a result, it is considered appropriate to include all active and inactive, wet and dry agriculture into a single habitat category, the evaluation of which is then based upon the conditions observed over the course of the entire survey period, rather than being reliant on any single visit. Despite the limitation of the site visit, understanding of the field's existing baseline condition by means of recording the type of vegetation planted during both the wet and dry season is important and helps in informing the process of wetland calculation.

Throughout the survey period, most of the agricultural fields were used for cultivation of dry farmland crops. Judging from aerial photographs, all areas mapped as agricultural land have a history of active agricultural use dating back at least 10 years. The site experienced a short period of tenancy change which resulted in abandonment of the fields. However, in late 2012, the site was re-ploughed and active agriculture mainly of the crop Lettuce *Lactuca sativa*. No wet agriculture was observed in late 2012. Due to the active management for agriculture e.g. typical weed controls, the agricultural land supports a low floristic diversity (30 plant species), with vegetation such as native grass *Cynodon dactylon,* herbs *Emilia sonchifolia* and *Bidens alba* and isolated fruit trees *Dimocarpus longan* and *Litchi chinensis* concentrated along the bunds. The area is also served by a small irrigation ditch.

Agricultural land within the Project Area supports a moderate bird diversity; 48 bird species were recorded using the agricultural land and associated area within the Project Area (Appendix 8-3 refers). About half of these are common, widespread species of anthropogenic habitats in Hong Kong (Carey *et al*. 2001), but 15 species are of conservation importance and an additional eight species are wetland-dependent. Among these bird

species, Red-throated Pipit, Little Ringed Plover and ardeids were recorded in small to moderate numbers in association with bare ground, short vegetation in wet agricultural land or around the wet fields. In addition, a single male Greater Painted-snipe was recorded in an inactive/abandoned wet agricultural field A8 in June 2008 and a pair was seen in late June. Overall, however, bird abundance was low relative to that in the continuous and contiguous pond system in the Deep Bay area. Mean bird density in habitats within the Project Areas is detailed in Appendix 8-8.

Diversity of other faunal groups was low, including two reptile species, seven amphibian species, seven dragonfly species and ten butterfly species. One species each of reptile, dragonfly and butterfly are species of conservation importance (Many-banded Krait, Coastal Glider and Danaid Egg-fly respectively); all three are currently widespread in Hong Kong. Moderate numbers of amphibians breed around the wet agricultural fields during the wet season, notably Ornate Pigmy Frog, for which counts in excess of 50 individuals were recorded.

Within the Assessment Area (but outside the Project Area), agricultural land (4.8 ha) is located immediately southwest of the Project Area (continuous with agricultural land within the Project Area) and south of the Ngau Tam Mei Drainage Channel. This agricultural land supports similar floral diversity and structural complexity to that within the Project Area. These areas also support similar faunal diversity, including 51 bird species, seven amphibian species, three dragonfly species and 11 butterfly species, most of which were recorded in the agricultural land south of the drainage channel. Of these, 13 birds and one butterfly species (Plain Hedge Blue) are listed as species of conservation importance by Fellowes *et al.* (2002).

Table 8-14 Ecological Value of Agricultural Land

Criterion	Agricultural land within the Project Area	Other agricultural land in the Assessment Area \Outside the Project Area
Naturalness	Man-made habitat intensively managed for active agriculture, although conditions are dependent upon management practices of land owners; grassland/shrubland through natural succession if left undisturbed.	Man-made habitat intensively managed for the active dry/wet agriculture.
Size	A small area in a Hong Kong context 4.9 ha).	A small area in a Hong Kong context (4.8ha).
Diversity	Low plant species diversity (30 plant species). Moderate bird diversity (48 bird species), but most species are common and widespread in anthropogenic habitats. Low diversity of other faunal groups (2 reptile species, 7 amphibian species, 7 dragonfly species and 10 butterfly species).	Low plant species diversity and structural complexity (39 plant species). Moderate bird diversity (51 bird species), but most species are common and widespread in anthropogenic habitats. Low diversity of other faunal groups (7 amphibian species, 3 dragonfly species and 11 butterfly species).
Rarity	A common habitat in Hong Kong but area is declining. 15 birds, 1 reptile, 1 dragonfly and 1 butterfly of conservation importance.	A common habitat in Hong Kong but area is declining. 13 birds and 1 butterfly are of conservation importance.
Re-creatability	Readily re-creatable.	Readily re-creatable.
Fragmentation	A single block within the Project Area, but fragmented from other agricultural land.	Fragmented by the drainage channel, roads and other nearby land uses.
Ecological corridor	Some linkages to nearby fish ponds and grassland/shrubland.	Some linkages to nearby grassland/shrubland and isolated ponds.
Potential value	Under current management regime (for dry agriculture), potential value for wildlife is limited due to continual disturbance and conflict in management objectives.	Under current management regime (which is largely for dry agriculture), potential value for wildlife is limited due to continual disturbance and

Criterion	Agricultural land within the Project Area	Other agricultural land in the Assessment Area \Outside the Project Area
	However, site has potential to be enhanced for wildlife with proper management practices and resources.	conflict in management objectives. However, site has potential to be enhanced for wildlife with proper management practices and resources.
Nursery/ breeding ground	Wet fields/patches apparently used for breeding by moderate numbers of amphibians.	No significant nursery/ breeding grounds identified.
Age	Not known but probably post-1945, and active management changes its properties continuously.	Not known but probably post-1945, and active management changes its properties continuously.
Abundance/ richness of wildlife	Moderate abundance of Red-throated Pipit, Little Ringed Plover and Ornate Pigmy Frog in agricultural land, but low diversity overall.	Low abundance/ richness of wildlife but moderate abundance for Ornate Pigmy Frog.
Ecological value	**Low to Moderate** as the agricultural land provides marginal suitable habitats for birds (including 15 species of conservation importance) and amphibians (all recorded are common species in Hong Kong).	**Low to Moderate.**

8.8.3 Pond Area

Ponds within the Project Area are mainly located in the northern part, adjacent to the ponds in the Deep Bay wetland system. In addition there is a small fish pond located to the southeast of the Project Area. This habitat type covers a total of 1.2 ha of land. All ponds within the Project Area are not actively managed for aquaculture of edible fish (Ponds 7, 8, 17 and 18). According to the pond owners and fish surveys, fish, including Bighead Carp *Aristichthys nobilis*, White-spotted Catfish *Clarias fuscus*, Grass Carp *Ctenopharyngodn idellus*, Mosquito Fish *Gambusia affinis* and Tilapia *Oreochromis niloticus*, from the northern ponds are occasionally caught for self-consumption.

Due to their small size and lack of management for some time, ponds within the Project Area have become degraded in function and habitat quality. Despite retaining connectivity with the continuous and contiguous Deep Bay wetland system to the northwest of the Assessment Area, their remoteness (towards the edge of the wetland system) from the main wetland system further diminishes their attractiveness to large waterbirds. These ponds support low flora and faunal diversity, including 20 plant species (the bunds are dominated by grassy vegetation (>70%), such as *Brachiaria mutica* and *Panicum repens,* with some common herbs including exotic *Bidens alba* and *Euphorbia hirta* and native *Eleusine lansium*, and a limited number of naturally established native tree *Macaranga tanarius*), 14 bird species, two amphibian species, one reptile species, ten dragonfly species and six butterfly species. Among the bird species recorded, seven (Grey Heron *Ardea cinerea*, Great Egret *Egretta alba*, Little Egret, Chinese Pond Heron, Black-crowned Night Heron *Nycticorax nycticorax*, Yellow Bittern *Ixobrychus sinensis* and White-throated Kingfisher *Halcyon smyrnensis*) are species of conservation importance and three other species are wetland-dependent species. However, bird abundance was low relative to their abundance in the continuous and contiguous pond system in the Deep Bay area. One butterfly species, Danaid Egg-fly, is listed as Local Concern by Fellowes *et al.* (2002), although, as discussed above, its population has increased rapidly in the territory.

Most pond areas within the Assessment Area are located in the northwest and are ecologically connected to the Deep Bay wetland system. A few ponds are also scattered to the east within Yau Mei San Tsuen. Many of these ponds, except Ponds 1, 3, 21, 22, 23 and 24, fall in the WCA boundary. Ponds 1 and 21 are used for cultivation of ornamental carp, but all other ponds in the Assessment Area are either inactive or have been abandoned, and few or no fish species were observed. Together with the surrounding overgrown ponds,

these inactive or abandoned fish ponds located in the northwest of the Assessment Area support higher diversity and abundance of birds than the pond habitat within the Project Area and other habitat types within the Assessment Area. A total of 76 bird species was recorded in these ponds, including 28 species of conservation importance, and 11 additional species are wetland-dependent. As human disturbance in this pond area is low and it is ecologically linked to the Deep Bay wetland system, a number of disturbance-sensitive species and large waterbirds, such as Grey Heron, Great Cormorant, Black-faced Spoonbill and ducks are able to use this area. Diversity of other faunal groups was comparatively low, including three amphibian species, one reptile species, 19 dragonfly species and 21 butterfly species. One dragonfly species Scarlet Basker and a butterfly species Danaid Egg-fly are listed by Fellowes *et al.* (2002) as species of Local Concern.

For details of bird species recorded in accessible ponds during the bird survey, see Appendix 8-9.

There was a trend towards the abandonment of fish ponds in the Deep Bay area in previous years as a result of the lower commercial value of pond fish. This trend seems to have slowed in more recent years, but there is currently no evidence towards the resumption of activity in previously abandoned ponds. It is expected therefore that the ponds present in the Assessment Area are likely to remain abandoned and that the ecological value of these will remain largely unchanged in future.

Table 8-15 Ecological Value of Pond Area

Criterion	Pond Area within the Project Area	Other Pond Area in the Assessment Area Outside the Project Area
Naturalness	Man-made habitat but with natural features; ponds are either not actively managed for aquaculture of edible fish or have been abandoned for a number of years and are degraded in function and habitat quality.	Man-made habitat but with natural features; ponds to the northwest of the Assessment Area are connected with the continuous and contiguous Deep Bay wetland system.
Size	Small in size within the Project Area (1.2 ha) and small for this habitat type in a Hong Kong context.	Moderate size within the Assessment Area (22.7 ha), but small relative to the area of ponds in the Deep Bay area.
Diversity	Low plant species diversity and structural complexity (20 plant species). Low faunal diversity (14 bird species, 2 amphibian species, 1 reptile species, 10 dragonfly species and 6 butterfly species).	Moderate plant species diversity (78 plant species). Moderate to high bird species diversity (76 birds) but relatively low diversity for other faunal groups (3 amphibian species, 1 reptile species, 19 dragonfly species and 21 butterfly species).
Rarity	A common habitat in the Deep Bay area. 7 bird species and 1 butterfly of conservation importance.	A common habitat in the Deep Bay area. 28 bird species, 1 dragonfly and 1 butterfly of conservation importance.
Re-creatability	Readily re-creatable.	Readily re-creatable.
Fragmentation	Generally low level of fragmentation and connected with adjacent fish ponds in the Deep Bay wetland system.	Most ponds in a single block continuous with the Deep Bay wetlands, although smaller ponds are isolated by villages, agricultural land and infrastructure.
Ecological corridor	Significant linkage with adjacent fish pond system in the Deep Bay Area.	Pond areas within WCA have significant linkage with adjacent fish pond system in the Deep Bay Area and provide an important foraging and resting areas for the waterbirds. Other pond areas show some linkages with adjacent wetlands and agricultural lands.
Potential value	Value would be improved significantly if protected and managed for wildlife.	Value of the pond areas within WCA would be improved significantly if protected and managed for wildlife; limited value for other small, isolated ponds.
Nursery/ breeding ground	Not known to be a significant nursery or breeding area for any species of	No significant nursery or breeding areas known.

Criterion	Pond Area within the Project Area	Other Pond Area in the Assessment Area Outside the Project Area
	importance.	
Age	Not known but probably post-1945.	Not known for the fish ponds/ponds.
Abundance/ richness of wildlife	Low abundance/ richness of wildlife, but includes seven bird species of conservation importance.	Moderate abundance/ richness of birds (include 28 bird species of conservation importance) in pond areas within WCA, low abundance/ richness of wildlife in other pond areas.
Ecological value	**Low to Moderate** (due to the abandoned and degraded pond habitats which reduce bird utilization).	**Moderate to High** (due to importance for bird species of conservation significance).

8.8.4 Marsh/Reed bed Area

Within the Project Area, marsh was identified at Pond 9, with an area of 0.9 ha, and a small area of reed (0.2 ha) is situated at Area 40, which was previously an abandoned pond. This area has been colonized by reed after abandonment of farming practices in the adjacent fields. Pond 9 is located within the WCA boundary and is contiguous with the extensive fish pond network in the Deep Bay wetland system. This marsh has developed from a pond which had been abandoned for many years and had become overgrown with emergent vegetation (dominated by exotic herbaceous vegetation *Typha angustifolia* (40%), *Mikania micrantha* and *Brachiaria mutica* (approx. 60% combined). These species are aggressive and can quickly occupy extensive areas of abandoned or inactive ponds. The formation of extensive blankets of *Mikania micrantha* and *Brachiaria mutica* limits the establishment of other naturally invading plants. The bund vegetation is dominated by grassy vegetation including *Panicum maximum* and *Brachiaria mutica,* common exotic herbaceous species such as *Wedelia trilobata* and *Bidens alba*, and isolated fruit trees *Litchi chinensis.* This marsh supports rather low flora and fauna diversity, with 12 plant species largely comprised of exotic species such as *Brachiaria mutica, Typha angustifolia* and *Bidens alba*, eight bird species, three amphibian species, three dragonfly species and five butterfly species. Of these, four bird species (Little Egret, Chinese Pond Heron, Pintail/Swinhoe's Snipe and White-throated Kingfisher) are of conservation importance (Fellowes *et al.*, 2002), while White-breasted Waterhen *Amaurornis phoenicurus* is wetland dependent..

Marsh/reed bed areas within the Assessment Area (totalling 2.2 ha) include the marshy area (shown as 'Pond' 16 in Figures 8-2a and 8-2b), the reed bed (small reed bed patches adjacent to Pond 3 and Farmland A8) and the marshland with small patches of reed bed mosaic (shown as 'Pond' 5). These marsh/reed bed areas support low diversities of plant (marsh: 13 species; reed bed: four species; marsh/reed bed: 13 species) and fauna (17 bird species, two amphibian species, seven dragonfly species and 16 butterfly species). Of these, three species (Chinese Pond Heron, Pallas's Grasshopper Warbler *Locustella certhiola* and White-cheeked Starling *Sturnus cineraceus*) are of conservation importance; while three other bird species are wetland dependent (White-breasted Waterhen, Common Moorhen *Gallinula chloropus* and Black-browed Reed Warbler *Acrocephalus bistrigiceps*). One butterfly species (Danaid Egg-fly) is listed as a species of Local Concern by Fellowes *et al.* (2002). However, the population of Danaid Egg-fly has since increased and the species is now widespread in Hong Kong (Lo 2005). This species was recorded in 'Pond' 16, with a maximum of 1 individual only.

As a result of natural succession processes, there is a tendency for marshes and reedbeds to progressively become invaded by invasive terrestrial plant species and consequently to dry out and decline in ecological value. The length of time taken for this varies according to the hydrological conditions of the site and the species invading the marsh/reed bed. For the purposes of this impact assessment, a precautionary approach is taken that involves evaluating the current value of this habitat rather than a future, degraded value.

Table 8-16 Ecological Value of Marsh/reedbed Area

Criterion	Marsh/reedbed area within the Project Area	Other marsh/reed bed area in the Assessment Area Outside the Project Area
Naturalness	Man-made habitat but with some natural features; marsh within the Project Area has developed from abandoned pond undergoing natural succession over a number of years but is dominated by exotic species, whereas reedbed area within the Project Area has become established recently following abandonment of farming in the adjacent fields.	Man-made habitat but with some natural features; marsh/reed bed habitat has developed from abandoned ponds undergoing natural succession over a number of years.
Size	Small in size within the Project Area (1.1 ha). Small in size in Hong Kong context.	Very small and scattered within the Assessment Area (2.2 ha).
Diversity	Very low plant species diversity (12 plant species). Low faunal diversity (8 bird species, 3 amphibian species, 3 dragonfly species and 5 butterfly species).	Low plant species diversity (marsh: 13 species; reed bed: 4 species; marsh/reed bed: 13 species). Low faunal diversity (17 bird species, 2 amphibian species, 7 dragonfly species and 16 butterfly species).
Rarity	Reed bed is a common habitat in the Deep Bay Area though areas of freshwater marsh are relatively small and scattered. Four birds of conservation importance.	Reed bed is a common habitat in the Deep Bay Area though areas of freshwater marsh are relatively small and scattered. Three birds and 1 butterfly species of conservation importance.
Re-creatability	Readily re-creatable.	Readily re-creatable.
Fragmentation	Not fragmented in the Project Area and continuous with other wetland habitats.	Scattered marsh/reed bed areas are somewhat fragmented by agricultural fields and developed areas within the Assessment Area.
Ecological corridor	Significant linkage with adjacent pond areas in WCA.	Marsh area (Pond 16) shows significant linkage with the adjacent pond areas to the north western part of the Assessment Area. Other ponds show some weak ecological corridor with adjacent fish ponds, agricultural land and shrubland/grassland habitats.
Potential value	Limited due to small size and high human disturbance, but could be improved if protected and managed for wildlife and human disturbance reduced.	Value of the marsh (Pond 16) within WCA could be improved if protected and managed for wildlife and human disturbance reduced; value for other ponds is very limited due to small size and high human disturbance.
Nursery/ breeding ground	Not known to be a significant nursery or breeding area for any species.	No significant nursery or breeding areas known.
Age	Age of ponds not known but probably became marsh areas within the last decade.	Not known.
Abundance/ richness of wildlife	Abundance and richness of wildlife low, but includes some wetland bird species and wetland bird species of conservation importance.	Abundance and richness of wildlife low but includes some wetland bird species of conservation importance
Ecological value	**Low** in view of small area and dominance of exotic vegetation.	**Low to Moderate**

8.8.5 Seasonally Wet Grassland

Within the Project Area, two patches of seasonally wet grassland (0.7 ha) was identified in the north western corner (adjacent to Pond 9) and at A3. This small area west of Pond 9 is hydrologically connected with the adjacent reed bed via the strip of seasonally wet grassland adjoining Fairview Park, which is located outside of the Project Area. On the other hand, A3

is not connected with any other ponds hydrologically and has been largely colonized by *Ipomoea aquatica* after abandonment of farming practices, potentially from seeds previously sown as an agricultural crop. The seasonally wet grassland within the Project Area supports a very low diversity of plants and is dominated by the exotic grasses *Brachiaria mutica* and *Panicum maximum*. No species from the surveyed fauna groups (bird, herpetofauna, butterfly and dragonfly) were recorded exclusively using this seasonally wet grassland in this survey. However, with its close proximity to the adjacent agricultural fields and grassland/shrubland, this grassland may provide 'stepping stones' for fauna to cross the nearby more open habitats.

In the Assessment Area several small to moderate sized patches of seasonally wet grassland (4.1 ha) were identified (shown as Ponds 2 and 20 in Figures 8-2a and 8-2b, a small area next to Pond 22, a small strip of land south of A5 and adjoining Fairview Park, a small area close to the open storage at the entrance of Palm Springs and an area behind Chuk Yuen Tsuen along Ha Chuk Yuen Road). This habitat is likely to have been derived from natural succession of abandoned agricultural land, ponds and other lower-lying wasteground that retains water during the wet season, or, as in the case in the small area adjoining Fairview Park and A5, from colonization of a stream section which has a shallow bottom. The seasonally wet grassland behind Chuk Yuen Tsuen supports low floristic diversity. The area is largely covered by grass *Panicum maximum* and herbs *Alocasia odora*, *Colocasia esculenta*, *Commelina diffusa* and *Ipomoea aquatica*. The other seasonally wet grassland areas support lower floristic diversity due to their limited sizes. A small number of wetland plant species including sedges *Cyperus distans*, *Torulinium odoratum* and *Fimbristylis nutans*, and other herbs such as *Ludwigia octovalvis*, *Commelina diffusa*, *Colocasia esculenta* and *Mikania micrantha* were recorded in these areas. Dumping of construction waste was observed in the area close to Palm Springs during the survey period.

These seasonally wet grasslands support a low faunal diversity, including four bird species, two reptile species, three amphibian species, 17 dragonfly species and 10 butterfly species. Of these, two birds (Zitting Cisticola and Red-billed Starling *Sturnus sericeus*) are of conservation importance, and one other bird species, White-breasted Waterhen, is wetland dependent. A butterfly species (Danaid Egg-fly) and a dragonfly species (Scarlet Basker) are listed as "Local Concern" by Fellowes *et al.* (2002). However, both populations have since increased and become widespread and common in Hong Kong (Wilson 2004 and Lo 2005).

As with Marsh and Reed bed, there is a tendency for Seasonally Wet Grassland to be colonized by terrestrial plant species under natural succession, and thus lose some of the wetland ecological function.

Table 8-17 Ecological Value of Seasonally Wet Grassland

Criterion	Seasonally wet grassland in the Project Area	Seasonally wet grassland in the Assessment Area Outside the Project Area
Naturalness	Semi-natural successional habitat.	Semi-natural successional habitat.
Size	Small in size within the Project Area (0.7 ha) and within a Hong Kong context.	Small in size within the Assessment Area (totally 4.1 ha).
Diversity	Very low plant species diversity and structural complexity (9 plant species) and no faunal species were recorded exclusively using this area within the Project Area.	Low plant species diversity and structural complexity (50 plant species). Low faunal diversity (4 bird species, 2 reptile species, 3 amphibian species, 17 dragonfly species and 10 butterfly species).
Rarity	Seasonally wet grassland is a common habitat type in Hong Kong.	Seasonally wet grassland is a common habitat type in Hong Kong. Species recorded are common and widespread in Hong Kong, with 2 birds, 1 butterfly and 1 dragonfly species of conservation importance.
Re-creatability	Readily re-creatable if water source can be maintained seasonally.	Readily re-creatable if water source can be maintained seasonally.
Fragmentation	Somewhat fragmented by agricultural	Fragmented by roads, village area and open

Criterion	Seasonally wet grassland in the Project Area	Seasonally wet grassland in the Assessment Area Outside the Project Area
	land.	storage.
Ecological corridor	Some linkages with reed bed/marsh nearby agricultural land and grassland/shrubland	Some linkages with nearby reed bed/marsh, agricultural land and grassland/shrubland.
Potential value	Potential for enhancement for wildlife given proper management practices and resources.	Moderate potential for the area close to Ha Chuk Yuen Road to be enhanced or converted into freshwater marsh with suitable hydrological conditions and vegetation management. Low potential for enhancement of the habitat close to Palm Springs due to frequent human disturbance. Some potential for the small patch adjoining Fairview Park and A5 due to existing ecological corridors and higher flow.
Nursery/ breeding ground	No significant nursery/breeding ground known.	Not a significant nursery/breeding ground.
Age	The area has been recently formed within the last 5 – 10 years.	The area close to Ha Chuk Yuen Road formed within the last 10 – 15 years, while the other areas are formed within the past 5-10 years.
Abundance/ richness of wildlife	Very low abundance and richness of wildlife.	Low abundance and richness of wildlife.
Ecological value	**Low**	**Low**

8.8.6 Stream

Within the Assessment Area, small to moderate-sized streams (a total of 3,420 m in length and covering an area of 0.6 ha) were identified mainly long southern periphery of Palm Springs, within Yau Mei San Tsuen and within the seasonally wet grassland close to Ha Chuk Yuen Road. In addition, small ditches for irrigation purpose are also present in the Project Site as part of the agricultural land.

The stream behind Palm Springs runs close to the northern and eastern periphery of the Project Area and then divides into two stream courses: one passes through Yau Mei San Tsuen and the other passes along the eastern periphery of the Project Area. Both of these streams are somewhat tidal and originate from the east of Castle Peak Road. The stream passing along the periphery of the Project Area is partly concrete-lined along the banks and/or bottom and some portions have gabion lining. It is highly polluted, possibly due to the slow water flow and domestic discharge from Yau Mei San Tsuen village. The stream in Yau Mei San Tsuen retains a semi-natural river bed and is relatively cleaner, but the faunal diversity and abundance is limited by its small dimensions and low flow rate. The stream passing through the seasonally wet grassland near Ha Chuk Yuen Road is a narrow and shallow semi-natural stream with its source from the nearby drainage channel, with low floristic diversity along the banks (dominated by herbs *Brachiaria mutica, Cyclosorus parasiticus,* and *Panicum maximum*, creeper *Wedelia trilobata* and isolated trees *Celtis sinensis, Leucaena leococephala, Melia azedarach* and *Sapium sebiferum*. Due to their small dimensions, low flow rate, gross pollution and high levels of anthropogenic disturbance in surrounding habitats, these streams and small ditches are of low ecological value.

The surveys recorded 23 plant species, three amphibian species, seven dragonfly species and 12 butterfly species. No species of conservation importance were recorded in this survey and all recorded fauna and flora species are common and widespread in the territory.

Table 8-18 Ecological Value of Stream

Criterion	Stream
Naturalness	Anthropogenic habitat with moderate to high pollution level and human disturbance.
Size	Very small in size within the Project Area (0.6 ha) and in a Hong Kong context.
Diversity	Low plant diversity and structural complexity (23 plant species). Low faunal diversity (3 amphibian species, 7 dragonfly species, 12 butterfly species).
Rarity	Polluted streams are relatively common habitat in Hong Kong. Species recorded are common and widespread in Hong Kong.
Re-creatability	Easily re-creatable in its current form.
Fragmentation	Fragmented by the nearby village and residential area.
Ecological corridor	Some ecological corridor with pond areas and seasonally wet grassland.
Potential value	Scope for increased value over time if pollution was reduced significantly, but still constrained by small size and surrounding land use.
Nursery/ breeding ground	Not a significant nursery or breeding ground for wildlife.
Age	Exact age not known. Channelization work probably fairly recent.
Abundance/ richness of wildlife	Low abundance/richness of wildlife but used by some common dragonfly and herpetofauna species.
Ecological value	**Low**

8.8.7 Drainage Channel

Three drainage channels, located in and bordering Fairview Park, along Ha Chuk Yuen Road and the Ngau Tam Mei Drainage Channel, were identified within the Assessment Area. These drainage channels cover a total of 6.3 ha (4.2%) of land. The former two channels are designed as small concrete-lined, low-flow channels of little ecological value. The Ngau Tam Mei Drainage Channel, however, is a trapezoidal, concrete channel with sloped, grasscrete banks to allow the establishment of hydroseeded grass and herbaceous plants. Plant species diversity is low (31 species) and mainly restricted to weedy herbaceous vegetation that is tolerant to regular trimming. Dominant species included exotic grass *Panicum maximum* and *Rhynchelytrum repens* and herbs *Bidens alba, Mimosa pudica* and *Sesbania cannabina*.

At the time of field surveys (September 2007 – August 2008) faunal diversity and abundance in this habitat type were low to moderate, with the Ngau Tam Mei Drainage Channel supporting slightly higher fauna diversity than the other two channels. Overall, 33 bird species, three butterfly species and one amphibian species were recorded in this habitat during the surveys. Of these, nine bird species are species of conservation importance (Grey Heron, Great Egret, Little Egret, Chinese Pond Heron, Little Ringed Plover, Wood Sandpiper *Tringa glareola*, White-throated Kingfisher, Zitting Cisticola and Red-billed Starling) and 8 other bird species are wetland dependent. These species were recorded in low numbers relative to their population in the Deep Bay wetland system.

However, as noted previously, a change in the management regime (allowing tidal ingress and egress) of the Ngau Tam Mei Drainage Channel implemented from the 2008 wet season, has had a marked effect on the utilization of the channel by ardeids and it now supports moderate to large numbers of foraging ardeids at certain tidal stages, especially during the non-breeding season. Overall ecological value of this channel is considered to be moderate as although numbers of ardeids foraging in the channel are relatively high, bird species diversity remains low and habitat is highly modified by human activities.

Table 8-19 Ecological Value of Drainage Channel

Criterion	Drainage Channel in the Assessment Area
Naturalness	Highly modified habitat, some limited natural features.
Size	Moderate size within the Assessment Area (6.3 ha) but small in size in a Hong Kong context.
Diversity	Low plant species diversity (31 species) and structural complexity. Low to moderate faunal diversity (33 bird species, 3 butterfly species and 1 amphibian species).
Rarity	A common habitat in Hong Kong, nine bird species of conservation importance.
Re-creatability	Readily re-creatable.
Fragmentation	Somewhat fragmented from the Deep Bay wetland system by adjacent land use (residential estates).
Ecological corridor	Downstream linkage to the Deep Bay wetland system.
Potential value	Some scope for increase in value if pollution loads decrease, but limited by management regime.
Nursery/ breeding ground	Not a significant nursery or breeding area but may be used to a limited extent as a feeding area by breeding egrets.
Age	Drainage channel in Fairview Park has been present for more than 20 years. The other two channels were completed within the past 10 years.
Abundance/ richness of wildlife	Ngau Tam Mei Channel supports moderate richness of wildlife and moderate to high numbers of ardeids; abundance and richness of wildlife both low for the other two channels.
Ecological value	**Low** (Drainage channel in Fairview Park and along Ha Chuk Yuen Road) and **Moderate** (Ngau Tam Mei Drainage Channel).

8.8.8 Secondary Woodland

A small secondary woodland patch is located on the hill behind the residential estate Green Crest within the Assessment Area. Due to its small size (0.6 ha), high levels of disturbance and fragmentation from the neighbouring residential area, this woodland has much simpler floristic structure and species diversity compared to many other secondary woodlands elsewhere in Hong Kong. This small woodland patch exists as a matrix of native and exotic trees and fruit tree stands (*Acacia confuse, Acacia auriculiformis, Casuarina equisetifolia*, *Macaranga tanarius* and *Trema tomentosa*), with low diversity of understorey vegetation. Fauna surveys were not conducted in this habitat because it shows no ecological corridor to the Project Area, therefore ecological impacts are very unlikely.

Natural succession would usually result in an increase in the value of woodland in the longer term, as species colonise the habitat. In this case, the small size of the woodland and the isolation from similar woodland habitat means that there is little scope for a significant increase in ecological value.

Table 8-20 Ecological Value of Secondary Woodland

Criterion	Secondary woodland in the Assessment Area
Naturalness	Semi-natural habitat with a high proportion of exotic trees and fruit trees with a low diversity of native understorey.
Size	Very small size within the Assessment Area (0.6 ha) and in Hong Kong context.
Diversity	Low species diversity and structural complexity (11 plant species); structural complexity would improve through time. Faunal diversity expected to be lower than in many woodlands elsewhere in Hong Kong.
Rarity	A common habitat in Hong Kong.
Re-creatability	Readily re-creatable due to low complexity of floristic structure, although trees need time to grow to achieve their full functions.
Fragmentation	Fragmented by villages and infrastructure.
Ecological corridor	Some linkage with adjacent plantation stand and hillside grassland; may provide "stepping stones" and refuges for woodland fauna.
Potential value	Ecological value will increase slowly with time if undisturbed, but value is limited by small size of woodland.
Nursery/ breeding ground	Not a significant nursery or breeding ground for wildlife.
Age	Probably fairly recently established.
Abundance/ richness of wildlife	Abundance or diversity of wildlife is low to moderate.
Ecological value	**Low**

8.8.9 Plantation

No plantation area was identified in the Project Area, but a total of 4.6 ha (3.2%) is present within the Assessment Area. This habitat includes roadside plantations of tall and mature trees planted for screening purpose along roads, and scattered small fruit tree plantations within the village area and developed area. The plant species diversity and abundance within these habitat patches are moderate (71 plant species), but largely consists of exotic species for landscaping and visual screening purposes. Roadside plantations are dominated by tree species included native *Ficus microcarpa, Hibiscus tiliaceus, Celtis sinensis* and exotic *Accia confusa, Casuarina equisetifolia, Delonix regia, Melaleuca quinquenervia* and *Eucalyptus citrriodora*, shrub including *Calliandra hamatocephala, Duranta erecta, Hibiscus rosa-sinensis* and *Rhododendron pulchrum.* Plantations in the village environ comprised largely *Dimocarpus longan, Mangifera indica, Eriobotrya japonica* and *Syzygium jambos*. Floristic diversity of the understorey is usually low and limited to several common native herb and woody species (such as *Celtis sinensis, Ligustrum sinense, Sterculia lanceolata* and *Zanthoxylum avicennae* and herbs *Alocasia odora* and *Solanum nigrum*). Fauna surveys revealed low faunal diversity in these plantation areas, with six butterfly species recorded in this survey. No species of conservation importance was recorded in this habitat type. Among the 32 bird species recorded in village area (mainly in Yau Mei San Tsuen) within the Assessment Area, a few were recorded in the small patches of plantation within villages.

As in secondary woodland, there is a tendency for plantations to increase in ecological value as new species colonise from elsewhere. Within the Assessment Area, however, this habitat is very disturbed and fragmented and is not functionally linked to other woodland of ecological value; consequently there is little scope for improvement in ecological value under natural processes.

Table 8-21 Ecological Value of Plantation

Criterion	Plantation along roads, infrastructure or within village in the Assessment Area
Naturalness	Anthropogenic habitat dominated by exotic species.
Size	Small and usually linear in shape within the Assessment Area (4.6 ha). Very small in size in Hong Kong context.
Diversity	Moderate floristic diversity and abundance (71 plant species), with little scope for improvement due to regular maintenance. Low faunal diversity (6 butterfly species and a small number of bird species from the neighbouring village area).
Rarity	Very common habitat in Hong Kong.
Re-creatability	Re-creation is simple but trees take time to grow.
Fragmentation	Highly fragmented as most plantation stands are along the road and around infrastructure.
Ecological corridor	Limited ecological corridors between roadside plantation and other habitat types due to size and anthropogenic influences.
Potential value	Little scope for increase in ecological value of roadside plantation due to intense management regime. Plantation within village may undergo succession slowly if undisturbed but value constrained by small size and level of disturbance.
Nursery/ breeding ground	Not a significant nursery or breeding ground for wildlife.
Age	Roadside plantation relatively young (around 20 years); fruit tree plantation in village at least 20 – 30 years old.
Abundance/ richness of wildlife	Low abundance and richness of wildlife utilization.
Ecological value	**Very low to Low**

8.8.10 Grassland/Shrubland

A small patch of grassland/shrubland (0.2 ha) was identified within the Project Area. However, this habitat type covers an area of 14.0 ha (9.8%) within the Assessment Area. Two moderately sized grassland/shrubland areas are located to the southwest of the Project Area and south of Kam Pok Road, several small areas are scattered within the village and open storage to the east and southeast of the Project Area, and an area is located to the east of the San Tin Highway. These areas support higher floral and faunal diversity and abundance than the grassland/shrubland habitats within the Project Area, with 87 plant species, 33 bird species, seven amphibian species, one reptile species, eight dragonfly species and 23 butterfly species recorded, mostly in the grassland/shrubland mosaic to the west of the Project Area. Four bird species (Grey Heron, Little Egret, Chinese Pond Heron and Red-billed Starling) and one butterfly species (Danaid Egg-fly) are species of conservation importance (Fellowes *et al.* 2002); while two additional bird species (White-breasted Waterhen and Oriental Reed Warbler *Acrocephalus orientalis*) and all dragonfly species are wetland-dependent., All fauna were recorded in very small numbers relative to their Hong Kong populations. The habitat within the Assessment Area supports moderate floristic diversity but is largely covered by grassy vegetation, exotic creepers, herbs and trees that could covered an abandoned land in short period. Other recorded native species are generally common to very common species that are widespread throughout the territory. Roadside shrub mix are dominated by native and exotic ornamental shrubs including *Calliandra haematocephala, Melastoma candidum* and *Rhodomyrtus tomentosa* and grass *Cynodon dactylon* and *Panicum maximum,* shrubs *Rhaphiolepis indica, Ricinus communis* and *Solanum torvum* and woody species *Leucaena leucocephala, Sapium sebiferum* and *Schefflera heptophylla.*

Table 8-22 Ecological Value of Grassland/Shrubland

Criterion	Grassland/Shrubland in the Project Area	Grassland/Shrubland in the Assessment Area Outside the Project Area
Naturalness	Semi-natural habitat maintained by regular management.	Natural successional habitat from abandoned agricultural land, filled ponds and wasteground.
Size	Very small (0.2 ha) within the Project Area and in a Hong Kong context.	Small to moderate in size within the Assessment Area (14.3 ha) but small in a Hong Kong context.
Diversity	Very low floral and faunal diversity and structural complexity.	Moderate plant species diversity (87 plant species). Low to moderate faunal diversity (33 bird species, 7 amphibian species, 1 reptile species, 8 dragonfly and 23 butterfly species).
Rarity	Very common habitat type in Hong Kong. Very low abundance of a few species of conservation concern, including 4 bird and 1 butterfly species.	Very common habitat type in Hong Kong. Very low abundance of a few species of conservation concern, including 4 bird and 1 butterfly species.
Re-creatability	Readily re-creatable.	Readily re-creatable.
Fragmentation	Linked with the grassland/shrubland to the west.	Somewhat fragmented.
Ecological corridor	Some linkages with nearby grassland/shrubland and agricultural land.	Some linkages with nearby agricultural land and ponds.
Potential value	Low potential for enhancement due to size and location.	Some limited scope for succession to shrubland for the larger habitat patches to the west of the Project Area and south of Kam Pok Road. Low potential for enhancement of roadside ornamental shrub mix.
Nursery/ breeding ground	Not a significant nursery or breeding area.	Not a significant nursery or breeding area.
Age	Habitat patches have developed relatively recently.	Habitat patches have developed relatively recently.
Abundance/ richness of wildlife	Very low abundance/richness of wildlife.	Low to moderate abundance/richness of wildlife.
Ecological value	**Very Low**	**Low**

8.8.11 Village Area

Village area includes individual flats and/or apartments in Yau Mei San Tsuen, Yau Tam Mei San Tsuen, Chuk Yuen Tsuen and Tai Yuen Villa, all situated along Castle Peak Road. No village area is located within the Project Area, while 9.9 ha (6.5%) is found within the Assessment Area. Diversity of plants is moderate, with a total of 69 species recorded. Plant composition is dominated by ornamental plants heavily managed by residents, with a few common species of plant naturally established (*Amaranthus viridis, Brachiaria mutica, Pennisetum purpureum, Oxalis corniculata* and woody plants such as *Leucaena leucocephala, Ligustrum sinense, Ricinus communis* and *Zanthoxylum avicennae*). Faunal use of this habitat type within the Assessment Area is low and includes 32 bird species, one reptile species, four amphibian species, five dragonfly species and six butterfly species. The majority of bird species were found in Yau Mei San Tsuen, adjacent to the Project Area. Only one of these, Chinese Pond Heron, is of conservation importance, and numbers of this species were very low relative to the total population in the Deep Bay Area (single individuals recorded on few occasions). Other recorded faunal species are common and widespread in the territory and they were present in low abundance within the Assessment Area. One butterfly species, Danaid Egg-fly, is listed as a species of Local Concern by Fellowes *et al.* (2002), although this species is now widespread in Hong Kong (Lo 2005).

Table 8-23 Ecological Value of Village Area

Criterion	Village Area in the Assessment Area
Naturalness	Anthropogenic habitat.
Size	Small to moderate sized habitats within the Assessment Area (9.9 ha), but small within a Hong Kong context.
Diversity	Moderate plant diversity but simple structural complexity (69 plant species) dominated by exotic ornamental plants with heavy human management. Moderate bird diversity (32 bird species) but low for other faunal groups (1 reptile species, 4 amphibian species, 5 dragonfly species and 6 butterfly species).
Rarity	A very common habitat in Hong Kong, with only one bird (Chinese Pond Heron) and one butterfly species (Danaid Egg-fly) of conservation importance.
Re-creatability	Readily re-creatable.
Fragmentation	Already highly fragmented habitat.
Ecological corridor	No significant ecological corridor with other habitats.
Potential value	Limited potential due to disturbance.
Nursery/ breeding ground	Not a significant nursery/breeding ground.
Age	Exact age unknown, but mostly over 20 years.
Abundance/ richness of wildlife	Low abundance and diversity of wildlife.
Ecological value	**Low**

8.8.12 Wasteground

Wasteground occurs as a result of land which has been cleared prior to construction work or as a dumping ground for fill/waste materials. Initially these areas have very little ecological value but, if suitable substrate is left undisturbed, vegetation succession can occur. No wasteground was identified within the Project Area but a total of 0.5 ha (0.3%) is present within the Assessment Area. As is typical of this habitat, the floral community was poorly developed, supporting only 19 plant species, most of which are exotic and very common in the territory, including herbs *Panicum maximum, Bidens alba*, *Conyza sumatrensis*, *Ipomoea cairica*, *Mikania micrantha, Rhynchelytrum repens* and naturally established tree *Leucaena leucocephala, Macaranga tanarius* and *Bombax ceiba*. Faunal surveys were not conducted in this habitat since the wasteground is located along roads or nearby village areas and shows no ecological corridor to the Project Area.

Although there is a tendency for wasteground to be colonized by new species under natural succession, the potential for this is limited as a result of the poor soil quality; furthermore, within the Assessment Area this habitat is relatively small in area and fragmented, and it is not expected that there will be a significant increase in ecological value.

Table 8-24 Ecological Value of Wasteground

Criterion	Wasteground in the Assessment Area
Naturalness	Anthropogenic habitat; progressively more natural with time.
Size	Small blocks within the Assessment Area (0.5 ha) and in Hong Kong context.
Diversity	Low species diversity and simple structural complexity (19 plant species). No faunal groups were recorded.
Rarity	A common habitat in Hong Kong.
Re-creatability	Readily re-creatable.
Fragmentation	Somewhat fragmented by infrastructural development and village.
Ecological corridor	No significant ecological corridor with other habitats.
Potential value	Limited potential value if not managed; natural succession for plants can eventually take place in the absence of human activity.
Nursery/ breeding ground	Not a significant nursery/breeding ground.
Age	Most wasteground within the Assessment Area has been created within the past 5-10 years.
Abundance/ richness of wildlife	Low abundance and diversity of wildlife.
Ecological value	**Very low to Low**

8.8.13 Developed Area/ Road/ Open Storage

No developed area, road or open storage is present within the Project Area, while the majority of land within the Assessment Area was covered by these uses (73.4 ha, 48.4%). These urbanized areas, include the residential estates (Fairview Park, Palm Springs, Royal Palms, Casa Paradizo and Green Crest), communal facility (Chuk Yuen Floodwater Pumping Station), road infrastructure (San Tin Highway, Castle Peak Road, Yau Pok Road and Kam Pok Road), a small number of concrete paths near villages, ponds and Ngau Tam Mai Drainage Channel, and open storage close to Palm Springs and opposite to Chuk Yuen Tsuen.

The ecological values of these habitat types are generally low due to the high level of disturbance by anthropogenic factors and the dominance of exotic plant species. Shrubby planting of ornamental species and low number of isolated trees species were recorded along the road habitat. Overall, developed areas, road (including roadside plantation) and open storage support a total of 78, 39 and 30 plant species, which are largely planted and managed for ornamental or screening purposes, such as *Acacia confusa*, *Albizia lebbeck*, *Bauhinia blakeana*, *Casuarina equisetifolia* and *Melaleuca quinquenervia*, or naturally established exotic species such as *Bidens alba*, *Panicum maximum*, *Rhynchelytrum repens* and *Sesbania cannabina*. The understorey of these area include naturally established herbs such as *Panicum maximum, Ipomoea cairica* and *Bidens alba,* and woody plants such as *Ficus hispida, Macaranga tanarius, Leucaena leucocephala* and *Schefflera heptaphylla*.

Faunal diversity found in these highly disturbed and modified habitats is very low, including one amphibian species (Brown Tree Frog) and five butterfly species. None of the species recorded are of conservation importance and/or wetland dependent.

Table 8-25 Ecological Value of Developed Area/Road/Open Storage

Criterion	Developed Area/ Road/ Open Storage in the Assessment Area
Naturalness	Anthropogenic habitat.
Size	Large in size within the Assessment Area (totally 73.4 ha covering developed area/road/open storage) but moderate in size in Hong Kong context.
Diversity	Very low structural complexity and moderate species diversity (78, 39 and 30) plant species for developed area, road and open storage respectively). Very low faunal species diversity (1 amphibian species and 5 butterfly species), all of which are common and widespread

Criterion	Developed Area/ Road/ Open Storage in the Assessment Area
	species.
Rarity	A very common habitat in Hong Kong. No species of conservation importance was recorded.
Re-creatability	Readily re-creatable.
Fragmentation	Already highly fragmented.
Ecological corridor	No significant ecological corridor with other habitats.
Potential value	No potential for increase in value due to high human impact and disturbance.
Nursery/ breeding ground	Not a significant nursery/breeding ground.
Age	Main residential estates and public facility were developed in early 1990s, while the road infrastructure and open storage has been established over the past 20 years.
Abundance/ richness of wildlife	Very low abundance and diversity of wildlife commensal with human activity.
Ecological value	**Very low**

8.9 Assessment Methodology for Potential Ecological Impacts

The potential ecological impacts of the proposed comprehensive development are evaluated under the following protocol. A series of development options and draft Master Layout Plans for the Project Area were prepared and reviewed relative to the ecological survey findings and feedback from CPI meetings (see details in Chapter 2). Whilst it is normal practice to evaluate the potential ecological impacts in the absence of mitigation, some protection measures are enshrined within the current zoning of OU(CDWPA) in which the continuous and contiguous fish ponds are protected and enhancement measures for the area to be included as part of the EIAO process in the form of a wetland restoration plan.This approach is described as Option B in **Section 2** (of the submitted EIA report). Additional ecological impacts and ecological enhancement measures were identified and evaluated, and the results of these are presented in **Section 8.10**. The potential ecological impacts were categorized as the following:

- Direct loss of habitats of ecological importance, either permanent or temporary and may occur on-site and/or off-site, due to construction works;
- Direct impacts to flora and fauna species of conservation importance, including reduction of species abundance and diversity;
- Indirect loss of habitat of ecological importance, either permanent or temporary, due to construction works;
- Indirect impacts to fauna species of conservation importance during both the construction and operational phases of the project, including disturbance impacts, loss or reduction of ecological corridors and functions, habitat fragmentation and impact to bird flight lines due to residential building heights;
- Potential bird collision impact with new structures;
- Indirect impact (pollution) on watercourses in Deep Bay;
- Cumulative and fragmentation impacts.
- For the purposes of the impact assessment, the conditions as presented in the report are used as a baseline against which potential impacts are assessed, but the potential changes in ecological value as described in the habitat evaluations are also considered when assessing the significance of impacts to each habitat. Though there are several potential futures for any site under different management objectives (such as for farming, for wildlife or for development), for the purpose of the current report, only the

latter is relevant. Hence, the impact evaluation in this section concerns only the scenario whereby the site would be developed in accordance with the planning intention of OU(CDWPA), i.e. all the existing continuous and contiguous fish pond in the Project Area will not be developed (Option B) This option forms the basis to identify, and where possible, quantify all potential impacts arising from development of the site. Measures are proposed to mitigate for these impacts by avoidance, minimization and/or compensation; many of these mitigation measures have already been taken into account during the site layout evaluation process, and have led to the final recommended site layout. Details of the mitigation measures (including those incorporated during the site layout evaluation process) are discussed in ***Section 8.11***.

8.10 Identification of Ecological Impacts

8.10.1 Direct Habitat Loss due to the Project

The Project Area covers a total of 8.1 ha of land which is mainly comprised of human-dominated habitat types including agricultural land (4.9 ha), pond area (1.2 ha), marsh (0.9 ha), reed bed (0.2 ha), grassland/ shrubland (0.2 ha), and seasonally wet grassland (0.7 ha). As detailed in **Section 8.9**, the impact assessment methodology requires an initial assessment of all potential impacts within the Project Area, under the current zoning of OU(CDWPA thus the provision of a wetland restoration area (under Option B in Section 2) is used as the baseline for identification of ecological impacts. It should be noted that under the layout option identified in Section 2 (layout option C), mitigation measures are adopted to avoid or minimize habitat loss such that not all habitats would be impacted; details of this mitigation are provided in Section 8.10. Assessments of the potential direct impacts on all habitat types identified within the Project Area are based on the assumption that the Project Area would be developed in accordance with the planning intention of OU(CDWPA) zoning (i.e. all existing continuous and contiguous fish ponds would be conserved), and findings are outlined in **Table 8-26- Table 8-30**.

Table 8-26 Potential direct ecological impacts to agricultural land, within the Project Area under Option B without further mitigation measures

Criteria	Impacts to agricultural land
Habitat Quality	Low to moderate (active management of agriculture, but some fields may be left fallow and/or allowed to flood).
Species	Low plant species diversity and abundance (30 plant species). Moderate bird diversity (48 species) and low diversity for other faunal groups (2 reptile species, 7 amphibian species, 7 dragonfly species and 10 butterfly species). Most species common and widespread in Hong Kong but 14 wetland-dependent bird species and fifteen bird species of conservation importance. One reptile of Potential Regional Concern (Many-banded Krait). One butterfly species of conservation importance.
Size/ Abundance	Small area (4.9 ha) to be lost to development. Overall faunal abundance is low, although moderate abundance of Red-throated Pipit (up to 30 individuals), Little Ringed Plover (up to 25 individuals) and Ornate Pigmy Frog (more than 50 individuals).
Duration	Habitat loss would be permanent due to requirement to maintain the site according to the approved plan.
Reversibility	Habitat loss to developed land would be irreversible.
Magnitude	Small as area to be lost is small in a Hong Kong context.
Overall Impact Severity without Mitigation	Impacts to agricultural land of **Low to Moderate Significance,** primarily because of loss of ecological function of the suitable habitats for bird species of conservation importance.

Table 8-27 Potential direct ecological impacts to pond areas within the Project Area under Option B without further mitigation measures

Criteria	Impacts to pond area
Habitat Quality	Low to moderate (abandoned/ not actively managed ponds that have degraded in function and quality for a number of years).
Species	Low plant species diversity and simple structural complexity (20 plant species). Low faunal diversity and abundance (especially for birds) relative to similar habitats nearby in Deep Bay wetland system. Faunal diversity include 14 bird species, 2 amphibian species, 1 reptile species, 10 dragonfly species and 6 butterfly species. Seven bird species and one butterfly of conservation importance.
Size/ Abundance	Small area (1.2 ha) within the Project Area. Faunal abundance low, and populations probably reliant on the nearby Deep Bay wetland system.
Duration	No fish pond would be lost (all conserved as part of wetland restoration area permanently).
Reversibility	No fish pond would be lost (all conserved as part of wetland restoration area permanently).
Magnitude	Low as area is small.
Overall Impact Severity without Mitigation	No adverse impact is predicted as all areas will be enhanced and managed for wildlife as part of the zoning requirement of the site. This is considered a **Moderate Ecological Gain**,

Table 8-28 Potential direct ecological impacts to marsh areas within the Project Area under Option B without further mitigation measures

Criteria	Impacts to marsh
Habitat Quality	Low (abandoned pond that has undergone natural succession to marshy habitat).
Species	Very low plant species diversity at marsh (12 plant species) and simple structural complexity due to the dominance of the weedy exotic plants. Faunal diversity and abundance very low, including 8 bird species, 3 amphibian species, 3 dragonfly species and 5 butterfly species. Four bird species of conservation importance.
Size/ Abundance	Small in size (0.9 ha) to be lost permanently. Faunal abundance very low.
Duration	Habitat would be lost permanently to fish ponds as part of the wetland restoration area.
Reversibility	Habitat loss would be irreversible due to active management as converted fish pond area in the wetland restoration area.
Magnitude	Low as area is small.
Overall Impact Severity without Mitigation	No adverse impact is predicted as all areas will be enhanced and managed for wildlife as part of the zoning requirement of the site, and active removal of highly exotic species such as *Typha*. This is considered a **Low to Moderate Ecological Gain**,

Table 8-29 Potential direct ecological impacts to seasonally wet grassland areas within the Project Area under Option B without further mitigation measure

Criteria	Impact to seasonally wet grassland
Habitat Quality	Low (abandoned pond/ low-lying habitat that has undergone natural succession to seasonally wet grassland)
Species	Very low plant species diversity (9 plant species). Very low faunal diversity recorded.
Size/ Abundance	Small within the Project Area (0.7 ha) and in Hong Kong context. Faunal abundance is very low.
Duration	Habitat would be lost permanently to fish pond or other wetland habitat to be managed as part of the wetland restoration area..
Reversibility	Habitat loss would be irreversible due to active management as converted fish pond or other wetland area in the wetland restoration area.
Magnitude	Low as area is small.
Overall Impact Severity without Mitigation	No adverse impact is predicted as all areas will be enhanced and managed for wildlife as part of the zoning requirement of the site. This is considered a **Low to Moderate Ecological Gain**,

Table 8-30 Potential direct ecological impacts to reedbed within the Project Area under Option B without further mitigation measure

Criteria	Impact to reed bed
Habitat Quality	Low (abandoned pond/ low-lying habitat that has undergone natural succession to reed bed)
Species	Very low plant species diversity (dominated by *Phragmites australis*). Very low faunal diversity recorded.
Size/ Abundance	Very small within the Project Area (0.2 ha) and in Hong Kong context. Faunal abundance is very low.
Duration	Habitat loss would be permanent.
Reversibility	Habitat loss would be irreversible.
Magnitude	Low as area is small.
Overall Impact Severity without Mitigation	Impacts to reedbed of **Low Significance** as habitat is of low ecological value and use by wildlife is limited.

Table 8-31 Potential direct ecological impacts to grassland/shrubland within the Project Area under Option B without further mitigation measure

Criteria	Impact to grassland/shrubland
Habitat Quality	Very Low
Species	Very low plant and faunal diversity.
Size/ Abundance	Very small within the Project Area (0.2 ha) and in Hong Kong context. Faunal abundance is very low.
Duration	Habitat loss would be permanent.
Reversibility	Habitat loss would be irreversible.
Magnitude	Initial assessment considers the loss of all existing habitat.
Overall Impact Severity without Mitigation	Impacts to grassland/shrubland of **NegligibleSignificance**.

8.10.2 Direct Impacts to Species of Conservation Importance due to the Project

8.10.2.1 Vegetation

Development within the development footprint will result in entire vegetation clearance, whereas the vegetation component in the remaining area will change in the event of no active management and through the event of natural succession. A total of 49 plant species was recorded within the Project Area, all of which are of low ecological value and most of which (22 species) are widespread exotic species in Hong Kong. Since no floral species of conservation importance were recorded and all species are common and widespread, ecological impacts to vegetation from development of the Project Area are considered to be **negligible**.

8.10.2.2 Mammals

No mammal species were recorded in the faunal surveys during the survey period, although two common bat species (Short-nosed Fruit Bat and Japanese Pipistrelle) are known to roost in small numbers nearby at Palm Springs, and may forage within the Project Area. Both species are very common and widespread in Hong Kong (Shek 2006) and are often found close to human activity; impacts are therefore considered to be of **very low significance**.

8.10.2.3 Birds

A total of 52 bird species was recorded within the Project Area, including 18 species of conservation importance (Fellowes *et al.* 2002). No bird species were recorded in significant numbers in relation to the Deep Bay populations. Of the species recorded, a flock of Red-throated Pipits (up to 30 individuals) was recorded throughout the winter and moderate numbers of some other species (up to 18 Little Egrets, nine Chinese Pond Herons and 25 Little Ringed Plovers) were present when suitable conditions (e.g. low-lying, short-vegetation or watered fields) were available in the agricultural land. These species are known to breed in Deep Bay Area, but were recorded in very low to low numbers in the Project Area during the peak breeding season. Between late May and early July 2008, only one Little Egret, two Chinese Pond Herons and four Little Ringed Plovers were recorded, suggesting that the area is not an important foraging area for these species during this time of year. Up to nine Chinese Pond Herons were recorded in March 2008 and 18 Little Egrets in July 2008. Although ardeids breed during these months in Hong Kong, these observations were at the limit of the breeding season (generally recognized to be March – July) and may have involved non-breeding birds. The very low numbers during the peak of the breeding season (May and June) suggests that few breeding birds forage at the site (see further elaboration in "Egretries and Breeding Season Egret Flight Lines" under Section 8.10.3.3). Greater Painted-snipe was recorded in small numbers; this species has a localised distribution in Hong Kong and suitable breeding habitat is available in the Assessment Area. Potential ecological impacts to these birds are outlined in **Table 8-32**.

Table 8-32 Potential direct ecological impacts to birds of conservation importance within the Project Area under Option B with no further mitigation measures

Criteria	Direct ecological impacts to birds of conservation importance
Species	18 bird species of conservation importance were recorded within the Project Area (maximum count in parentheses), including: Grey Heron (2), Great Egret (1), Little Egret (18), Chinese Pond Heron (9), Black-crowned Night Heron (1), Yellow Bitten (1), Greater Painted-snipe (2), Little Ringed Plover (25), Wood Sandpiper (2), Pintail/Swinhoe's Snipe (3), White-throated Kingfisher (1), Red-throated Pipit (30), Zitting Cisticola (4), Yellow-billed Grosbeak (1), Red-billed Starling (5), Daurian Starling (1), White-cheeked Starling (1) and White-shouldered Starling (12).
Protection Status	All wild birds are protected under Cap 170 in Hong Kong.
Distribution	None of the species are considered to be restricted in range.
Rarity	Most of the species of conservation importance recorded are common and widespread in the Deep Bay area but are relatively uncommon or rare elsewhere in Hong Kong. Species are listed in Fellowes *et al*. (2002) as: Global Concern: Red-billed Starling (though a listing of "Regional Concern" is considered more appropriate as it is no longer listed as of global conservation concern by IUCN due to population increase of the species); Potential Regional Concern: Grey Heron, Great Egret, Little Egret, Chinese Pond Heron, White-cheeked Starling; Local Concern: Black-crowned Night Heron (breeding population), Yellow Bittern (breeding population), Greater Painted-snipe, Little Ringed Plover (breeding population), Wood Sandpiper, Swinhoe's Snipe, White-throated Kingfisher (breeding population), Red-throated Pipit, Zitting Cisticola, Yellow-billed Grosbeak, White-shouldered Starling (breeding population) and Daurian Starling.
Abundance	Numbers of most species present in the Project Area are very small in comparison to Deep Bay populations. Low to moderate numbers of Little Ringed Plover and Red-throated Pipit were recorded, although both are widespread and common around Deep Bay and, though Little Ringed Plover breeds in Hong Kong, only small numbers were recorded on site during the peak breeding season and it was not thought to breed there. Though numbers of Greater Painted-snipe recorded in the Project Area were small and there was no evidence that it breeds there (maximum of only two birds), there is suitable breeding habitat nearby. This species has a small breeding population in Hong Kong which is threatened by habitat loss.
Duration	Impacts to species which utilize the agricultural land would be permanent since the existing habitats would be lost, while impacts to species which utilize fish pond, marsh and seasonally wet grassland would be confined to the construction of the wetland restoration area.

Criteria	Direct ecological impacts to birds of conservation importance
Reversibility	Loss of agricultural land to development would be permanent and irreversible, while temporary loss of fish ponds, seasonally wet grassland and marsh due to construction of the wetland restoration area would be reversible.
Magnitude	Magnitude of impacts for most of the bird species would be low because their numbers of individuals are small in relative to Deep Bay populations and alternative sites are available locally.
Overall Impact Severity without Mitigation	Impacts to Little Egret, Chinese Pond Heron are of **Low Significance** due to provision of wetland restoration area. Impacts to Greater Painted-snipes and Red-throated Pipit are considered to be of **Low to Moderate Significance** due to loss of agricultural land, seasonally wet grassland and marsh habitat. Impacts to Little Ringed Plover are considered to be of **Low Significance** because the evaluation as a species of conservation concern refers to breeding populations whereas most individuals (up to 25 on one survey) were recorded during the non-breeding season and there was no evidence of breeding on site. Impacts to other bird species are of **Very Low to Low Significance**.

8.10.2.4 Herpetofauna

In general, the diversity and abundance of herpetofauna species recorded in the surveys was low, with only three reptile species and eight amphibian species recorded within the Project Area. The only species of conservation importance was a single Many-banded Krait observed in an active agricultural field during a night-time survey in the wet season; this species is regarded as vulnerable in China (Zhao 1998) and is considered by Fellowes *et al.* (2002) to be of Potential Regional Concern, although it is widespread and common in a variety of terrestrial habitats in Hong Kong (Chan *et al.* 2005). Impacts to this species are considered to be of Low Significance because only a single individual of this widespread species was recorded.

Moderate numbers of seven amphibian species were recorded during the night-time surveys in the wet season. This included more than 50 individuals of Ornate Pigmy Frog recorded in the agricultural fields within the Project Area. The presence of open, earthen ditches with some riparian vegetation around the agricultural field provides good concealment for amphibians, which breed in wet fields or ditches (Karsen *et al.* 1998). Since these are non-vagile species (species which cannot readily re-locate themselves to favourable habitats which are cut off by anthropogenic features), and their habit of burying themselves in soft substrate; the loss of favourable habitats is likely to result in direct mortality to the population on-site. However, none of the species recorded on-site are of particular conservation concern, and no long term adverse ecological impact to amphibian population is predicted.

8.10.2.5 Dragonfly

Twelve dragonfly species were recorded within the Project Area, the majority of which were found around the agricultural land (seven species) and pond areas (ten species). Of these, Coastal Glider was considered by Fellowes *et al.* (2002) to be of Local Concern. Despite being uncommon and localised in Hong Kong, this species is one of the most widespread and common dragonfly species in the world (Wilson 2004). A single individual of Coastal Glider was observed around agricultural land within the Project Area during the surveys. In view of the very large global population, and the very small population level at Yau Mei San Tsuen, impacts to this species are considered to be of negligible to very low significance.

8.10.2.6 Butterfly

Fifteen butterfly species were recorded within the Project Area. The only species of conservation importance was Danaid Egg-fly, considered by Fellowes *et al.* (2002) to be of Local Concern, two individuals of which was recorded during surveys. This species has increased since publication of Fellowes *et al.* (2002), and is now widespread throughout Hong Kong (Lo 2005). The larval food plants of this species include *Portulaca oleracea* (Bascombe *et al.* 1999) and woody species of Hibiscus (Chou 1999), both of which were recorded in the Assessment Area. Since the larval food plants are not present within the

Project Area and very few individuals were recorded, ecological impacts to Danaid Egg-fly are considered to be of negligible to very low significance.

8.10.2.7 Fish

Fish present in the drainage ditches within the agricultural land comprised small numbers of very common, widespread species, most of which are not native to Hong Kong. Impacts to these fish populations are considered to be negligible.

Table 8-33 Potential direct ecological impacts to herpetofauna, dragonfly and butterfly species of conservation importance within the Project Area under Option B and without further mitigation measures

Criteria	Direct impacts on herpetofauna species of conservation importance	Direct impacts on amphibian diversity and local population	Direct impacts on dragonfly species of conservation importance	Direct impacts on butterfly species of conservation importance
Species	1 species of reptile, Many-banded Krait, is listed by Fellowes *et al.* (2002) as of Potential Regional Concern.	7 amphibian species recorded. None of them are of conservation concern.	1 species, Coastal Glider, is listed by Fellowes *et al.* (2002) as of Local Concern.	1 species, Danaid Egg-fly, is listed by Fellowes *et al.* (2002) as of Local Concern.
Protection Status	Not protected.	Not protected.	Not protected.	Not protected.
Distribution	The species is widespread and common in terrestrial habitats in Hong Kong.	Species recorded are widespread in the New Territories in Hong Kong.	This species is found in the New Territories in Hong Kong but widespread in a global context.	This species has a very wide range (Bascombe 1999), and the population in Hong Kong has increased since the publication of Fellowes *et al*. 2002.
Rarity	Many-banded Krait is uncommon in China but is widespread in Hong Kong (Chan *et al.* 2005).	Species recorded are common and widespread in the New Territories in Hong Kong.	Coastal Glider is uncommon in Hong Kong but is globally very widespread (Wilson 2004).	Danaid Egg-fly was formerly scarce but has become widespread in Hong Kong in recent years.
Abundance	A single individual of Many-banded Krait recorded during the survey period.	Moderate abundance of amphibians, in particular, the Ornate Pigmy Frog (>50 individuals), was recorded on the surveys.	A single Coastal Glider recorded within the Project Area.	Very small number of Danaid Egg-fly recorded within the Project Area (totally 2 individuals recorded during the survey period).
Duration	Impacts would be permanent since the existing habitats would be lost.	Impacts would be permanent since the existing habitats would be lost.	Impacts would be permanent since the existing habitats would be lost.	Impacts would probably be temporary even in the absence of ecological mitigation measures since Danaid Egg-fly commonly utilizes shrubs popular in amenity planting areas.
Reversibility	Impacts of habitat loss could be reversed by provision of suitable habitat.	Impacts of habitat loss could be reversed by provision of suitable habitat.	Impacts of habitat loss could be reversed by provision of suitable habitats.	Impacts of habitat loss could be reversed by provision of suitable plant species for breeding.
Magnitude	Magnitude of impacts would be very low to low due to small number of individuals recorded, and distribution of the species in a Hong	Magnitude of impacts would be small in a Hong Kong context but higher at a local scale.	Magnitude would be very low: only one Coastal Glider was recorded on one occasion.	Magnitude would be very low because the very small numbers of individuals (up to two) were recorded within the Project Area.

Criteria	Direct impacts on herpetofauna species of conservation importance	Direct impacts on amphibian diversity and local population	Direct impacts on dragonfly species of conservation importance	Direct impacts on butterfly species of conservation importance
	Kong context.			
Overall Impact Severity without Mitigation	Impacts to Many-banded Krait of **Low Significance.**	Impacts are of **Negligible to Very Low Significance** since species recorded concerned only very widespread and common species.	Impacts are of **Negligible to Very Low Significance**, only one individual was recorded during the survey period.	Impacts are of **Negligible to Very Low Significance** due to the small number of individuals recorded.

8.10.3 Identification of Indirect Ecological Impacts

Potential indirect ecological impacts outside the Project Area include increased human disturbance to habitats and faunal species close to the Project Area, pollution of downstream watercourses, changes to the hydrology due to increased surface runoff and fragmentation of wetland habitats.

8.10.3.1 Indirect Habitat Loss/ Disturbance

Indirect loss of habitat to disturbance-sensitive species could arise through increased disturbance preventing or impeding species' use of a habitat. The distance from the source at which disturbance impact occurs varies depending upon the type and frequency of disturbance and the toleration of disturbance varies between species and habitat. In general, birds constitute most of the disturbance-sensitive species in the Deep Bay area due to the open habitat type and the large numbers of larger species which are present (open country and large bird and mammal species are generally sensitive to disturbance at larger distances than smaller species and those utilizing closed habitats). In practice, for the purposes of calculation of ecological impacts, a baseline width for the disturbance corridor has been estimated at 100 m from the proposed development. The distance of 100 m is based on the approximate distance at which there is a significant likelihood of disturbance to an individual of the more disturbance-sensitive species of conservation importance present in the vicinity of the proposed development in significant numbers (open country waterbirds such as Little Egrets around fish ponds). This distance of 100 m is based on international experience (e.g. Blumstein et al. 2001, Blumstein et al. 2005), as well as Hong Kong field experience (e.g. Anon 2002).

With regard to the current Project, not all the area within the Assessment Area is likely to be further disturbed due to the barrier effect of certain anthropogenic features (such as large residential areas, San Tin Highway and to a lesser extent, the public roads on either side of the Ngau Tam Mei Drainage Channel). Potential areas where disturbance may arise from the proposed development include Ponds 3, 4, 6, 10 and 11, marsh, reed bed, seasonally wet grassland, stream corridors, Ngau Tam Mei Drainage Channel and grassland/shrubland. Disturbance impacts to ponds in the northwest of the Assessment Area (Ponds 13-16, 25-36) are not predicted as they are visually concealed from the Project Area by residential estates at Palm Springs and Fairview Park, which are also a source of disturbance. Some human disturbance to these pond areas located to the northwest and east of the Project Area may, however, occur during the operational phase if the residents are allowed to use the footpaths to these pond areas. Proper design and mitigation measures (e.g. fencing or wall barrier) should be implemented to minimize the disturbance on the wildlife and the adjacent existing habitats.

Other indirect impacts (pollution, sediment runoff and hydrological changes) relate to streams and drainage channels which are hydrologically linked to the Project Area; current and former ponds (including habitats which have undergone succession into Marsh, Reed bed or Seasonally Wet Grassland) are isolated from the Project Area and would not be impacted by pollution events.

Habitats elsewhere within the Assessment Area (ponds, seasonally wet grassland, reed bed, drainage channel, agricultural land, secondary woodland, plantation, grassland/ shrubland, road, village area, developed area, open storage and wasteground) are not considered to be indirectly impacted by the proposed comprehensive development due to the existing anthropogenic barriers such as the San Tin Highway, Ngau Tam Mei Drainage Channel, Kam Pok Road and local residential estates, which are also a major source of disturbance, hence no ecological corridors with the habitats in the Project Area.

Table 8-34a Potential indirect ecological impacts to habitats in the Assessment Area under Option B and without further mitigation measures

Criteria	Indirect impacts to pond area	Indirect impacts to marsh, reed bed and seasonally wet grassland	Indirect impacts to stream corridor and Ngau Tam Mei Drainage Channel	Indirect impacts to grassland/ shrubland to the south western part
Habitat Quality	Moderate to High (small number of ponds to the northwest and several small, isolated ponds to the east of the Assessment Area)	Low to Moderate (habitats developed from agricultural land, wasteground, grassland and abandoned ponds undergo natural succession)	Low (for the adjacent stream) to Moderate (for Ngau Tam Mei Drainage Channel supporting considerable bird abundance).	Low.
Species	Low diversity of fauna and flora. 15 bird species recorded within the disturbance corridor, i.e. Ponds 3, 4, 6, 10 and 11. Also 1 reptile, 2 amphibians, 15 dragonflies and 9 butterflies. Of these, 12 birds, one dragonfly and one butterfly species of conservation importance.	Low diversity of fauna and flora species recorded in the marsh, reed bed and seasonally wet grassland areas, including 8 birds, 2 amphibians, 9 dragonflies and 18 butterfly species. Of these, 4 bird species, one dragonfly and one butterfly species are of conservation importance.	Low diversity of fauna and flora species recorded in the stream corridors but moderate to high numbers and moderate diversity of bird species found in Ngau Tam Mei Drainage Channel. Overall, 33 bird species, 3 amphibians, 7 dragonflies and 11 butterflies recorded; of these, nine bird species of conservation importance are recorded.	Very low diversity of disturbance-sensitive species, comprising only three disturbance-sensitive bird species (Chinese Pond Heron, Grey Heron and Little Egret).
Size/ Abundance	A small area within the disturbance corridor of the Assessment Area, and very small in a Hong Kong context. Ponds in this area support low abundance of fauna and flora.	Habitat area very small in a Hong Kong context. Abundances of fauna and flora are low.	Small in size within the Assessment Area and very small in a Hong Kong context. Abundance of most of fauna and flora are low, but numbers of foraging ardeids moderate to high	Small in size within the Assessment Area and very small in a Hong Kong context. Low abundance of disturbance-sensitive species.
Duration	Disturbance impacts would be greatest during the construction phase. No disturbance impacts predicted for the ponds further northwest within the WCA during the operational phase due to the presence of wetland restoration	Disturbance impacts are most likely during construction but there would be some ongoing impacts during operation.	Disturbance and pollution impacts to stream corridor are most likely during construction but there would be some ongoing impacts during operation. No pollution impacts to Ngau Tam Mei Channel during construction or operation as it is physically and hydrologically separated from the Project Area by a public road. Some potential disturbance	Disturbance impacts would be greatest during the construction phase but some additional disturbance during the operation phase.

Criteria	Indirect impacts to pond area	Indirect impacts to marsh, reed bed and seasonally wet grassland	Indirect impacts to stream corridor and Ngau Tam Mei Drainage Channel	Indirect impacts to grassland/ shrubland to the south western part
	area which serves as a buffer.		impacts to large waterbirds using Ngau Tam Mei Channel due to construction activities but only minor increase during operational period (due to slight increase in human activity on the roads alongside the channel).	
Reversibility	Construction phase disturbance would be temporary and reversible. Operational phase disturbance would be permanent and on-going but of low magnitude.	Construction phase disturbance impacts would be temporary and reversible.	Minor pollution events to stream corridor would be relatively easy to reverse but more serious pollution problems may be more difficult to reverse. Disturbance during construction phase would be temporary but during operation phase would be permanent but of low magnitude.	Construction phase disturbance impact would be temporary and reversible. Disturbance during operational phase would be permanent and on-going but of low magnitude.
Magnitude	Degree of disturbance would be moderate to high during the construction phase, especially if construction work is conducted at the northern edge of the Project Area during the dry season, when more disturbance-sensitive waterbirds of conservation importance are present. Operational phase impacts negligible due to presence of wetland restoration area.	The habitat is used by relatively few disturbance-sensitive species, thus the magnitude of disturbance impacts would be small.	Major pollution events, especially chemical pollution, would have a large impact on water quality in stream corridor. Minor organic pollution and sediment runoff would have a lesser impact, especially in comparison to existing (relatively high) pollution levels. The magnitude of disturbance to the large waterbirds using the Ngau Tam Mei Drainage Channel would be small to moderate during the construction phase and small during the operational phase.	The habitat is used by very few disturbance-sensitive species, thus the magnitude of disturbance impacts would be very small.

Criteria	Indirect impacts to pond area	Indirect impacts to marsh, reed bed and seasonally wet grassland	Indirect impacts to stream corridor and Ngau Tam Mei Drainage Channel	Indirect impacts to grassland/ shrubland to the south western part
Overall Impact Severity without Mitigation	Construction phase impacts of **Moderate** or **Moderate to High Significance** depending upon duration and timing of works. Operational phase impacts of **Negligible Significance** due to presence of a wetland restoration area.	Disturbance impacts of **Very Low Significance** due to the low abundance of disturbance-sensitive species.	Impacts from pollution of watercourses (including stream corridors and Ngau Tam Mei Drainage Channel) within the Assessment Area are considered to be of **Very Low Significance** because the areas to be impacted are currently of low ecological value and are polluted from other sources. Disturbance impacts of **Low to Moderate Significance** for Ngau Tam Mei Drainage Channel during construction but of **Low Significance** during operation, and **Very Low Significance** for other watercourses due to location.	Disturbance impacts during the construction and operational phases are likely to be of **Very Low Significance**.

During the construction of the residential portion, disturbance to the then-completed Wetland Restoration Area might result. During the phase when the residential portion is a construction site, issues generally associated with a construction site might impact on the WRA; these include human and/or dog intrusion into the wetland, dumping of rubbish, spillage of chemicals and/or oil, fire hazard and discharge of grey or other water/liquid into the WRA.

During the operational phase of the site, disturbance to the WRA in the form of light, noise and human activities might be derived from the residential portion. Only authorized persons are allowed access onto the WRA; there will be no direct access from the private gardens in the residential portion. An extensive width of reedbed (between 10m to 20m) and buffer planting are proposed at the interface between the WRA and the residential portion while the houses have been set back from the interface. The physical distance is anticipated to be sufficient to buffer against noise generated from the residential portion. The tree and shrub species (**Annex 1** of **Appendix 8-10** refers) proposed are expected to reach heights between 1.5 m to 12 m when mature. As illustrated in **Figure 11-18**, any potential human or light disturbance from the residential portion would be screened out. The design of the houses will not incorporate lights which point towards the WRA and the tree buffer is anticipated to screen out any other potential light disturbance from the houses; no light disturbance is anticipated to the WRA during the operational phase.

Table 8-35b Potential indirect ecological impacts to habitats in the Wetland Restoration Area during the construction and operational phase of the residential portion without further mitigation measures

Criteria	Indirect impacts to pond area during the construction phase	Indirect impacts to the habitats at WRA during the operational phase
Habitat Quality	Moderate to High (newly restored and enhanced wetland actively managed for a suite of target species)	Moderate to High (newly restored and enhanced wetland actively managed for a suite of target species)
Species	No data as the WRA is yet to be completed. However, it is anticipated that the target species would be using the site.	No data as the WRA is yet to be completed. However, it is anticipated that the target species would be using the site.
Size/ Abundance	A moderate area of restored wetland in a Hong Kong context.	A moderate area of restored wetland in a Hong Kong context.
Duration	Construction phase of the residential portion.	Permanent.
Reversibility	Human and dog disturbance would be temporary and reversible. Other forms of disturbance (rubbish, spillage of chemicals/oil, discharge of water/liquid and fire) might have a more lasting effect depending on the extent of impact.	Human and dog disturbance would be temporary and reversible. Other forms of disturbance (rubbish, light and noise) might have a more lasting effect depending on the extent of impact.
Magnitude	Magnitude of impact from humans and dogs would depend upon frequency and number of individuals hence could vary from low to moderate. Other forms of disturbance potentially of moderate to high magnitude depending largely on the element being discharged/dumped into the wetland and the extent of area involved.	No access is allowed for non-authorized persons and the WRA will be managed to be free of dogs. Hence, disturbance from non-authorized access and rubbish dumping is anticipated to be minimal. The design of the WRA (by providing an extensive width of reedbed and buffer planting of selected species at the interface with the residential portion) has provided sufficient buffer to screen out any potential light, noise and human disturbance impact to the WRA.
Overall Impact Severity without Mitigation	Disturbance from human and/or dog intrusion of **Moderate Significance**. Other forms of disturbance potentially of **Moderate to High** Significance.	Disturbance impact predicted to be of **Low Significance** during the operational phase due to design elements of the WRA.

8.10.3.2 Indirect Impact (pollution) on Watercourses and Deep Bay

Within the Assessment Area, watercourses which discharge into the adjacent drainage channels that ultimately feed into Deep Bay are located along the southern periphery of Palm Springs and within Yau Mei San Tsuen. Areas downstream of the Project Area, including Mai Po Inner Deep Bay Ramsar Site and the Inner Deep Bay SSSI, would be potentially impacted by the pollution of these watercourses and increased surface runoff. Deep Bay contains diverse habitats which are suitable for a large number of threatened species, including several species of Global, Regional or Local Concern, and is recognised as being an internationally important wetland. Therefore, any pollution of this wetland ecosystem would have a detrimental impact on the ecological value of the area. However, Mai Po Nature Reserve is not directly downstream of the Project Area and would not be directly impacted. Similarly, the Bay itself is rather remote from the Assessment Area, hence is buffered to some extent from pollution events in the Assessment Area by distance.

Potential sources of pollution from the Project Area into the highlighted stream corridors include sediments released during site excavation, chemical waste from mechanical equipment, especially oils and lubricants, and domestic discharge, including sewage. Table

8-36 outlines the potential ecological impacts from pollution to watercourses downstream in the Project Area.

Table 8-36 Potential indirect ecological impacts to watercourses downstream within the Assessment Area without mitigation measures

Criteria	Indirect ecological impacts to watercourses downstream in the Project Area
Habitat Quality	Watercourses downstream of the Project Area are grossly polluted and thus are of relatively low ecological value. Deep Bay wetland system is of very high ecological value to wildlife.
Species	Watercourses downstream of the Project Area support very low diversity of flora and fauna species. Mangrove and intertidal habitats in Deep Bay support high diversity and abundances of faunal species, including many species of conservation importance.
Size/ Abundance	Watercourses within the Project Area are very small, but Deep Bay itself is large.
Duration	Impacts from sporadic increase in sedimentation from surface runoff are temporary. However, release of contaminants during excavation, chemical waste from mechanical equipment and domestic effluent may have a more lasting impact on the system.
Reversibility	Significant pollution events could be cleaned up to some degree but this would be costly and could have long-term impacts on ecosystems.
Magnitude	Watercourses draining the Project Area are very small in a Deep Bay context and any pollution event would also be small relative to the total volume of Deep Bay, especially if the sources of pollution could be rapidly identified and contained.
Overall Impact Severity without Mitigation	Potential pollution impacts to watercourses and Deep Bay would be of **Low Significance** due to the very small size of the Project Area relative to the bay, although serious chemical pollution events could be of **Moderate Significance**.

8.10.3.3 Indirect Impacts to Species of Conservation Importance

Vegetation

No plant species of conservation importance were recorded in the Assessment Area; all species are common and abundant throughout the territory, and several species are non-native. Wetland vegetation comprises pollution-tolerant species and is mostly located within current or former ponds which are hydrologically isolated from the Project Area. The potential impacts to vegetation arising from organic pollution, sediment runoff or hydrological changes are therefore considered to be of **Very Low Significance**.

During the construction phase, vegetation in habitats adjacent to the Project Area, including the ornamental shrub mix along the southern periphery of the Area, could suffer impacts from the deposition of dust on leaf surfaces. As there is no plant species of conservation importance are recorded within the Assessment Area and the impacts would be temporary, this impact is considered to be of **Negligible to Very Low Significance**. Good site practice during the construction of the development would help in minimizing the impacts on the vegetation.

Mammals

No terrestrial mammals were identified within the Assessment Area and hence disturbance impact to mammals is not considered to be significant. Two bat species (Short-nosed Fruit Bat and Japanese Pipistrelle) are known to roost at Palm Springs and some individuals may forage within the Project Area. Both are common and widespread species in Hong Kong, thus indirect impacts to these species are considered to be of **Very Low Significance**.

Birds

Indirect impacts to bird populations may arise from increased disturbance to disturbance-sensitive species (mostly large waterbirds) in habitats close to the Project Area and from any interruptions to flight lines crossing the Area. Disturbance impacts are considered to be

potentially greatest in open habitats within a 100 m disturbance corridor of the Project Area (100m being a representative average for the distance at which large open country waterbirds are disturbed by human activity in the absence of habituation), specifically Ponds 3, 4, 6, 10 and 11 and the Ngau Tam Mei Drainage Channel. Impacts to closed or partially-closed habitats including marsh, reed bed, seasonally wet grassland, stream corridors, and grassland/shrubland will be smaller as the habitats themselves provide a visual barrier and/or cover and these habitats are relatively little used by the most disturbance sensitive species. Numbers of disturbance-sensitive species in most of these areas were low (with a maximum of fewer than ten individuals of Little Grebe, Great Cormorant, Grey Heron, Great Egret, Little Egret, Chinese Pond Heron, Striated Heron and Black-crowed Night Heron). Except for the Ngau Tam Mei Drainage Channel, the majority of waterbird activity was recorded around ponds in the northwest of the Assessment Area (including Ponds 13-16 and 25-36). These are not only more distant from the Project Area, but are also visually concealed from the Project Area by existing residential developments at Palm Springs and Fairview Park (themselves a source of potential disturbance). Construction phase disturbance to these ponds would not be significant, but some human disturbance to these pond areas might occur during the operational phase. However, this is unlikely to be significant as there will be no direct linkages between the Project Area and existing footpaths in these pond areas.

In the absence of mitigation there may be some impact to birds foraging in the Channel during the construction phase as, although birds foraging in the channel are already habituated to some extent to pedestrian and vehicle movements on the roads alongside the channel, there will be increased noise and activity, associated with construction and construction traffic. However, any increase in human activity in this area is quantitative only (resulting from an increase in frequency of human activity) rather than a qualitative change (as would arise if human activity were to be newly introduced to a previously undisturbed area) and hence the construction stage impact (disturbance) on waterbirds using the channel is predicted to be of **Low to Moderate Significance** and would be reduced to **Low Significance** during the Operational Phase.

Egretries and Breeding Season Egret Flight Lines

The Project Area lies within the potential foraging distance (approximately 3.5 km) of egretries located at Mai Po Village and Mai Po Lung Village, which are located at distances of 1575 m and 2000 m respectively from the Project Area. At these distances from the Project Area, the egretries themselves will not be sensitive to direct disturbance impacts from the development.

Bird survey data from the egret breeding season suggest that the number of ardeids using habitats within the Project Area is relatively low. Although counts of nine Chinese Pond Herons in March and 18 Little Egrets in July occurred during the egret nesting period, the timing relative to the peak breeding season for the species involved (March – June for Little Egret, April - July for Chinese Pond Heron) suggests these may have involved non-breeding birds. Numbers of both species recorded in the Project Area during May and June were very low. This suggests that habitats on-site do not provide an important foraging area for the breeding ardeids. This is supported by data collected for CEDD regarding utilization of the Ngau Tam Mei Drainage Channel (see **Section 8.7.2**) by birds after the change in water management regime.

Data collected at Mai Po Village egretry and at the Project Area during the 2011 breeding season indicate that the Project Area does not lie on a major flight-line for birds from the egretry. Most birds were recorded flying towards fish ponds around Mai Po and Tam Kon Chau. A smaller number of individuals were seen to fly between Royal Palms and San Tin Highway. These birds pass to the east of the Project Area and would not be impacted by the development. Birds flying over Palm Springs and Royal Palms (which is approx. at 17mPD; less than 5% of all flight-lines from the egretry) do fly over the Project Area. These birds fly

over the existing buildings, so buildings within the Project Area would not have a significant impact if these are of a similar height or lower than the existing buildings; the building height of the proposed residential development is restricted to 3-storey (i.e. +17 mPD) only, which, though somewhat higher, is still considered comparable to the adjacent existing residential estates such as Palm Springs and Fairview Park.

Based on the distribution of foraging birds during the breeding season and the observed flight-lines from the egretry, it is anticipated that impacts to breeding egrets in the form of loss of foraging habitat and impediment to the flight lines between foraging ground and the egretry would be of **Low Significance**.

Disturbance to Non-Breeding Ardeid Foraging Areas and Non-Breeding Season Ardeid Flight Lines

Numbers of ardeids using the Ngau Tam Mei Drainage Channel, flying along the Channel, or flying to and from the Channel over the Assessment Area, were moderate to high; species recorded in the course of four flight line counts during November/December 2009 (with mean number recorded in parentheses) were Grey Heron (7), Great Egret (33), Little Egret (74) and Chinese Pond Heron (13).

Hence, the Ngau Tam Mei Drainage Channel is used by some ardeids during the non-breeding season and there are flight lines both along the Drainage Channel and between the Channel and across the Assessment Area to the Deep Bay wetland. However, based on the recorded numbers, these comprise a very small proportion (Grey Heron <1%, Great Egret 3.8%) and small proportion (Little Egret 8%, Chinese Pond Heron 6%) of birds wintering in Hong Kong based on the maximum count of birds recorded in the winter when the flight line survey was undertaken 2009 – 2010 (Anon 2010). Development of the Project Area is not expected to have significant impacts on flight lines across the Project Area as these are used by few birds compared to the respective overall wintering population. Similarly, the major flight line (Flight Line 1) to the west of the Project Area, which already crosses Fairview Park, will be unaffected.

Of potentially greatest significance is the potential impact on the flight line (Flight Line 3) which links the Ngau Tam Mei Drainage Channel and the Deep Bay wetlands and which passes along the eastern boundary of the Project Area and passes over or at least close to Area 40 at the southeast corner of the Project Area. This flight line appears to follow the ponds between Fairview Park and Palm Springs and is clearly an important route for Little Egret and, particularly, Chinese Pond Heron. Though development of the Project Area would not block the flight line it would potentially be narrowed. The potential impact is therefore considered to be **Low to Moderate Significance** for Little Egret and Chinese Pond Heron during the construction phase. This impact would fall to **Low Significance** to Little Egret following completion of construction, as there is no evidence that Little Egret would be inhibited from flying over the development (as it currently does on Flight Line 1 over Fairview Park), but would potentially remain of **Low to Moderate Significance** for Chinese Pond Heron (which appears to avoid using Flight Line 1).

Bird Collision Impact with New Structures

The siting of noise barriers alongside roads has already been identified as a contributor to avian mortality in HK, and the magnitude of this impact is likely to be greater should these structures be placed in otherwise largely rural areas such as those in the Deep Bay area. Mortality occurs as a result of birds perceiving a clear path through a barrier, which can occur if it is transparent, or *appears* to be transparent at some distance, or if the barrier is highly reflective, thus appearing to be composed of the adjacent natural vegetation. Potential impacts of collision mortality will be minimised by the use of opaque, non-reflective noise barriers, through which it is obvious there is no passage, and in which no reflection of the surrounding environment is created.

The risk is higher if the structure is of a height taller than the surrounding buildings (which would then appear to be a passageway for birds). The proposed Project involves the provision of low-rise residential development with ancillary wetland restoration area. However, in order to mitigate for potential construction noise during the construction phase, temporary noise barriers are proposed as noise mitigation measures of the Project. Several heights of noise barriers are proposed, ranging from 3m to 6m tall at different locations (Figure 4-6 refers), with the top level of the temporary noise barrier at +6.5mPD to +8mPD. None of the proposed temporary noise barriers would be higher than existing surrounding buildings.

The design of these barriers has incorporated elements which will reduce visual impact and the risk of bird collision impacts by selection of materials which are opaque, non-reflective with colour that would blend in with the environment. In addition, landscaping treatment will be introduced in the landscape buffers in front of the noise to further reduce the visual impact and the risk of bird collision (**Figure 11-42**). These measures will reduce the potential of creating an impression for birds that a passageway exists.

Given the relative heights of the existing buildings, and the design and landscape measures adopted for the noise barriers, the indirect impact of bird collision during construction are considered to be **Low Significance** during the construction phase.

Table 8-37a Potential indirect ecological impacts to birds of conservation importance in the Assessment Area without mitigation measures

Criteria	Indirect ecological impacts to birds of conservation importance	Indirect ecological impacts to nearby egretries during the breeding season	Indirect ecological impacts to non-breeding ardeid foraging areas and non-breeding ardeid flight line
Species	A total of eight species which are relatively disturbance-sensitive and are of conservation importance were recorded within the potentially disturbance-impacted habitats.	Two species of ardeids are known to breed in the two nearby egretries: Little Egret and Chinese Pond Heron.	Four ardeid species which are relatively disturbance-sensitive and are of conservation importance were recorded within the potentially disturbance-impacted section of the Ngau Tam Mei Drainage Channel.
Protection Status	All wild birds are protected under Cap. 170 in Hong Kong.	All wild birds are protected under Cap. 170 in Hong Kong.	All wild birds are protected under Cap. 170 in Hong Kong.
Distribution	None of the species are particularly restricted in range.	None of the species are particularly restricted in range.	None of the species are particularly restricted in range.
Rarity	All the species concerned are common and widespread in the Deep Bay area, but are listed in Fellowes *et al.* (2002) as species of conservation importance: Potential Regional Concern: Great Cormorant, Grey Heron, Great Egret, Little Egret, Chinese Pond Heron; Local Concern: Little Grebe, Striated Heron, Black-crowned Night Heron	Species concerned are common and widespread in the Deep Bay Area whereas egretries are widespread in the territories though are not particularly common.	All the species concerned are common and widespread in the Deep Bay area, but are listed in Fellowes *et al.* (2002) as species of conservation importance: Potential Regional Concern: Grey Heron, Great Egret, Little Egret, Chinese Pond Heron;
Abundance	In most of the Assessment Areas numbers of disturbance-sensitive birds were very small relative to the total Deep Bay population; however numbers of ardeids in the Ngau Tam Mei Drainage Channel and using flight lines over the Assessment were Moderate.	Birds recorded during the core breeding season (March to June for Little Egret and April to July for Chinese Pond Heron) were very low, though higher counts were recorded after the peak breeding season and might have involved non-breeding birds.	Low numbers when compared to the wintering population in Deep Bay area: Grey Heron (7 birds; <1%), Great Egret (33 birds, 3.8%), Little Egret (74 birds, 8%), Chinese Pond Heron (13 birds, 6%).

Criteria	Indirect ecological impacts to birds of conservation importance	Indirect ecological impacts to nearby egretries during the breeding season	Indirect ecological impacts to non-breeding ardeid foraging areas and non-breeding ardeid flight line
Duration	Disturbance impacts would be greatest during construction, although some low level ongoing disturbance may arise by increased human activity in the area during the operational phase (especially to birds using the Ngau Tam Mei Drainage channel).	Disturbance to foraging ground would be greatest during construction although some low level ongoing disturbance may arise by increased human activity in the area during the operational phase (especially to birds using the Ngau Tam Mei Drainage Channel).	Disturbance impact would be greatest during construction although some low level ongoing disturbance may arise by increased human activity in the area during the operational phase (especially to birds using the Ngau Tam Mei Drainage Channel) and the flight line (Flight Line 3) passing along the eastern boundary of the site and linking the Channel and the Deep Bay wetlands
Reversibility	Construction phase disturbance impacts would be temporary and would cease once the construction finished. Operational phase disturbance impacts would be ongoing but of low magnitude.	Construction phase disturbance impacts would be temporary and would cease once the construction finished. Operational phase disturbance impacts would be ongoing but of low magnitude.	Construction phase disturbance impacts would be temporary and would cease once the construction finished. Operational phase disturbance impacts would be ongoing but of low magnitude except impacts to ardeids using Flight Line 3 which may be of moderate magnitude in the absence of mitigation.
Magnitude	The magnitude of impacts would be low to moderate during construction, as these habitats already have some disturbance from existing human activity. Operation phase impacts are considered to be of low magnitude.	The magnitude of impacts would be low to moderate during construction, as these habitats already have some disturbance from existing human activity. Operation phase impacts are considered to be of low magnitude.	The magnitude of impacts would be low to moderate during construction, as these habitats already have some disturbance from existing human activity. Operation phase impacts are considered to be of low magnitude except impacts to ardeids using Flight Line 3 which may be of moderate magnitude in the absence of mitigation.
Overall Impact Severity without Mitigation	Construction phase disturbance impacts are considered to be of **Low to Moderate Significance** due to the small number of individuals present within the habitats potentially to be indirectly impacted and the existing levels of disturbance in the area. Operation phase impacts are considered to be of **Low Significance**.	**No Direct Impacts** to egretries at Mai Po Village or Mai Po Lung Village, as these are relatively distant and findings indicated that the Project Area is not a major foraging ground for these egrets or fly over to reach other foraging sites during the breeding season. Impact of **Low Significance** to egret flight lines during the breeding season because few birds from the egretries fly over the Project Site.	Construction phase disturbance impacts are considered to be of **Low to Moderate Significance** due to the small number of individuals present within the habitats potentially to be indirectly impacted and the existing levels of disturbance in the area. **No Significant** operational phase **Impact** to non-breeding foraging ardeids and egret flight lines during non-breeding season except on Flight Line 3 where impacts to Chinese Pond Heron of **Low to Moderate Significance** during construction and operation and impacts to Little Egret **Low to Moderate Impact** during construction phase only.

Table 8-37b Potential bird collision impact with new structures without mitigation measures

Criteria	Bird collision impact with new structures
Species	Passerine birds; most are common and widespread in the Deep Bay Area.
Protection Status	All wild birds are protected under Cap. 170 in Hong Kong.
Distribution	Passerine species recorded are not restricted in range.
Rarity	Passerine species recorded are not rare.
Abundance	None of the passerine species are recorded in particular high numbers.
Duration	Temporary; noise barriers are required during the construction phase only.
Reversibility	Irreversible as death is typically the consequence of collision.
Magnitude	Likely to be low due to the low numbers of passerines recorded in the Project Site and the immediate environs and the design of the noise barriers (use of opaque and non-reflective materials).
Overall Impact Severity without Mitigation	Given the design of the temporary structures (noise barriers), overall impact severity is considered **Very Low to Low** as these structures would be rather visible to birds.

Other Fauna

Whilst all fauna (and flora) respond to disturbance to habitat conditions, disturbance impacts from human presence, movement, noise or vehicle movements are largely observed in mammals and birds, though most herpetofauna will move away from an approaching noise (such as a hiker), these could go unobserved due to the cryptic nature of these species. Potentially unobserved are for dragonfly/butterfly species which move away before detection is possible either due to their size or the nature of habitat making observation from a distance impossible. In general, species/groups which are regularly observed at close range by an observer are considered less sensitive to disturbance. Thus, for the purpose of impact assessment, disturbance impact as defined in Section **8.10.3.1** applies. Hence, other fauna recorded in the area (including herpetofauna, dragonflies and butterflies) which are not sensitive to disturbance are therefore not considered to be indirectly impacted by development of the Project Area. Stream fauna downstream of the Project Area are not considered to be of ecological importance because of the high levels of disturbance and pollution to which these streams have been subjected. These stream fauna are also, therefore, not considered to be significantly impacted.

8.10.3.4 Cumulative and Fragmentation Impacts

The Project Area is located towards the landward edge of the WCA and the Deep Bay wetland system. Habitats within the Project Area were found to be of low to moderate ecological value to wildlife, used by very low to low numbers of species of conservation importance, and generally support low diversity and abundance of faunal species relative to the Deep Bay populations. There has been a historical loss of habitat at the fringe of wetland habitat, but the rate of wetland loss has now slowed as a result of planning guidelines. Existing conditions are used as the baseline for the impacts evaluated in the report. Further impacts may arise as a result of other developments proposed or planned in the area; the assessment of cumulative impacts investigates other developments proposed in the area to ensure the impacts of the development in the Project Area do not contribute significantly to the overall habitat loss.

Other projects proposed in the vicinity of the Project Area include:

- Proposed residential cum passive recreation development within “Recreation” zone and “Residential (Group C)” zone at various lots in DD 104, Yuen Long (EIA-220/2014)

- Proposed Comprehensive Development at Wo Shang Wai (WSW), Yuen Long (EIA-144/2008)
- Construction of cycle tracks and the associated supporting facilities from Sha Po Tsuen to Shek Sheung River (EIA-159/2008)
- Proposed residential development within 'Residential (Group D)' Zone at various lots in DD104, Yuen Long, N.T. (ESB-204/2009)
- Construction of Cycle Tracks and the associated Supporting Facilities at Nam Sang Wai, Yuen Long (EIA-205/2012)
- Proposed low-density residential development at various lots and their adjoining government land in D.D. 104, east of Kam Pok Road, Mai Po, Yuen Long (ESB-210/2009)

EIA reports are available for the "REC" zone abutting the Project Area and the WSW residential development while both of the proposed cycle tracks, while only Project Profiles are available for the remaining three proposed developments.

According to EIA-220/2014, the area abutting the Project Area is proposed to be developed as a passive recreational area with the provision of a landscape pond at the northwestern corner of that area. The ecological values of the existing habitats are considered to be "Very Low" to "Low to Moderate" while faunal usage of the site ranges from "Very Low" to "Low". It was concluded that due to the low ecological value of the site, the loss of the existing habitats would not result in any adverse ecological impact to the area. According to the EIA, there will be some overlap in the construction phase of the project (site clearance to commence in 2017) with the current proposed Project. However, the WRA of the current Project is anticipated to be completed in the third quarter of 2016, which would function as a wetland refuge for wildlife. Given the above, no additional or cumulative impact is predicted as the result of the implementation of this project and the current Project. According to EIA, an area of passive recreation with a landscape pond of 0.6 ha will be provided in the northern site (which abuts the current Project), while an area of residential development will be provided at the southern portion of the site. A strip of buffer planting is proposed at the boundary with the current Project. The landscape features including the pond and the planting are anticipated to provide some habitat for species which are tolerant of human disturbance. Hence, no additional ecological cumulative impact is predicted.

The construction of the WSW residential development has commenced in 2010, and the Wetland Restoration Area was established in October 2012. Any ecological impacts accrued by the project are considered mitigated through the provision, operation and adaptive management of the WRA. Further, the development is separated by the Palm Springs and Royal Springs development such that additional increase in human disturbance will very unlikely to be impacting on the current development. Hence, no additional ecological cumulative impact is predicted.

The construction of the cycle track from Sha Po Tsuen to Shek Sheung River will connect the existing cycle track networks from Yuen Long to Sheung Shui and provide supporting facilities for the users. The alignment of the cycle track will pass the Project Area along the existing Yau Pok Road. Habitat loss from the cycle track would affect mostly developed area/abandoned ground/wasteland, all of which were regarded as of Low to Negligible Ecological Value. No active/inactive fish ponds would be directly impacted or lost, but the cycle track project would involve a partial loss of a small area of wetland close to Mai Po Village. This wetland loss is very small (0.07 ha) and located away from the Project Area, so cumulative impacts would not be significant. There may be a slight cumulative increase in disturbance as a result of the development of the Project Area in addition to the cycle track, but the magnitude of this increase is expected to be small relative to the disturbance created

by the cycle track itself. The cumulative impact of the development of the project area and the cycle track is therefore predicted to be of **Low Significance**.

The construction of the proposed cycle track from Nam Sang Wai will connect the existing cycle tracks from Tin Shui Wai to San Tam Road. In addition, a small section of cycle track is proposed for the section from the southern section of Yau Pok Road (from junction with Kam Pok Road onwards) to almost reaching the confluence of Shan Pui River and Kam Tin River. None of the proposed sections links to or passes through the Project Area, and all sections are sufficiently distant from the Project Area such that no additional cumulative impact is predicted in additional to the Nam Sang Wai cycle tracks. It is worth noting that if this cycle track is implemented as well as the cycle track from Sha Po Tsuen to Shek Sheung River, cyclists from Tin Shui Wai will have access to Yau Pok Road; there could be further increase in disturbance from these two cycle tracks. However, the cumulative impact from the development of the Project Area in addition to the cycle tracks is predicted to be of **Low Significance**.

The other proposed residential developments mentioned are located on the south side of Kam Pok Road and the north side of Yau Pok Road. The sites for these include a total of 1.99 ha of wetland habitats. There is currently no EIA report available for these developments, so the final design of the development and any associated mitigation measures are not currently known. It is assumed that these projects would conform to the "No Net Loss in Wetland" principle, as required in the planning guidelines for the area. .

The location of the Project Area at the edge of the Deep Bay wetlands means that loss of these habitats would not cause a significant degree of fragmentation within the wetland ecosystem as a whole. The existing area does, however, provide an important ecological corridor between the fish pond habitats to the northwest (between Fairview Park and Palm Springs) and habitats surrounding the Ngau Tam Mei Drainage Channel (including agricultural land and grassland/shrubland which are of low ecological value to wildlife, in particular that of conservation-important species). . Given that the wetland habitats within the WCA portion under the current Project Area would be protected, conserved and enhanced for wildlife, cumulative impacts of wetland loss of highly fragmented and small wetland habitats of the other proposed residential developments are likely to be **Low Significance**, while potentially of **Low to Moderate Significance** for species with low dispersal ability.

In view of the potential cumulative and fragmentation impacts on wetland habitats and ecological corridor with the existing wetlands (include Ngau Tam Mei Drainage Channel), the current Project will have some, albeit minor, contribution. If development of these concurrent developments and the current Project follows the planning intention (including the protection and enhancement of existing habitats and development located on formed land and furthest away from the continuous and contiguous wetland area), the overall cumulative and fragmentation impacts of development of the Yau Mei San Tsuen area will be reduced.

8.11 Mitigation Measures Adopted to Avoid, Minimize and Compensate for Ecological Impacts

Table 8-38 below summarizes the findings of the predicted ecological impacts of development of the Project Area according to the planning intention as set out by the zoning (i.e. OU(CDWPA)), if no mitigation measures were adopted on the site, as evaluated in **Section 8.10**. All impacts identified as of a Moderate or High Significance would require mitigation measures to avoid, minimize and/or compensate for loss of functions or habitats. The proposed mitigation measures are discussed in the following paragraphs.

Table 8-38 Summary of predicted significance of impacts under Option B without further mitigation measures

Potential Impact	Predicted Significance of Impact
Direct habitat loss in the Project Area	
Loss of agricultural land	Habitat loss of **Low to Moderate Significance.**
Loss of pond areas	Temporary habitat loss of **Low to Moderate Significance.**
Loss of marsh	Habitat loss of **Low Significance.**
Loss of seasonally wet grassland	Habitat loss of **Low Significance.**
Loss of reed	Habitat loss of **Low Significance.**
Loss of grassland/shrubland	Habitat loss of **Negligible Significance**.
Direct impacts to species of conservation importance	
Impacts to vegetation	**No Significant Impact** (no species of conservation significance are present).
Impacts to mammals	Impacts to Japanese Pipistrelle and Short-nosed Fruit Bat of **Very Low Significance**. Other mammals not known to use the Project Area, thus **No Significant Impact**.
Impacts to bird species of conservation importance	Impacts to Little Egret, Chinese Pond Heron are of **Low to Significance** due to provision of wetland restoration area. Impacts to Greater Painted-snipe and Red-throated Pipit are considered to be of **Low to Moderate Significance** due to loss of agricultural land, seasonally wet grassland and marsh habitat. Impacts to Little Ringed Plover are considered to be of **Low Significance** because the evaluation as a species of conservation concern refers to breeding populations whereas most individuals (up to 25 on one survey) were recorded during the non-breeding season and there was no evidence of breeding on site. Impacts to other bird species are of **Very Low to Low Significance**. Bird collision impact is predicted to be of **Low Significance** given the design and the relative heights of the temporary noise barriers.
Impacts to reptile species of conservation importance	One species of reptile, Many-banded Krait, is listed as species of Potential Regional Concern but is widespread and common throughout the territory. Impacts to Many-banded Krait of **Low Significance**, while **No Significant Impact** on other reptile species because none of them are of species of conservation importance.
Impacts on amphibians diversity and local population	Impacts are of **Negligible to Very Low Significance** since species recorded concerned only very widespread and common species.
Impacts to dragonflies	Impacts are of **Negligible to Very Low Significance** because populations recorded in the Project Area are very small and only a single species of conservation importance was recorded (one record of a single individual of Coastal Glider).
Impacts to butterflies	Impacts are of **Negligible to Very Low Significance** due to the small number of individuals of a single species of conservation importance (Danaid Egg-fly) (maximum 2 individuals recorded).
Impacts to fish	**No Significant Impact** because the drainage ditches within the Project Area supported very low diversity and abundance of common fish species.
Indirect impacts to habitats in the Assessment Area (outside the Project Area)	
Indirect impacts to adjacent pond areas	Construction phase impacts of **Moderate to High Significance** depending upon duration and timing of works. Operational phase impacts of **Negligible Significance** due to presence of a wetland restoration area.
Indirect impacts to marsh, reed bed and seasonally wet grassland	Disturbance impacts of **Very Low Significance** due to the low abundance of disturbance-sensitive species.
Indirect impacts to the adjacent stream and Ngau Tam Mei Drainage Channel	Impacts from pollution of watercourses (including stream corridors and Ngau Tam Mei Drainage Channel) within the Assessment Area are considered to be of **Very Low Significance** because the areas to be impacted are currently of low ecological value and are polluted from other sources. Disturbance impacts of **Low to Moderate Significance** for Ngau Tam Mei Drainage Channel during construction but of **Low Significance** during operation, and **Very Low Significance** for other watercourses due to location.
Indirect impacts to grassland/shrubland to the south western part	Disturbance impacts during the construction and operational phases are likely to be of **Very Low Significance**.

Potential Impact	Predicted Significance of Impact
Indirect Impacts to the newly formed WRA during the construction phase	Disturbance from human and/or dog intrusion of **Moderate Significance**. Other forms of disturbance potentially of **Moderate to High** Significance.
Indirect Impacts to the newly formed WRA during the operational phase	Disturbance impact predicted to be of **Low Significance** during the operational phase due to design elements of the WRA.
Indirect impacts to other habitats within the Assessment Area	**No Significant Impacts** to other habitats within the Assessment Area because these areas are small, support low abundance and diversity of faunal and floral species and/or show little or no ecological corridor to the Project Area.
Pollution impacts to watercourses and Deep Bay	Potential sediment pollution impacts to watercourses and Deep Bay would be of **Low Significance** due to the very small size of the Project Area relative to the bay, although serious chemical pollution events could be of **Moderate Significance**.
Cumulative impacts of wetland loss	Although the potential cumulative impact of the incremental loss of Deep Bay wetland habitats is large, the contribution of the proposed comprehensive development to this cumulative impact would be of **Low to Moderate Significance**.
Impacts from habitat fragmentation	The local impact of fragmentation would be of **Low to Moderate Significance** to herpetofauna populations by obstructing the linkage between fish ponds to the north and agricultural land to the south.
Indirect impacts to species of conservation importance	
Indirect impacts to vegetation	Impacts of pollution and dust deposition of **Very Low Significance** because no plant species of conservation importance was recorded.
Indirect impacts to mammals	**No Significant Impact** to terrestrial mammal species and **Very Low Significance** to the two bat species (Short-nosed Fruit Bat and Japanese Pipistrelle) roosting at Palm Springs.
Indirect impacts to birds	Construction phase disturbance impacts are considered to be of **Low to Moderate Significance** due to the small number of individuals present within the habitats potentially to be indirectly impacted and the existing levels of disturbance in the area. Operation phase impacts are considered to be of **Low Significance**.
Indirect impacts to egret flight-lines and egretries	**No Direct Impacts** to egretries at Mai Po Village or Mai Po Lung Village, as these are relatively distant and there is no evidence that these birds forage in the Project Area or fly over to reach other foraging sites during the breeding season. Impact of **Low Significance** to egret flight lines during the breeding season because few birds from the egretries fly over the Project Site. **No Significant Impact** to egret flight lines during non-breeding season except on Flight Line 3 where impacts to Chinese Pond Heron of **Low to Moderate Significance** during construction and operation and impacts to Little Egret **Low to Moderate Impact** during construction phase only.
Indirect ecological impacts to non-breeding ardeid foraging areas and non-breeding ardeid flight lines	Construction phase disturbance impacts are considered to be of **Low to Moderate Significance** due to the small number of individuals present within the habitats potentially to be indirectly impacted and the existing levels of disturbance in the area. Operation phase impacts are considered to be of **Low Significance** except impacts to ardeids using Flight Line 3 which may be of **Low to Moderate Significance** in the absence of mitigation.
Indirect impacts to other fauna	Other species (herpetofauna, dragonflies and butterflies) are not sensitive to disturbance and would not be impacted. Species breeding in watercourses are widespread and tolerant of the existing pollution levels, thus unlikely to be impacted by a small increase in pollution. **No Significant Impact** predicted for these groups.

In order to determine the appropriate mitigation measures to ensure that there are no significant residual ecological impacts arising from the Project; the requirements and guiding principles outlined in the EIAO Technical Memorandum Annex 16 are followed; these are considered in the order of priority of avoidance, minimization and compensation according to the severity of predicted significance of each impact.

In addition, part of the Project Area falls within the boundary of WCA, and the entire area is currently zoned as OU(CDWPA); thus, the planning intentions and guiding principles as

outlined in TPB PG No.12C and the explanatory note under OU(CDWPA) of OZP No. S/YL-MP/6 apply. Relevant guiding principles are listed below:

- 'no-net-loss in wetland' principle;
- avoidance of loss of fish ponds and habitat fragmentation;
- all active/abandoned fish ponds are to be conserved;
- the integrity of the habitat should be maintained to avoid disturbance and/or fragmentation;
- consideration may be given to ecologically beneficial alternative uses to existing fish ponds which would perform ecological functions similar to or better than the existing fish ponds and would be compatible with the conservation objectives of the wetland in Deep Bay Area;
- should not add to the pollution loading of the Deep Bay Area;
- any new development should be located on the formed land and as far away from the existing fish pond within the development site with no pond filling;
- with no decline in the wetland function of the fish ponds within and near the development site; and
- consideration of limited low-density private residential/recreational development at the landward fringe of the WCA in exchange for committed long-term conservation and management of the remaining ponds within the development site. Development of this nature should require minimum pond filling and should be located as far away from the Deep Bay as possible and/or adjoining to an existing development site.

The corollary of the guiding principles outlined above is that, all factors being equal, proposed development should be located on existing formed land with no pond-filling, the development should be placed as far away from Deep Bay as possible and alternative ecologically beneficial habitats other than fish ponds should be incorporated in the proposed scheme.

No fertilizers and herbicides will be routinely used for vegetation management in the WRA, hence reducing any potential source of contamination into the adjacent watercourses that feed into Deep Bay.

8.11.1 Proposed Measures to Mitigate Potential Adverse Ecological Impact

Significant adverse ecological impacts will be avoided by following the guiding principles detailed above. Proposed mitigation and enhancement measures to the significant potential ecological impacts are described in the following sections.

8.11.1.1 Consideration of Alternative Site Layouts to Avoid or Minimize Wetland Loss

As part of the design process, alternative site layouts have been considered in order to investigate alternative approaches to achieve the requirements laid out in the guiding principles listed above. Some of these alternative options are described in the following paragraphs, which also consider the ways in which these designs would mitigate for habitat loss.

Layout Option A involves development of the entire Project Area. This extent of development would result in the loss of 3.0 ha of wetland habitats, including ponds, marsh

and seasonally wet grassland. In addition, some parts of the agricultural land may be seasonally flooded and thus may function as wetland; the extent of this flooding may vary between or within years, thus mapping of the exact extent would be uncertain. The loss of these habitats is of low to moderate ecological significance due to their connectivity with the Deep Bay wetland system to the north western part, and would also result in impacts to species using the existing wetland habitats. Furthermore, development of the fish pond area would not comply with the guiding principles outlined above. Option A was considered to have significant ecological impacts, and was therefore not considered suitable for the site.

Layout Option B involves retention of the existing wetland habitats within the WCA, as well as the existing Area 40. This would avoid loss of these wetland habitats, as well as avoiding direct impacts to species using these habitats. Because the development area would be located on the landward (southern) side of the site, fragmentation would be reduced and disturbance impacts to adjacent wetland habitats would also be reduced. Residual impacts would result from loss of agricultural land (and associated species). This could be compensated by the retention of the existing ponds, which could be managed to enhance ecological value, potentially involving the incorporation of alternative habitats to enhance the value over that of the existing fish ponds.

The layout is further developed in Layout Option C, which involves the retention not only of the existing fish ponds but also wetland restoration on some of the existing agricultural land in the northeast of the site (A1 and A2). This option further minimizes the habitat loss compared to Option B, and also provides greater potential for habitat enhancement as compensation. The additional area to be retained is adjacent to existing marsh / reed bed within the CA zone outside the site boundary (Pond 5), thus further minimising the potential disturbance impacts to these adjacent wetlands. Development around Area 40 would also be reduced, with planting around the boundary of the pond to act as an amenity wetland.

Based on the above, it was considered that Layout Option C was the most ecologically suitable approach to minimisation of impacts, and this option was taken forward for further consideration. The basic layout was further refined to address residual ecological impacts, in particular potential fragmentation impacts. A link has been provided along the eastern boundary to connect Area 40 with the rest of the retained wetland, to allow for the movement of amphibians and other terrestrial wetland species. A setback with peripheral planting is provided in the southwest portion of the site, which will minimize potential (albeit small) disturbance impacts to habitats in this area. This revised layout forms the Recommended Option (Option D) for development of the site.

8.11.1.2 Compensation for Residual Loss of Habitats in the Project Area

Most wetland habitats would be retained under the Recommended Option (Option D), but there would be residual impacts to agricultural land. Surveys found that these impacted habitats support low faunal and floral diversity and abundance, and are consequently considered to be of “low” (grassland/shrubland and reed at Area 40) or “low to moderate” (agricultural land) ecological value. Several bird species, including species of conservation importance, were recorded utilizing habitats in the human-maintained agricultural land within the Project Area; however, and the conditions required by these species would be relatively easily to re-create by appropriate wetland management. Accordingly, it is not considered that these habitats are of sufficient ecological value that these should be avoided and retained in their present form, as long as equally or more suitable habitat for the species of conservation importance is provided in compensation.

Under the guiding principles listed in **Section 8.11**, and as set out under the OU(CDWPA) zoning for the site, management of the retained wetland habitat to enhance the ecological value of the habitat is proposed as part of the proposed comprehensive development within the Project Area.

As detailed above, the habitats in the north of the Project Area (including ponds, marsh, and seasonally wet grassland) will be retained and enhanced under the Recommended Option (Option D). Wetland compensation will be provided for the residual loss of wetland habitats within the Project Area. A total of 3.0 ha of wetland habitats (ponds, marsh, reed and seasonally wet grassland) are present in the Project Area. Some areas of agricultural land may also function as seasonal wetland due to management practices for wet crop cultivation by wet season flooding, or left fallow for field preparation, the extent of which will vary within or between seasons. Thus, understanding of the intention of the fields by means of recording the type of vegetation planted during both the wet and dry season is important and is used as information for the process of wetland calculation. According to the field visits undertaken between December 2012 and February 2013, the baseline conditions are observed to be in use for cultivating lettuce which is a dry crop.

A total of 3.8 ha of wetland habitat will be enhanced / restored within the WRA, including 0.2 ha of Area 40 retained as an amenity pond. The design of wetland within the WRA is such that will be residual loss of agricultural land will be fully compensated by incorporating habitats with similar ecological function to agricultural land (such as wet mud) while complementing and increasing the wetland function of the overall wetland function of the Project Area. The proposed layout plan of the WRA is provided in **Figure 8.5**, while **Table 8-42** to **Table 8-44** describe the functions of each proposed wetland habitat within the WRA. Details of the design rationale, habitat maintenance and management plan, and monitoring programe for the WRA are given in the Wetland Restoration Plan in **Appendix 8-10**, which also includes the specification of resources requirement for implementation, management agents and their responsibility, as well as a contingency plan for the management of the proposed mitigation wetland.

Consideration Given to Alternative Ecologically Beneficial Habitats

The planning intention for the OU(CDWPA) zone is to protect and conserve the existing wetland system that is continuous and contiguous with the wetlands within the Deep Bay wetland system. Wetland habitats located in the northern and north western parts of the Project Area are within the WCA, and will be conserved due to their intrinsic ecological value and linkage to the wider Deep Bay wetland system.

Findings from literature review and results of the surveys indicate that the Project Area is of relatively lower ecological value than many other parts of the WCA and retaining certain habitats in their present form may not be the most ecologically-beneficial alternative for the site. In particular, the ecological value of the ponds within the Project Area (Ponds 8, 9 and 18) is somewhat compromised by their location which results in high level of anthropogenic disturbance. Thus it is considered that that the overall ecological value of the site may be enhanced by conversion of some existing habitats into alternative habitats, which are known to be utilized by species likely to be impacted by the proposed development. These habitats will also be utilized by species at the landward edge of the Deep Bay wetland system. Alternative wetland habitats considered suitable for the site include deep water ponds (with shallow water zones), marsh, reed bed, wooded bund, grassy bund, bamboo clump and gravel islands; the areas of each habitat are summarized in **Table 8-42** and details of the habitats are provided in **Table 8-39** to **Table 8-45**.

The main WRA is situated on the northern side of the Project Area, comprising three deep water ponds separated by grassy bunds and bordered by areas of shallow water (except the pond located in Pond 18). Several gravel islands are situated in the shallow water zones, with two bamboo clumps planted in the middle of the south-westernmost gravel island. Several clumps of bamboo will also be planted in the northern and south western boundaries of the Area. Three marsh cells are proposed in the southeast of the WRA and separated by grassy bunds. To minimize disturbance, the main WRA will buffered from the proposed

development by wooded bund and/ or reed, and from the existing development in the north by grassy bund/reed bed.

Table 8-39 Comparison between Areas of Existing Habitats & Those to be provided under the Recommended Option

Time Frame	Existing Habitat		Proposed Habitat	
	2008^		Recommended Option	
Habitat	**ha**	**%**	**ha**	**%**
Agricultural Land	4.9	60.1	-	-
Pond	1.2	14.9	1.6	19.3
Marsh	0.9	11.6	0.8	10.1
Reed	0.2	2.4	0.6*	6.2
Seasonally Wet Grassland	0.7	8.7	-	-
Grassland/Shrubland	0.2	2.3		
Grassy Bund	-	-	0.4	4.9
Wooded Bund	-	-	0.3	4.6
Bamboo Clump	-	-	<0.1	0.5
Gravel	-	-	<0.1	0.8
Development Area	-	-	4.3	53.7
Total Area	**8.1**	**100**	**8.1**	**100**
Wetland habitat total	**3.0**	**30.4**	**3.8**	**45.3**

Note: Figures above are rounded to the nearest decimal place. Hence, figures may not add up to the total value. * indicates that of which 0.1 ha is located within the WBA. ^ verified in 2014.

Table 8-40 Details of the proposed deep water pond in the Wetland Restoration Area

	Deep water pond with shallow water zone
Description	Three areas of 1 - 2.5 m in depth of open water bordered by reed bed in the south, east and northeast, and by a grassy bund to the northwest.
Justification	Deep water pond is an existing habitat on site considered to be of low to moderate ecological value at present but of higher value elsewhere in Deep Bay. These will serve to shield the area from the proposed development. Secluded small ponds provide a good loafing environment for some migratory waterbird species such as ducks. Ponds will be deep enough to prevent reed encroachment, and will also serve as a water reserve to ensure water remains on site in the dry season. Shallow water (20cm - <1m) and muddy margins will provide foraging habitats for ardeids and other waterbirds.
Species which may utilize the habitat	Breeding: Amphibians, dragonflies (both in shallow water zone). Foraging: Waterbirds such as egrets (Little Egret, Chinese Pond Heron) (in deep water and shallow water zones). Roosting: Waterbirds such as egrets (Little Egret, Chinese Pond Heron), dragonflies (both in deep water and shallow water zones).

Table 8-41 Details of the proposed marsh in the Wetland Restoration Area

	Marsh
Description	An area of marsh containing native vegetation will be planted on an undulating pond bottom, bordering the deep water pond and between the WCA and the residential development. Marsh will be formed in three to four cells depending on the WRA option.
Justification	Marsh is an existing habitat type on-site but is currently of low ecological value as it supports very low diversity of flora and fauna and is in the process of natural succession to non-wetland habitat. The ecological value habitat will be enhanced by replacing exotic and terrestrial species (such as *Panicum maximum* and *Bidens alba*) with native species, and by dividing into cells to permit management of suitable water levels. Marsh is an important habitat for various bird species, including Greater Painted-snipe, and also serves as a breeding habitat for amphibians.
Species which may utilize the habitat	Breeding: Waterbirds such as snipes (Greater Pained-snipe) and amphibians. Foraging: Waterbirds such as egrets (Little Egret, Chinese Pond Heron) and snipes (Greater Painted-snipe), amphibians and dragonflies. Roosting: Waterbirds such as egrets (Little Egret, Chinese Pond Heron) and snipes (Greater Painted-snipe).

Table 8-42 Details of the proposed reed bed in the Wetland Restoration Area

	Reed bed
Description	An area of reed *Phragmites australis* will be planted on an undulating pond bottom, bordering the deep water pond, adjacent to the residential development. Reed will also be planted along the ecological corridor between Area 40 and other wetland habitats to provide screening and thus minimize disturbance to the adjacent wetlands outside the Project Area.
Justification	Reed bed 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 or regional conservation concern.
Species which may utilize the habitat	Breeding: Reed-associated species Foraging: Reed-associated species and other waterbirds such as egrets (Little Egret and Chinese Pond Heron) and snipes (Greater Painted-snipe). Roosting: Reed-associated species.

Table 8-43 Details of the proposed wooded bund in the Wetland Restoration Area

	Wooded bund
Description	Tree and shrub species that are tolerant of waterlogged soils will be planted along the boundaries of the marsh, reedbed where it interfaces the residential area, and around Area 40.
Justification	Planted trees / shrubs will provide shade and a favourable terrestrial microclimate for herpetofauna and are used by a suite of bird species for foraging or roosting. The wooded bund will also provide screening of wetland habitats from disturbance, including screening of Area 40 from disturbance to the south of the Project Area (especially the proposed cycle track), and screening of the marsh from the proposed development.
Species which may utilize the habitat	Foraging: Reptiles, amphibians, passerines, butterflies and dragonflies. Roosting: Egrets (Little Egret, Chinese Pond Heron), butterflies and dragonflies. Dispersal: Reptiles, amphibians.

Table 8-44 Details of the proposed grassy bund in the Wetland Restoration Area

	Grassy bund
Description	Grassy bund planted with native herb species will border the WRA in the northern, western and eastern boundaries and between the different cells of the deep water and marsh areas.
Justification	Grassy bund is an element of the fish pond ecosystem in Deep Bay Area. Grassy bunds serve as a roosting and foraging area for ardeids and other species of conservation importance such as Red-throated Pipit. These bunds will form a footpath from which the Project Area will be monitored and maintained.
Species which may utilize the habitat	Foraging: Amphibians, reptiles, passerines such as pipits (Red-throated Pipit), butterflies and dragonflies. Roosting: Egrets (Little Egret, Chinese Pond Heron), amphibians, butterflies and dragonflies.

Table 8-45 Details of the proposed bamboo clump in the Wetland Restoration Area

	Bamboo clump
Description	Several clumps of bamboo of the species *Bambusa eutuldoides* and *B. gibba* will be planted on the grassy bunds in the western and northern boundaries.
Justification	Bamboo is favoured by egrets for roosting and nesting and will diversify the habitats provided for wildlife.
Species which may utilize the habitat	Breeding: Potentially ardeids such as Little Egret, Chinese Pond Heron. Foraging: Dragonflies. Roosting: Egrets (Little Egret, Chinese Pond Heron) and dragonflies.

Table 8-46 Details of the proposed gravel islands in the Wetland Restoration Area

	Gravel
Description	Islands of unvegetated bare ground will be formed in the deep water pond.
Justification	Exposed areas of bare ground serve as roosting and loafing areas for waterbirds, including ardeids. The muddy margins and shallow water area provide favourable foraging area for waders including Little Ringed Plover, which also nests in this habitat.
Species which may utilize the habitat	Breeding: Potentially Little Ringed Plover. Foraging: Waterbirds Roosting: Waterbirds such as egrets (Little Egret, Chinese Pond Heron).

The overall area for wetland mitigation (3.8 ha, ~47% of the total area of Project Site; including 0.2 ha of Wetland and Visual Buffer provided to comply with TPB No. 12C, see Section 8.11.1.3 below) exceeds the area of existing wetland habitats within the Project Area (3.0 ha). By exceeding the area of existing wetland habitat, the WRA will also mitigation for the areas of agricultural land which may function temporarily as wetland due to seasonal flooding following rainfall (the extent of which will vary within and between seasons). Habitat management is considered to increase the ecological function of this wetland over existing levels. This will be achieved by provision of a greater diversity of habitats (including reed bed, marsh, gravel, bamboo clumps, open water of various depths, wooded bund and grassy bund) suitable for both wetland-dependent and other taxa. Furthermore, the proposed habitats within the WRA are predicted to increase the ecological value and function over the existing conditions by reducing fragmentation, integrating adjoining wetlands and buffering wetlands from the proposed development. A comparison of the existing habitats with the proposed habitats is provided in Table 8-47.

Table 8-47 Comparison of the ecological potential of existing and proposed habitats in the Project Area

	Existing habitats	Proposed habitats
Habitat quality & potential	Agricultural Land (4.9 ha) : low to moderate Pond (1.2 ha): low to moderate Marsh (0.9 ha): low Reed (0.2 ha): low Seasonally Wet Grassland (0.7 ha): low Grassland/Shrubland (0.2 ha): low	Pond, including deep water and shallow water (1.6 ha): moderate[(1)] Reed bed (0.6 ha): moderate [(1)] Marsh (0.8 ha): moderate [(1)] Wooded Bund (0.4 ha): low to moderate [(1)] Grassy Bund (0.3 ha): low to moderate [(1)] Bamboo Clump (<0.1 ha): low to moderate [(1)] Gravel (<0.1 ha): low to moderate [(1)]
Habitat utilization & potential	Low floral and faunal diversity, except for bird fauna in the agricultural land which supported moderate diversity. However, most species recorded were common and widespread in the Deep Bay context and not of conservation importance. Very limited potential for increase in ecological value due to present management regime (agricultural land) and deterioration (pond, marsh and seasonally wet grassland) as these habitats have been abandoned and, in the long-term succession to non-wetland habitats is likely.	Design of the habitats takes into account the existing wildlife use and the potential of the area. Target species chosen are reflective and complementary to the ecological potential of the Project Area in the landward periphery of the Deep Bay wetland system; Under adaptive management of these habitats, ecological conditions can remain favourable/ suitable for wildlife and target species; Pollution and human disturbance will be controlled/ removed; Habitats provided are more diverse and incorporate designs which maximize favourable foraging and roosting areas; Deep water pond, shallow water and marsh will be planted and managed with suitable emergent and floating vegetation to provide a number of suitable micro-habitats for a suite of wetland dependent fauna; Extensive area of shallow water provides favourable conditions for foraging waterbirds; Reed fringes provide suitable foraging and roosting habitat for a number of reed-dependent bird species; Areas of exposed, open gravel provide roosting and loafing sites for waterbirds, and potential; breeding habitat for Little Ringed Plover; Wooded bund, bamboo clumps and grassy bund will be planted with native species and managed to be attractive to species of conservation importance;
Other factors	Currently these areas are either managed actively for commercial purposes or left abandoned; villagers/landowners have no/little incentive to manage these areas for the benefit of wildlife. Abandoned ponds or farmland may further deteriorate into non-wetland habitats in the long run as these undergo natural succession. Consequently, there will be foreseeable loss of wetland both in terms of area and function.	Committed adaptive management of the habitats for wildlife will be pursued. This allows for periodic review of the usage and conditions of these habitats; There is significant gain in ecological function of the wetland areas and no loss in total wetland area.

[(1)] *habitat potential to wildlife under adaptive management*

8.11.1.3 Proposed Measures to Comply with the TPB PG No.12C Guideline

According to Section 6.7 of TPB Guideline 12C Guideline, there is an intention to "provide a wetland and visual buffer to separate the development from the WCA to minimize its impact on the wetland [i.e. WCA] and to restore some of the lost fish ponds to an appropriate form of wetland adjoining the WCA". Whilst the entire development falls entirely within the WBA, a wetland a visual buffer to be provided within the WBA is required.

In considering the design of the Wetland & Visual Buffer, the following are taken into account:

- the potential disturbance impact from the proposed development, particularly with regard to the type of activities predicted at the interface between the WBA and the WCA;

- the design intention and proposed target species of the WRA, and the need to provide habitat/design and ecological functions complimentary to those proposed in the WRA;

A. Consideration Regarding Potential Disturbance Impact from the Proposed Development

It is proposed to provide private gardens along the entire interface between the WBA and WCA. No access to the WRA will be gained through the private gardens as a boundary fence of 1.8m high will be erected to delineate the site. The proposed level at the residential portion is +5.5mPD while the existing level at the WRA (approx. +3.5mPD at bund) will be maintained as far as possible where appropriate. Several existing trees along the interface will be retained and some additional buffer landscape planting will be provided. Given the level difference and the buffering function of the private garden and the screening effect of the tree/buffer planting at the interface, it is anticipated that disturbance from human activities from the proposed residential portion would be minor.

B. Consideration Regarding Potential Disturbance Impact to the Proposed Target Species in the Absence of the Wetland & Visual Buffer

Three reed-fringed ponds are proposed to be provided at the WRA to the north of the proposed residential portion primarily for Little Egret, Chinese Pond Heron, Greater Painted-snipe and amphibians, while marsh is proposed to the east of the development primarily for Chinese Pond Heron, Greater Painted-snipe, Red-throated Pipit and amphibians. As noted in **Section 8.10.3.1** above, large birds in open country habitats (such as waterbirds around fish ponds) constitute most of the disturbance-sensitive species in the Deep Bay area. Species preferring marsh habitat (such as Greater Painted-snipe) are generally more tolerant to disturbance, due to the presence of vegetation functioning as a cover. Hence, of the three bird species targeted in the pond habitat in the WRA, only Little Egret and Chinese Pond Heron are potentially impacted by disturbance from the proposed development. In a study of bird's Flight Initiation Distance (FID) and urban disturbance, Lin *et al*. (2011) considered Little Egret as a species with "significant tolerance to urban disturbance", with higher tolerance (shorter FID) in urbanized areas than in less urbanized area. The FID of this species is reported to be between 9 – 30 m. Though the study showed that Chinese Pond Heron is "potentially tolerant" to human disturbance, field experience with Chinese Pond Herons in ponds with heavily vegetated margins (such as grass or reeds) indicated that the species could be very tolerant under these circumstance (have exceedingly short FID).

The proposed design of the WRA has included the provision of reed-fringed ponds and marsh which are in themselves measures effective in providing cover for the target species and screening out human presence. Thus, together with the measures described under Point A above, potential disturbance impact to the proposed target species in the absence of a Wetland & Visual Buffer along the WBA is anticipated to be very minor.

C. Consideration Regarding Design Intention of & Integration of the Wetland & Visual Buffer with the WRA

A wetland buffer is defined as an area adjacent to the wetland. A Wetland & Visual Buffer therefore is an area adjacent to the wetland with visual buffering function. As noted in Point A above, some existing trees and a landscape buffer is already proposed at the interface with the proposed development, and the potential disturbance from the proposed development is anticipated to be minor after implementation of these measures. Accordingly,

the emphasis for this area is placed on providing an area with functions complementary to the ecological functions of the proposed wetland habitats in the WRA.

Thus, it is proposed to extend the reedbed strip 5m into the WBA as an additional measure. Since the potential disturbance from the proposed development is anticipated to be low due to the configuration of the two sites and the interface treatment, an additional 5m buffer is considered sufficient to further protect the WRA and minimize disturbance, while reinforcing and providing a complementary ecological function with the WRA. Together with the proposed reedbed within the WRA, the total width of the reedbed to be provided would be approx. 20m.

Table 8-48 Summary of the existing habitat condition within the Project Area and the respective habitat restoration after the implementation of the proposed development and WRA

Location	Existing habitat condition	Proposed habitat restoration / enhancement
Pond 7	Inactive pond and grassy bund with low numbers of fish for self-consumption; it supports very low bird and dragonfly diversities	Pond with deep water zone, reed bed and grassy bund; suitable habitats for waterbirds, reed-associated species and dragonflies.
Pond 8	Inactive pond and grassy bund with very low numbers of fish for self-consumption; it supports low bird and dragonfly diversities.	Pond with deep water, shallow water zone, grassy bund, reed bed and gravel; suitable habitats for waterbirds, reed-associated species and dragonflies.
Pond 9	Marsh and grassy bund developed from abandoned pond through natural succession; it supports very limited flora and fauna.	Connected with Pond 17 to provide pond with deep water zone, shallow water zone, grassy bund, reed bed, gravel and bamboo clumps; suitable habitats for waterbirds, reed-associated species and dragonflies.
Pond 17	A pond at the start of the survey period, but was temporarily drained for agricultural use during most of the survey period and has subsequently been reflooded.	Connected with Pond 9 to provide pond with deep water zone, shallow water zone, grassy bund and reed bed; suitable habitats for waterbirds, reed-associated species and dragonflies.
Pond 18	Inactive pond and grassy bund; it supports very low numbers of birds.	Pond with deep water, grassy bund and reed bed; suitable habitats for waterbirds.
Area 40	Area recently colonized by reed from a previously inactive pond with grassy bund; it supported very low number of birds (such as Great Egret and Chinese Pond Heron).	Pond with deep water, shallow water and wooded bund; suitable habitats for waterbirds, reed-associated species and dragonflies.
A1 – A2	Agricultural land (including wet and dry agricultural land) with grassy bund supporting low number of birds and amphibians.	Marsh and grassy bund; suitable habitats for waterbirds and amphibians.
A3	The area was agricultural land with grassy bund supporting low number of birds during the survey period and has subsequently turned into a seasonally wet grassland following abandonment of agricultural practices.	Marsh with grassy and wooded bund; connected with A1-2; suitable habitats for waterbirds and amphibians.
A4 – A10	Agricultural land (including wet and dry agricultural land) with grassy bund supporting low number of birds (such as Little Egret, Chinese Pond Heron, Red-throated Pipit).	Developed area.
Seasonally wet grassland near Pond 9	Seasonally wet grassland and grassy bund developed from abandoned pond through natural succession; it supports very low flora and fauna diversity.	Connected with Pond 9 to provide reed bed, grassy bund and bamboo clumps; potential habitats for egrets and waterbirds to roost and forage.

Grassland/ shrubland abutting "Recreation" zone	Grassland/shrubland on raised ground supported low floral and faunal diversity due to management regime.	Developed area.
Grassland/ shrubland abutting Fairview Park and the channel	Grassland/shrubland on either side of the channel and supports low diversity and abundance of flora and fauna.	Buffer planting with native species appropriate for wildlife use

Table 8-49 Evaluation of Recommended Option in terms of fulfilment of guiding principles outlined in the TPB PG. No.12C, Explanatory Notes to OZPS/YL-MP/6 and other ecological considerations

Criterion		Does Recommended Option and WRP fulfil objective?
A. Fulfilment of guiding principles outlined in TPB PG No. 12C and OZP No. S/YL – MP/6		
1	No-net-loss in wetland in terms of function and area	**Yes.** No net loss of wetland
2	Avoidance of loss of fish ponds and habitat fragmentation	**Yes.** None of the fish ponds are lost. The isolated Area 40, which was formerly a pond, is retained, with reconnection to the main WRA.
3	All existing continuous and adjoining active/abandoned fish ponds to be conserved	**Yes.** None of the fish ponds are lost. Ponds 7, 9 and 18 (abandoned ponds and marsh developed from ponds undergoing natural succession) are re-contoured and enhanced.
4	Any new development should be located on the formed land without any pond filling	**Yes.** No pond-filling is involved;
5	The integrity of the habitat should be maintained to avoid disturbance and/or fragmentation.	**Yes.** Disturbance impact is minimized by concentrating developed areas to the landward side and adjoining existing anthropogenic habitat (Yau Pok Road and the proposed Cycle Track). Disturbance to Area 40 from Yau Pok Road and the proposed Cycle Track would be minimized by screen planting.
6	Alternative ecologically beneficial uses to existing fish ponds which would perform ecological functions similar to or better than the existing fish ponds to be replaced and be compatible with the conservation objectives of the wetland in Deep Bay Area	**Yes.** Proposed habitats are not confined to fish pond habitat. A variety of wetland habitats are proposed to maximize the ecological potential of the Area, regarding the location and species recorded on-site and in the immediate vicinity;
7	Should not add to the pollution loading of the Deep Bay Area	**Yes.** No discharge of sewerage from the proposed development and suitable minimization measures will be taken during the construction period.
8	Low-density private residential/recreational development [to be provided] at the landward fringe of the WCA	**Yes.** The proposed development is situated on the landward fringe of the WCA, adjoining Fairview Park and Yau Pok Road;
9	Pond filling to be minimized and be located as far away from the Deep Bay and/or adjoining the existing Project Area	**Yes.** No pond-filling is involved. The development is situated as far as possible from Deep Bay.
10	Any new development to be located away from the existing fish pond within the Project Area	**Yes.** New development is located on the landward side of the Project Area and appropriate set-back of residential houses would minimize disturbance to the WRA.
11	No decline in the wetland function of the fish ponds within and near the Project Area	**Yes.** The proposed wetland habitats serve to complement and enhance the ecological function and integrity of the periphery of the Deep Bay wetland system.
12	Provide a wetland and visual buffer to separate the development from the WCA to minimize its impact on	**Yes.** An additional strip of reedbed (and buffer planting) is provided on the WBA-side of the development adjoining the proposed reed in the WCA. The total width of the reedbed would be increased to

Criterion		Does Recommended Option and WRP fulfil objective?
	the wetland	approx. 20m.
B. Other ecological factors		
12	Concept design and target species reflect and maximize the existing and potential wildlife usage of the Project Area	**Yes.** See discussion on the ecological value of the existing habitats in **Section 8.8**; wildlife use in **Sections 8.7.2– 8.7.8**, comparison of existing habitats in **Table 8.34** and habitat description of the proposed habitats in **Tables 8-35 – 8.41** above.
13	Overall wetland configuration	**Yes.** All existing and former ponds are retained, restored and conserved to maintain the habitat integrity within WCA and adjoining wetland habitats in WBA. By connecting Area 40 to the main WRA, a wetland buffer will be provided between the proposed residential development and the adjoining wetland habitats located to the east, minimizing the human disturbance impact to the adjoining wetland areas.
14	Maximize ecological potential of the wetland habitats	**Yes.** The habitats will be managed for wildlife and new habitats will be provided to maximize the ecological potential of the site within the limitations of the wetland configuration and location relation to the Deep Bay wetland system; The design of wooded planting and shallow pond would enhance its potential ecological attractiveness to fauna.
15	Maximize ecological potential of the area for wildlife	**Yes.** Despite the constraint of the location of the WRA on the landward edge of the Deep Bay wetland system, where ecological potential of habitats in the east and southeast are somewhat limited by the proximity of anthropogenic habitats outside the Project Area, the proposed habitat will nevertheless fulfil an important ecological function.

Table 8-50 Total Wetland Area to be provided after the provision of 5m of reeds at the interface between the WCA and WBA

Time Frame	Proposed Habitat	
	Recommended Option	
Habitat	**ha**	**%**
Pond	1.6	19.3
Marsh	0.8	10.1
Reed	0.6*	7.5
Grassy Bund	0.4	4.9
Wooded Bund	0.3	4.6
Bamboo Clump	<0.1	0.5
Gravel	<0.1	0.8
Development Area	4.3	52.3
Total Area	**8.1**	**100**
Wetland habitat total	**3.8**	**47.7**

* of which 0.1 ha is located within the WBA.

8.11.1.4 Mitigation for Direct Impacts to Bird Species of Conservation Importance

Though numbers of bird species of conservation importance on site were small, numbers of three species (Little Egret, Chinese Pond Heron and Red-throated Pipit) are considered sufficient that minimization of impacts is required, by ensuring that the WRA is designed to take account of the needs of these species. Although Red-throated Pipit was recorded in relatively large numbers (a maximum of 30 individuals recorded), the presence of this species in the existing agricultural land is due to habitat suitability and, as a flocking species, the number of individuals is not directly area-related. Accordingly, the suitability of the WRA for Red-throated Pipit will depend more on the type of habitat than the area of the habitat. Accordingly, the design of wetland and other terrestrial habitats for this species will take this into account without compromising mitigation measures for other target species.

The numbers of Greater Painted-snipe recorded on site (a maximum of two individuals) were not, in themselves, of significance. However, measures to compensate direct impacts to this species are proposed, on a precautionary basis, for three reasons: this is a cryptic species which may have been under-recorded during surveys; dates of observations suggest that it may be a breeding species in the Assessment Area; and this species is localized in Hong Kong and is vulnerable to loss of its preferred habitat (freshwater marsh and wet agricultural land). Accordingly, the needs of this species will also be taken into account in the WRA design. Conversely, while numbers of Little Ringed Plover were moderately high (up to 25 individuals), only the breeding population of this species is considered to be of conservation significance (Local Concern), and this is a common wintering species around fish pond habitats in Deep Bay during winter. There was no evidence of breeding of this species in the Project Area, and impacts to the species are considered to be low. The proposed provision of gravel in the wetland design would provide appropriate habitat for this species, including potential breeding habitat.

Loss of habitats for bird species of conservation importance including the four species mentioned above (Little Egret, Chinese Pond Heron, Red-throated Pipit and Greater Painted-snipe) will be compensated by the provision of suitable habitats in the WRA, including marsh, grassy bund, bamboo clumps and shallow water zone, prior to the site clearance and formation works in the residential portion. Temporary impacts and disturbance to these bird species through loss of foraging habitat during wetland construction are minimized by providing a temporary enhancement area (Figure 8-6), in the form of shallow water pond and marsh, on existing agricultural land at the south western part of the Project Area. The temporary wetland enhancement area will include areas of providing shallow water and marsh. The direct impact and disturbance to wetland birds will be limited to the start of the construction period, as the WRA will be constructed during the wet season of the first year of construction and prior to main construction of the proposed residential development to minimize impacts during the period of greatest abundance of waterbirds. Accordingly, operation of the temporary wetland enhancement area will be stopped after the completion of the construction and planting works of the WRA.

In combination, therefore, direct impact and disturbance to birds will be minimized throughout the construction period by the provision of temporary enhancement area and the early completion of the WRA.

Apart from the loss of foraging habitat to the bird species of conservation importance, no other direct impacts to bird species or to species of conservation importance from other fauna groups are considered to require mitigation. Proposed management and enhancement of the WRA would compensate for loss of habitat used by many of these species.

8.11.1.5 Proposed Mitigation Measures for Amphibians

Though no amphibian species of conservation importance were recorded on site, moderate numbers of common amphibian species were recorded during the breeding season. As discussed in **Section 8.10.2.4** above, impacts to the species' populations in a Deep Bay context are expected to be very small, hence in a Deep Bay and Hong Kong context impacts are not significant, and no specific mitigation measure is required. However, the amphibians on-site are anticipated to be benefitted from the provision of a temporary enhancement area (Figure 8-6) as outlined under **Section 8.11.2.1** below.

8.11.2 Proposed Mitigation Measures to Minimize Potential Indirect Ecological Impact

Minimization measures are proposed to avoid or minimize the following predicted indirect impacts:

- Disturbance to adjacent ponds and disturbance-sensitive waterbirds;

- Flight line impacts;
- Indirect impact to stream corridors and Ngau Tam Mei Drainage Channel;
- Pollution impacts to watercourses and Deep Bay;
- Impacts from habitat fragmentation;
- Indirect (disturbance) impacts to other bird species; and
- Temporary impacts arising from the construction of WRA.

8.11.2.1 Mitigation for Disturbance to Adjacent Ponds, the Newly Formed WRA and Disturbance Sensitive Waterbirds

Clear demarcation of the Project Area limits is required in order to minimize and contain any disturbance during the construction period. Special attention will be paid to the northern and north-western limits of the Project Area, which are adjacent to the inactive/abandoned ponds connected with the Deep Bay wetland system. These pond areas and the associated wildlife are regarded as ecologically sensitive receivers from the proposed development.

The ponds lying to the east and northwest of the Project Area may be impacted by noise/visual disturbance during the construction phase. As explained in **Sections 8.7.2** and **8.10.3.3**, ponds in the northwest of the Assessment Area (including Ponds 13 – 16 and 25 – 36) support the majority of waterbird activity, but are more distant from the Project Area and are visually concealed from the Project Area by the existing residential developments (Palm Springs, Royal Palms and Fairview Park), hence construction phase disturbance to these ponds would be minimal.

The ponds (including Ponds 3, 4, 6, 10 and 11) lying to the east and northwest within the 100m disturbance corridor of the Project Area would be affected by the construction phase disturbance, but consequences of disturbance to these ponds are anticipated to be minor after the installation of site hoarding. In addition, these ponds are currently supporting low faunal diversity, partly because of the management regime (i.e. abandoned) and partly because they are subject to human disturbance from existing residential development (Palm Springs, Royal Palms and Fairview Park) and village (Yau Mei San Tsuen). Hence, disturbance impact to these ponds during the construction of the site hoarding is anticipated to be small. In addition, disturbance impacts will be mitigated by the provision of the WRA acting as a buffer from the proposed development, wetland restoration and conservation concepts incorporated into the Master Layout Plan through specific design rationale (including landscape buffer planting and a solid visual barrier between the WRA and the proposed residential area, provision of private back yards to set back houses from the WRA, restricted building heights (3 storeys) to be similar to the surrounding existing residential estates, no unsupervised public access to the WRA, and orientation of housing and the road layout away from the WRA. The implementation of the site hoarding will be scheduled to avoid peak winter bird season (between October and March) to minimize disturbance.

Construction of the WRA will be undertaken at the start of the proposed project (prior to the main residential construction), with earthworks restricted to minimal pond re-profiling work for excavating the existing ponds to a depth of 1 – 2.5m, re-contouring the pond bund and excavating some existing pond bunds to provide larger ponds. The proposed earthworks are similar to usual fish pond maintenance practice, and earthwork machinery will be restricted to a small dredger as is commonly utilised in fish pond maintenance.

Furthermore, a temporary hoarding around the WRA and a movable noise barrier around the machinery will be maintained during the construction of WRA. Once the temporary barrier is formed, the site formation for the WRA will be completed in the wet season of the first

construction year, so as to minimize disturbance impacts during the period of greatest abundance of disturbance-sensitive waterbirds. In addition to the above measures, impacts on waterbirds during the construction of the WRA will be minimized by the utilization of an area of existing agricultural land in the west of the Project Area for the temporary provision of shallow water pond (0.75ha) and marsh (0.35ha) during WRA construction. Only, minor adjustments to the existing agricultural regime following traditional wetland agricultural practices will be necessary to provide suitable habitat for potentially impacted bird species (Little Egret, Chinese Pond Heron, Greater Painted-snipe and Red-throated Pipit) as these are all species which readily utilize such habitat.

During the construction period, no dogs will be allowed on the construction site to ensure that these do not provide a source of disturbance to waterbirds. Access of construction workers is not allowed unless for management and/or maintenance purposes of the WRA. Good site practice and selection of quiet equipment are expected to minimize noise impacts to waterbirds. Night-time light disturbance will be minimized by limiting the amount of lighting on the Project Area and by locating light sources far away from the adjacent ponds. Planting and initial vegetation maintenance will commence in the subsequent wet season.

During the following 1.5 years of establishment and stabilization, the temporary barrier around the northern, eastern and north western boundary of the WRA will be replaced with a 1.8 m high dog-proof chain-link fence with design elements which prevent dogs from digging under so that the wetland in WRA will be able to integrate with the adjacent ponds and will provide a buffer from ongoing construction work in the residential development and to prevent disturbance to the WRA resulting from access by human and dogs.

During the main construction phase for the residential development, a temporary 3m high visual barrier will be erected along the interface between the WRA and the residential area. The only major sensitive receivers to the disturbance impacts arising during the Construction Phase are large waterbirds, a considerable number of which utilize the wetland system to the northwest of the Project Area (approximately 400 – 500m away from the proposed residential area). In addition to the presence of the 100m wide WRA which will perform as a buffer zone between these areas of high wildlife utilization and the proposed residential area, the construction of temporary 3-m visual barrier will further reduce anthropogenic disturbance and impact from the proposed residential area, to the adjacent ponds. Good site practices will be followed to minimize noise, visual and light disturbance to the waterbirds.

Reed bed and wooded bund habitats, fenced by a permanent perimeter wall of 1.8 m high on the landward side, will be formed along the interface between the WRA and the proposed residential area. Together with landscape planting and retention of existing trees along the interface, mature reed bed and moderate-sized shrubs and trees will minimize disturbance to waterbirds in the open water zones and marshy habitats. No unsupervised public access into the WRA and the adjacent ponds will be allowed to ensure that direct human disturbance to waterbirds in the adjacent wetlands will be avoided as far as possible.

On the boundary between the WRA and the adjacent ponds outside the Project Area a 1.8 m high fence will be formed to prevent unsupervised public access from surrounding footpaths without reducing ecological continuity and connectivity with the adjacent wetland habitats.

The proposed residential area immediately adjacent to the WRA is designed to be compatible with the objectives of wetland restoration and conservation. According to the Mai Po & Fairview Park OZP (No. S/YL-MP/6), only a low-density residential development with a maximum building height of 3 storeys, including car park, is permitted in the Project Area. This height restriction is similar to that in the surrounding existing residential estates (Palm Springs, Royal Palms and Fairview Park). Orientation of housing and road layouts will be inwards and wherever possible the residential layout will be such that private back yards form the immediate interface with the WRA. All these design features will ensure any potential anthropogenic disturbances will be concentrated away from the WRA.

In addition, in accordance with the TPB PG No.12C, a Wetland & Visual Buffer of a 5m-wide reedbed strip associated with some screening trees and shrubs will be provided along the interface between the WBA and WCA (Section 8.11.1.3 refers). Given the level difference of 2m and the buffering function of the private garden and the screening effect of the tree/buffer planting at the interface, it is anticipated that disturbance from human activities from the proposed residential portion would be minor. Overall, impacts to the waterbirds in the adjacent ponds will be reduced to a low level during the construction period and residual impacts during the operational period will be insignificant.

Potential disturbance impacts to birds in Ngau Tam Mei channel would involve a slight increase in activity over existing levels. Disturbance would be greatest during the construction period. Construction activities within the site will be screened from the channel by provision of a solid barrier to minimize potential impacts to waterbirds.

Other forms of disturbance to the newly formed WRA (potential spillage of materials or dumping of rubbish) will be mitigated through good site practice (**Section 8.11.2.3**) and good design of the water surface drainage system.

8.11.2.2 Mitigation for Flight Line Impacts

One significant non-breeding season ardeid flight line (Flight Line 3) between the Ngau Tam Mei Drainage Channel and the wider Deep Bay wetland system passes along the eastern side of the site and is close to Area 40. Retention and enhancement of Area 40 and its incorporation within the WRA will ensure that this flight line is not compromised or narrowed by disturbance or development. During the breeding season no important flight-lines were located over the Project Area, and no further mitigation measures are required for breeding season flight-lines, while the area retained (approx. 10-25m in width) will minimize the disturbance to the non-breeding bird flight line (Flight Line 3).

8.11.2.3 Indirect Impact to Stream Corridors and Ngau Tam Mei Drainage Channel and Pollution Impacts to Watercourses and Deep Bay

During the construction period, potential pollutants from the Project Area, including sediments released during site excavation, chemical waste from mechanical equipment, especially oils and lubricants, and domestic waste water, could enter the adjacent stream corridors, Ngau Tam Mei Drainage Channel and ponds to the north and east. The watercourses feed into Deep Bay, an area of high ecological value, where pollution events could have a significant ecological impact.

Nevertheless, good site practice during the construction phase, appropriate design of the surface water collection system and efficient sewerage management is required in order to eliminate on-site run-off to the Channel and Deep Bay system.

During the operational phase, no sewage or water from the residential areas will be discharged into the WRA, which will be fully self-contained with rainwater as its major water source. Pond water will only be transferred between ponds, thus no pond water discharge is expected (layout of WRA is shown in Figure 8-5). All sewage from the site would be treated by the interim sewerage treatment plant (or the public sewer system upon completion) prior to discharge. Surface water runoff from the residential area will be collected and discharge into NTMDC after passing through sand traps and/or oil interceptors, especially for car parks and similar facilities. In addition, a system of containment bunding will be implemented (where appropriate) in the event of emergency (such as car accident which involved major spillage of oil, chemical or fuel, dispersants or fire fighting foam etc.).

8.11.2.4 Impacts from Habitat Fragmentation

Habitat fragmentation may arise from the isolation of existing pond of the Project Area. To ensure the continuity of habitats for wetland-dependent taxa, in particular herpetofauna, and to fulfil the 'No-Net-Loss' of wetland habitats criterion, the following measures safeguarding the continuity of wetland habitats will be implemented:

- Provision of wetland habitats in a unit contiguous and continuous with the existing ponds in the east including measures to restore linkages between (currently isolated) Area 40 and the wider wetland system;
- Avoidance of anthropogenic structures in the boundaries adjacent to the existing wetland habitats, and employment of natural barriers such as grassy bund, reed bed and (wet) wooded planting, which will serve as potential roosting and foraging sites for many species; and
- Concentration of the proposed development in the south and west of the Project Area, adjacent to existing anthropogenic habitats (Yau Pok Road and Fairview Park) to reduce additional anthropogenic impacts to a minimum.

8.11.2.5 Mitigation for the Impacts Arising from the Construction of Wetland Restoration Area

Construction of the Wetland Restoration Area will involve temporary occupation of wetland habitats within the Project Area. Noise and increased human disturbance arising from the construction of WRA may reduce the utilisation of wetland habitat in proximity to the WRA (especially Pond 10 and 11 which are within 100m of the WRA boundary) by disturbance-sensitive species (mostly large waterbirds). Construction phase impacts are temporary, but may be significant without any mitigation measures.

A temporary hoarding and a movable noise barrier around the WRA will be maintained during the construction of WRA to minimize the noise impact. The site formation of the WRA will be carried out during the wet season to avoid the period of greatest abundance of disturbance–sensitive waterbirds. The proposed temporary wetland enhancement area will mitigate the temporary loss of wetland habitat within the Project Area and during the construction of WRA. Although the temporary wetland enhancement area is smaller than the WRA, phasing of works in the WRA and the retention of other existing habitat would ensure that there is no loss of wetland function during this period. During the construction period, no dogs will be allowed on the construction site to ensure that these do not provide a source of disturbance to waterbirds. Good site practice and utilization of quiet equipment are expected to minimize noise impacts to waterbirds. Night-time light disturbance will be minimized by limiting the amount of lighting on the Project Area and by locating light sources far away from the adjacent ponds.

8.12 Post-mitigation Acceptability of the Project

Potential adverse ecological impacts of the Project and required mitigation are summarized in Table 8-51 below. With the implementation of appropriate mitigation measures, it is predicted that the Project will fully mitigate for the mainly minor potential adverse ecological impacts and will also be beneficial to other wildlife which are not expected to be severely impacted; the corollary of this is that the Project is likely to result in ecological benefits for the Project Area.

The area of managed wetland in the proposed WRA (3.8 ha; including 0.2 ha of Wetland and Visual Buffer) is greater than the area of the existing wetland habitats (3.0 ha), and the ecological value of these wetlands is expected to increase due to active management. Most agricultural land (totalling 4.9 ha) to be lost by the Project was managed for active dry

agriculture throughout the survey period (and judging from aerial photographs, for a number of years prior to the surveys), and thus had limited wetland function; an increase in wetland area within the WRA is considered to be ecologically beneficial in the Deep Bay area, where there has been a cumulative loss of wetland habitats as a result of changes in land use (albeit at a lower rate in recent years following the introduction of planning guidelines).

Overall, it is considered that there will be moderate but significant beneficial ecological effect arising from the Project.

Table 8-51 Summary of potential ecological impacts, required mitigation measures and post-mitigation acceptability of the project

Potential Impact	Predicted Significance of Impact	Proposed Mitigation Measure	Residual Impact
Direct habitat loss in the Project Area			
Loss of agricultural land	Low to Moderate Significance.	Compensation of wetland function will be provided by management of suitable habitats in the WRA.	None.
Loss of pond areas	Low to Moderate Significance.	Selection of a suitable layout design ensures there is no loss of existing pond area. Pond habitats will be enhanced by management of the WRA.	None.
Loss of marsh	Low Significance.	Impacts of Low Significance do not normally require mitigation. Areas of marsh will be provided in the WRA.	None.
Loss of reed bed	Low Significance.	Impacts of Low Significance do not normally require mitigation. Areas of reed will be provided in the WRA.	None.
Loss of seasonally wet grassland	Low Significance.	Impacts of Low Significance do not normally require mitigation. Habitats with a similar function will be provided in the WRA.	None.
Loss of grassland/shrubland	Negligible Significance.	Impacts of Low Significance do not normally require mitigation. Habitats with enhanced function will be provided in the WRA.	None.
Direct impacts on species of conservation importance			
Impacts on vegetation	No Significant Impact.	No mitigation measure is required.	None. Management of exotic vegetation and the planting of native species in the WRA is likely to be ecologically beneficial to wildlife.
Impacts on mammals	Very Low Impact for Japanese Pipistrelle and Short-nosed Fruit Bat. No other mammals are known to use the Project	No mitigation measure is required but planting of Chinese Fan Palm will provide roosting and foraging habitat for	Low Impact. Provision of roosting and foraging habitat will be a net benefit to Short-nosed Fruit Bat.

Potential Impact	Predicted Significance of Impact	Proposed Mitigation Measure	Residual Impact
	Area, thus No Significant Impact.	Short-nosed Fruit Bat	
Impacts on bird species of conservation importance	Low Significance for Little Egret Chinese Pond Heron and Little Ringed Plover. Low to moderate significance for Red-throated Pipit Greater Painted-snipe. Very low to Low Significance for other bird species. **Low Significance** for bird collision impact given the design and the relative heights of the temporary noise barriers.	Loss of habitats will be compensated by enhancing or restoring habitats in the WRA. Significant ardeid flight lines will be avoided by development. Noise/visual disturbance will be minimized during the construction period by temporary visual barrier and during the operation phase by landscape and habitat planting buffer, and no unsupervised public access into the WRA and the adjacent ponds will be allowed. Design of the temporary noise barrier has incorporated design (use of opaque and non-reflective materials) and colours which would blend in with the environment.	Impacts on all species of Very Low or Low Significance. Long-term commitment to the management of the WRA is likely to be beneficial to a suite of other bird species of conservation importance as well as these species. Bird collision impact with the temporary noise barrier is anticipated to be of Negligible to Very Low Significance.
Impacts on reptile species of conservation importance (Many-banded Krait)	Low Significance for Many-banded Krait; No Significant Impact on other reptile species	No mitigation measure is required.	Impacts of Low Significance. Long-term commitment to the management of the WRA is likely to be beneficial to a suite of reptile species of conservation importance.
Impacts on amphibians diversity and local population	Negligible to Very Low Significance.	Minimization through translocation and provision of suitable habitats in the WRA.	Low Significance. The habitats provided in the WRA are expected to ensure the continued existence of the local amphibian population.
Impacts on dragonfly species of conservation importance (Coastal Glider)	Negligible to Very Low Significance.	No mitigation measure is required.	Negligible to Very Low Significance. Long-term commitment to the management of the WRA is likely to be beneficial to a suite of dragonfly species.
Impacts on butterfly species of conservation importance (Danaid Egg-fly)	Negligible to Very Low Significance.	No mitigation measure is required.	Negligible to Very Low Significance. Long-term commitment to the management of the WRA is likely to be beneficial to a suite of butterfly species.
Impacts on fish species of conservation importance	No Significant Impact.	No mitigation measure is required.	No Significant Impact.

Potential Impact	Predicted Significance of Impact	Proposed Mitigation Measure	Residual Impact
Indirect impacts on habitats in the Assessment Area (outside the Project Area)			
Indirect impacts on adjacent pond areas	Negligible Significance during operation. Moderate to High during construction phase.	Construction of the WRA will commence at the start of the construction phase and prior to the main construction work. Temporary screening materials during the construction period will be erected, while design of the WRA and residential area will incorporate elements (such as buffer planting, suitable wetland habitats in the WRA as buffer area, proper orientation of housing, road layout and club house) to minimize impacts during the operation phase.	Impacts reduced to Low Significance.
Indirect impacts on marsh, reed bed and seasonally wet grassland	Very Low Significance.	No mitigation measure is required	Very Low Significance.
Indirect impacts on stream corridors and Ngau Tam Mei Drainage Channel	Very Low Significance for watercourses within the Assessment Area. Low to Moderate Significance for Ngau Tam Mei Drainage Channel during construction but Low Significance during operation.	Minimization through good site practice and good design of surface water drainage.	Impacts of Low Significance.
Indirect impacts on grassland/shrubland	Very Low Significance.	No mitigation measure is required	Very Low Significance.
Indirect impacts on other habitats within the Assessment Area	No Significant Impacts.	No mitigation measure is required	No Significant Impacts.
Indirect Impacts on the newly formed WRA during the construction phase	Disturbance from human and/or dog intrusion of **Moderate Significance**. Other forms of disturbance potentially of **Moderate to High** Significance.	No access for dogs while access for human is strictly restricted to works required for management and/or maintenance of the WRA only. Other forms of disturbance through good site practice and good design of surface water drainage.	No Significant Impacts
Indirect Impacts on the newly formed WRA during the operational phase	Disturbance impact predicted to be of **Low Significance** during the operational phase due to design elements of the WRA.	No un-authorized access and the wetland will be kept free of dogs. The design of the WRA has provided sufficient buffer against potential noise and light disturbance from the residential area.	No Significant Impacts
Pollution impacts on watercourses and Deep Bay	Low to Moderate (in the case of serious chemical pollution events)	Minimization through good site practice and good design of surface	Low Significance.

Potential Impact	Predicted Significance of Impact	Proposed Mitigation Measure	Residual Impact
	Significance.	water drainage.	
Cumulative impacts on wetland loss	Low to Moderate Significance.	Avoidance through the provision of compensatory habitats with similar or enhanced ecological functions in the WRA.	Low Significance.
Impacts from habitat fragmentation	Low to Moderate Significance to herpetofauna populations.	Partly avoided by selection of a site layout to retain existing ponds. Further minimized by provision of dispersal corridors at the perimeter of the development, to ensure linkage of wetland habitats in the WRA and those outside the Project Area.	Low Significance.
Indirect impacts on species of conservation importance			
Indirect impacts on vegetation	Very Low Significance.	No mitigation measure is required	Very Low Significance.
Indirect impacts on mammals	No significant impact on terrestrial mammals. Impact of Very Low Significance to two bat species (Short-nosed Fruit Bat and Japanese Pipistrelle).	No mitigation measure is required	Very Low Significant Impact.
Indirect impacts on birds	Construction phase disturbance impacts are considered to be of Low to Moderate Significance. Operation phase disturbance impacts are considered to be of Low Significance.	Minimization through temporary visual barrier to reduce noise/visual disturbance during the construction period; while impact during the operation phase will be minimized by landscape and habitat buffer, and no unsupervised public access into the WRA and the adjacent ponds will be allowed. Layout will ensure that there is no development on or near flight lines.	Impacts of Low Significance.
Indirect impacts on egret flight-lines	Low Significance to egret flight line during the breeding season.	Minimization through temporary visual barrier to reduce noise/visual disturbance during the construction period; while impact during the operation phase will be minimized by landscape and habitat buffer, and no unsupervised public access into the WRA and the adjacent ponds will be allowed. Layout will ensure that there is no development on or near flight lines.	Impacts of Low Significance.
Indirect impacts on egretries	No direct impact on egretries. Impacts on Flight lines of Low Significance.	No mitigation measure is required.	No direct impact. Impacts on flight lines of Low Significance.

Potential Impact	Predicted Significance of Impact	Proposed Mitigation Measure	Residual Impact
Indirect ecological impacts on non-breeding ardeid foraging areas and non-breeding ardeid flight line	Construction phase disturbance impacts are considered to be of **Low to Moderate Significance** due to the small number of individuals present within the habitats potentially to be indirectly impacted and the existing levels of disturbance in the area. Operation phase impacts are considered to be of **Low Significance** except impacts on ardeids using Flight Line 3 which may be of **Low to Moderate Significance** in the absence of mitigation.	Minimization through provision of wetland along the eastern side of the Project Area by converting part of the agricultural land into wetland habitat and retaining Area 40 as an amenity pond, and suitable buffer planting.	Very Low Significant Impact.
Indirect impacts on other fauna	No Significant Impact	No mitigation measure is required	None.

8.13 Ecological Monitoring Programme

8.13.1 Target Species

Following a review of the baseline data, target species for the rehabilitated wetlands have been identified as those species of conservation importance which were recorded in significant numbers during the baseline ecological surveys and which therefore may be impacted by the proposed development.

To qualify as a Target Species as species must fulfil the following requirement:

- It is a species of Conservation Importance based upon criteria provided by BirdLife International (2006 and web updates), IUCN Species Survival Commission (2001) or Fellowes *et al.* (2002), which was recorded in numbers considered to be of significance during the baseline ecological surveys.

The data of baseline surveys were reviewed to determine if there were species (especially wetland-dependent species) which, although not of conservation importance, were recorded in particularly high numbers in a Hong Kong context. This review was to determine whether or not the site was of importance to species which, although not of conservation concern, would be significantly impacted by the proposed development, in the context of their distribution and abundance in Deep Bay or Hong Kong as a whole. There was no species which fell into this category based on this review, but the amphibian community was considered to be important at a local scale.

The detailed rationale of formulating the target species for the WRA is given in **Section 4.2** of **Appendix 8-10** and a summary of the target species is shown in **Table 8-51**.

Table 8-52 Target species for the WRA

Species	Reason for Selection	Conservation Status
Birds		
Little Egret *Egretta garzetta*	Breeding at Mai Po Village egretry; recorded on site on a regular basis	Potential Regional Concern (Fellowes et al. 2002)
Chinese Pond Heron *Ardeola bacchus*	Breeding at Mai Po Village egretry; recorded on site on a regular basis	Potential Regional Concern (Fellowes et al. 2002)
Greater Painted-snipe *Rostratula benghalensis*	One observation in the Project Area and one observation nearby; does not strictly meet selection criteria but included on a precautionary basis.	Local Concern (Fellowes et al. 2002)
Red-throated Pipit *Anthus cervinus*	Relatively large population (max. of 30 individuals) was recorded wintering in agricultural land of the Project Area	Local Concern (Fellowes et al. 2002)
Amphibians	Moderate populations recorded in the agricultural land of the Project Area;	N/A

A total of seven types of habitat will be provided within WRA for the target species (See **Table 8-52** and **Section 4.3 of Appendix 8-10** for the rationale of providing these habitats). Although the WRA aims to attract the target species, it is considered that the WRA, with the long term management, would be beneficial to increase the utilization of the non-target species (e.g., dragonfly and butterfly) as well. Hence, monitoring work is proposed for the target species and other wetland-dependent fauna before (baseline ecological monitoring), during (construction phase monitoring) and after (operational phase monitoring) the construction.

Table 8-53 Summary of the habitats to be provided for the Target Species in the Project Area at Yau Mei San Tsuen

Target Species	Shallow water	Reed bed	Marsh	Grassy bund	Wooded bund	Bamboo clump	Gravel
Little Egret	F	F			R	R	R
Chinese Pond Heron	F	F			R	R	
Greater painted-snipe	F		B, F, R				
Red-throated Pipit			F	F			
Amphibians			F, B, R	F, R			

Key: habitat important for B = Breeding: F = Foraging; R = Roosting/resting.

8.13.2 Ecological Monitoring EM&A Requirements

As discussed above, ecological monitoring for the target species will be required before (baseline ecological monitoring), during (construction phase monitoring) and after (operational phase monitoring) the construction. Details are mentioned in the following paragraphs as well as in the EM&A Manual.

8.13.2.1 Baseline Ecological Monitoring

In order to fill the information gap due to the changes in environment from the baseline ecological survey conditions to the wetland restoration process, monitoring of target species and other wetland-dependent fauna will be carried out in the Project and Assessment Areas 12 months prior to the commencement of any site clearance required for the construction for wetland and residential development. The frequency of the monitoring is summarized in Table 8-54 and the methodology is detailed in **Section 7 of Appendix 8-10**.

8.13.2.2 Construction Phase Ecological Monitoring

During the construction of the restored/ enhanced wetland and the residential area, target and other wetland-dependent species will be monitored within the Project and Assessment Areas. This monitoring work can ensure that the any unexpected event and on- or off-site impacts are quickly identified; hence, corresponding remedial actions can be taken. The frequency of the monitoring is summarized in Table 8-54 and the methodology is detailed in **Section 7 of Appendix 8-10**.

8.13.2.3 Operational Phase Ecological Monitoring

Ecological monitoring during the operational phase is essential to assess the effectiveness of the restored/enhanced wetland in attracting wildlife and implementing proper wetland management approach in any unexpected events. Abundance and diversity of fauna groups (birds, dragonflies, butterflies and herpetofauna) and their prey (aquatic invertebrates, benthic invertebrates and freshwater fish) are required for the monitoring. The frequency of the monitoring is summarized in **Table 8-54** and the methodology is detailed in **Section 7 of Appendix 8-10**.

The management strategy and requirements of the WRA during the operational phase, are provided in the Wetland Restoration Plan in **Appendix 8-10**.

Table 8-54 Summary of Baseline, Construction and Operational Phase Ecological Monitoring for the WRA within the Project Area

Faunal Groups	Baseline Ecological Monitoring	Construction Phase Ecological Monitoring	Operational Phase Ecological Monitoring
Birds	Twice monthly (including Assessment Area)	Weekly (including Assessment Area).	Monthly (excluding Assessment Area).
Dragonflies and Butterflies	Once per month during March to November.	Once per month during March to November.	Once every two months during March to September.
Herpetofauna	Once per month during April to November.	Once per month during April to November.	Once per month during April to November.
Aquatic invertebrates	Not required.	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Benthic Invertebrates	Not required.	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Freshwater fish	Not required.	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Habitat types	Not required.	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Vegetation cover	Not required.	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Pedology	Not required.	Not required.	At the beginning of the establishment period of the WRA and after any contamination.
Water Quality	Not required.	Following filling with water monthly for in situ water quality and every six	Monthly for in situ water quality and every six months (end of the wet

Faunal Groups	Baseline Ecological Monitoring	Construction Phase Ecological Monitoring	Operational Phase Ecological Monitoring
		months (end of the wet season and end of the dry season) for laboratory testing.	season and end of the dry season) for laboratory testing.
Site Inspections	Not required.	Weekly.	Twice per month.

8.14 Conclusion

Findings from a 12-month ecological survey indicate that the habitats on-site support low numbers of fauna of conservation importance. Larger numbers of fauna of conservation importance utilize fish ponds to the north.

All significant impacts to these fauna of conservation importance, both on and off-site, will be mitigated by appropriate measures during both the construction and operation of the Project. Furthermore, with the implementation of the Wetland Restoration Area and a long-term commitment to manage the area, it is likely that the Project will bring about moderate but significant ecological benefit to a site on the landward fringe of the Deep Bay wetland system.

8.15 References

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9. FISHERIES

9.1 Introduction

This section presents the fisheries impact assessment for the Proposed Comprehensive Development and Wetland Restoration near Yau Mei San Tsuen (hereafter called the "Project"). The fisheries impact assessment includes the following tasks:

- Review of pertinent assessment legislation and guidelines;
- Assessment methodology;
- Baseline information on the fish ponds within the Assessment Area (within 500 m of its boundary and beyond this if potentially impacted);
- Assessment of the existing aquaculture activities and fisheries resources;
- Prediction of fisheries impacts; and
- Recommendations on required mitigation measures (if any).

9.2 Legislation and Standards

The following legislation and guidance notes are applicable to the evaluation of fisheries impact related to the Project:

- Environmental Impact Assessment Ordinance (Cap. 499);
- Fisheries Protection Ordinance (Cap. 171);
- Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO), Annexes 9 and 17;
- Hong Kong Planning Standards and Guidelines, Chapter 10; and
- Town Planning Board Guidelines for Application for Developments within Deep Bay Area under Section 16 of the Town Planning Ordinance.

9.3 Assessment Methodology

Literature review was conducted to assess the baseline status of pond fish culture activity within Hong Kong, with particular attention paid to the Assessment Area. Literatures and information reviewed include:

- AFCD Annual Reports (1997-2013);
- AFCD's website on aquaculture (http://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu.html);
- Profit Point Enterprises Limited. 2008. Proposed Comprehensive Development at Wo Shang Wai, Yuen Long. EIA report submitted to EPD; and
- CEDD (2008) The Construction of Cycle Tracks and the Associated Supporting Facilities from Sha Po Tsuen to Shek Sheung River, EIA report submitted to EPD.

Site visits were undertaken to investigate the actual fisheries status within the Assessment Area. These took place in June 2008 and August 2008. The information is supplemented by interviews with local people, fish farmers and pond owners where clarification was required. In addition, activities related to fish pond operation within the Assessment Area, if any, were recorded during the monthly ecological surveys conducted between September 2007 and August 2008. An additional visit to Area 40 was conducted in September 2009 and further verified in July and November 2013.

9.4 Baseline Conditions

9.4.1 Literature Review

Pond fish culture has been practiced in north western Hong Kong for a long period of time. Traditionally, only primary freshwater fishes and several brackish species, such as Bighead Carp *Aristichthys nobilis*, Edible Goldfish *Carassius auratus*, Grass Carp *Ctenopharyngodon idellus*, Mud Carp *Cirrhinus chinensis*, Grey Mullet *Mugil cephalus* and Tilapia *Oreochromis niloticus* were farmed. However, in recent years, certain marine species such as Giant Grouper *Epinephelus lanceolatus*, Yellowfin Seabream *Acanthopagrus latus* and Scat *Scatophagus argus* have also been cultured in diluted seawater by fish farms close to the shoreline (such as Mai Po). In addition, AFCD has introduced some exotic aquaculture species (such as Jade Perch *Scortum barcoo*) to Hong Kong. Several fish farms have started to culture species new to the Hong Kong aquaculture sector and AFCD has undertaken much promotional work. The annual pond fish production and fish pond area in the territory are listed in the following table.

Table 9-1 Annual pond fish production and fish pond area

Year	Pond Fish Production (tonne)	Fish Pond Area (ha)
1997	5000	1125
1998	4900	1110
1999	4500	1094
2000	2817	1060
2001	2550	1059
2002	1989	1030
2003	2114	1029
2004	1977	1026
2005	1897	1026
2006	1943	1024
2007	1927	1160
2008	2266	1160
2009	2105	1120
2010	2190	1109
2011	2315	1130
2012	2244	1149
2013	2187	1150

However, based on the information from AFCD, local pond fish production still accounted for only 3% of local freshwater and brackish fish consumption in 2013. Most freshwater and brackish fishes consumed in the territory are imported from the Mainland.

Some of the fish ponds within the Assessment Area were assessed and regarded as inactive/ abandoned by Profit Point Enterprises Ltd (2008).

There are four open water ponds within the Project Area (Ponds 7, 8, 18 and 40 in Figures 8-2a and 8-2b) and two water bodies from which water may be used in ponds downstream of the Project Area. Pond 17 was drained and transformed to agricultural land during the survey period, hence, this pond was not surveyed during this period. A site visit was made in May 2011 and revealed that Pond 17 was covered with shallow water which is unlikely to be viable for fish culture during the period of this re-transformation. Within the Assessment Area, there are a number of ponds to the northwest of the Project Area which are continuous to the Deep Bay pond system and a number of small isolated ponds.

9.4.2 Site Investigation

No commercial aquaculture of fish is found within the Assessment Area. Of the ponds that are present, three major use categories were identified: ponds utilized for purposes of water storage in association with ornamental fish culture, inactively managed ponds for self-consumption and inactively managed/abandoned ponds. Findings are discussed in detail below. Status of the ponds within the Assessment Area is listed in Table 9-2 and the areas of the ponds and their status within the Project Area and Assessment Area are detailed in **Table 9-3**.

Site visits were undertaken, in June and August 2008, to investigate the fisheries status within the Assessment Area. The information was supplemented by interviews with local people, fish farmers and pond owners where clarification was required. In addition, activities related to fish pond operation within the Assessment Area, if any, were recorded during the monthly ecological surveys conducted between September 2007 and August 2008. An additional visit to Area 40 were conducted in September 2009, July and November 2013 to verify its latest status of fish culture activity, and it was confirmed that the condition of this area was unchanged from that in 2008.

9.4.2.1 Edible fish cultivation

Throughout the survey period from September 2007 and August 2008, no normal edible fish culture practices, such as drying, liming, re-profiling, fish fry releasing and large-scale harvesting using seine nets, nor operating aquaculture machinery, such as pond aerators, were observed. Since practices and equipment relating to edible fish farming were absent from the ponds within the Assessment Area, it is very likely that aquaculture of edible fish is not practiced on-site.

9.4.2.2 Ornamental fish cultivation

Ponds 6, 7, 21 and 40 were found to be utilised by an ornamental carp (Koi *Cyprinus carpio*) farm nearby and were used for keeping ornamental fishes. No edible fish culture was being conducted in these ponds.

9.4.2.3 Inactively managed ponds for self-consumption

There are signs that some of the ponds in the Assessment Area, including Ponds 8 and 18 in the Project Area, are used for small-scale, self-consumption of fish. A local villager was found catching fish using a cast net in Pond 8 in June 2008, who claimed that these fishes were kept for self-consumption only. Likewise during a site visit in August 2008, vegetables taken from nearby farmland were found dumped in Pond 8 (see Plate 1). It was later confirmed by the pond occupier that these were dumped into the pond for feeding fish (see Plate 2). He also stressed that the fishes (mainly Tilapia) were cultured for self-consumption and he seldom sold his harvest to the market. However, these signs of limited aquaculture activities were absent in subsequent field visits in July and November 2013.

Table 9-2 Status of ponds and fish species known to exist in these ponds within the Assessment Area

Pond	Fish Observed or Claimed to be Cultured by Pond Owner	Status/Purpose
6, 7, 21 and 40	Ornamental Carp	For culture of ornamental carp
8, 14 and 18	Bighead Carp, White-spotted Catfish*, Grass Carp*, Mosquito Fish, Tilapia	Inactive/ Self-consumption*
10, 11, 15, 22-24	Bighead Carp, Grass Carp, Mosquito Fish, Tilapia	Inactive/ Abandoned
1, 3-4, 12- 13, 19, 25-39	Not observed	Inactive/ Abandoned
Other ponds	Not observed	Inactive/ Abandoned
Three abandoned ponds (Ponds A, B and C) at the extreme west of the Project Area in Area A8 (abutting the adjacent proposed development)	No fish observed as these ponds were observed to be used for cultivation of agricultural crops.	Inactive/ Abandoned

* Information collected from the pond owners

Sizes of different types of fish ponds within the Project Area and Assessment Area are listed in Table 9-3.

Table 9-3 Sizes of different types of fish ponds with the Project Area and Assessment Area

Type/Purpose of Fish Pond #	Project Area	Assessment Area	Total
Active/ornamental fish	0.0 ha	0.4 ha	0.4 ha
Inactive/self-consumption	1.4 ha	1.1 ha	1.9 ha
Inactive/ Abandoned	0.4 ha	22.2 ha	22.4 ha

Pond 17 is not included in this calculation as it was agricultural land during the survey period.

9.4.2.4 Water bodies connecting to other fish ponds downstream

There are two small, lotic water bodies which lie within and in close proximity to the Project Area. An irrigation ditch originating from a pool with water being extracted from the Ngau Tam Mei Drainage Channel passes through the Project Area and eventually drains into Fairview Park Drainage Channel. The other stream lies to the east of the Project Area and is a partly-gabion walled stream with a natural bottom and high pollution load. This stream does not pass through the Project Area and drains into the channel bordering Palm Springs. Locations of these two water bodies are shown in Figure 9-1. Except these two water courses, other small streams/ ditches within the Assessment Area are very distant from the Project Area.

The ditch within the Project Area is totally surrounded by farmland. Water from this ditch is used for irrigating the agricultural land via portable pumps. Pumps were also found transferring water from the ditch aforementioned to nearby ponds.

According to the EIA report for the Wo Shang Wai development (Profit Point Enterprises Ltd 2008), the ponds to the northwest and outside of the Assessment Area consist of brackish and freshwater active fish farms. In view of the normal practice of local fish farming, owners of these ponds are likely to extract water from nearby streams/ creeks for refilling.

9.5 Prediction of Impacts

9.5.1 Direct Fisheries Impact during the Construction Phase

As aforementioned, there are no ponds for edible fish aquaculture within the Project Area. Although the ponds inside the Project Area were mainly inactive or for culturing ornamental fishes, they may have the potential for re-development for edible fish culture and impacts on these ponds should not be discounted. The abandoned ponds A, B, and C will be lost to the development, and Ponds 7, 8, 17 and 18 will be converted into wetland habitat (ponds) and managed as part of the Wetland Restoration Area. The total area of all these ponds is 1.8 ha, which amounts to 0.16% of the total fish pond area in Hong Kong (based on 2012 figure). The potential of these ponds to be significant in terms of fisheries production is considered to be **very low** (less than 1% of overall fishpond area). Hence, though there will be permanent loss (due to conversion to wetland) within the project area, no significant fisheries impact is anticipated, the permanent loss of these ponds to fisheries of Hong Kong is considered to be of **Negligible to Very Low Significance**.

9.5.2 Direct Fisheries Impact during the Operational Phase

Fish ponds 7,8,17 and 18 will be converted into deep water ponds as part of the Wetland Restore Area. According to the proposed management scheme, the wetland will be secured to strictly control human access. Fence wall will be provided at the interface between the WRA and the residential portion while wire mesh fence will be erected to prevent access and disturbance from outside the Project Site. Such arrangement would rule out the possibility for fish farmers to redevelop these fish ponds for edible fish culture. However, as same as stated in the above paragraph, the potential of these ponds to be significant in terms of fisheries production is considered to be **very low**. Hence, the conversion of these fish ponds throughout the operation of the Project is not anticipated to have significant fisheries impact. The permanent loss of these ponds to fisheries of Hong Kong during the operational phase is therefore considered to be of **Negligible to Very Low Significance**.

9.5.3 Indirect Fisheries Impact Due to the Deterioration of Water Quality

The stream close to the Project Area may be affected by construction runoff, dust, silt and chemical waste arising from construction activities. Untreated runoff and sediment would raise the level of suspended solids (SS). Elevated SS level may have acute or chronic effect on fishes. Since this stream drains into the watercourses to the northwest of the Assessment Area and these watercourses may provide water for active fish ponds, pollutants discharging into this stream may eventually cause an indirect fisheries impact. Blockage of this stream due to untidy construction activities (e.g. disorderly dumping of excavated material) may also affect the water supply of the active fish ponds and thus affect the aqua-cultural activities downstream. However, good site practices will be implemented during the construction phase of the Project. Excavated material and other inert construction wastes produced will be transferred to proper recipients (i.e. landfill). An emergency response plan for any water pollution in the fish ponds surrounding the Project Area will be implemented. Measures are detailed in Chapter 5 (Water Quality Impact Assessment) of this EIA report. With these measures, indirect impacts on fisheries due to the construction activities will be controlled and become insignificant.

The irrigation ditch within the Project Area will be blocked. However, since this is not directly or indirectly related to fisheries activities (i.e. it drains only into the heavily polluted Fairview Park Drainage Channel, which is not likely to be an important water source for active fish ponds; the ditch itself is also not a water source of any pond), any impact on this ditch is unlikely to cause any significant adverse effect on culture fisheries.

9.5.4 Indirect Fisheries Impact During the Operational Phase

During the operation phase, sewage from the residential area and runoff from the Wetland Restoration Area (henceforth the WRA) would cause indirect impact on the water bodies nearby. However, since the Project falls under the EIA Ordinance for which a Sewerage Impact Assessment is required, sewage from the residential area will be either discharged through a public sewerage system or treated on-site through sewerage treatment plant to the standard acceptable to the EPD. Hence, impact from sewage is not anticipated. The WRA will comprise ponds, reed bed and marshland. Reed bed is known to have water-filtering function and is likely to help alleviate the pollution load of the water. In addition, the design of the WRA incorporates measures to control and maintain the flow of water between the wetland and other water bodies; hence, the WRA is unlikely to create additional wastewater discharge and thus operation of such wetland would not cause any additional adverse impact on nearby water bodies. Therefore, there will be no fisheries impact (due to deterioration of the water quality of the stream) during the operation phase.

9.6 Evaluation of Impacts

Impact evaluation based on the criteria set in Annex 9 of TM-EIAO is listed in Table 9-4.

Table 9-4 Evaluation of Fisheries Impact in the Absence of Mitigation Measures

Criteria	Description
Nature of impact	A total of 1.8 ha of ponds would be lost to the development (Ponds A, B and C) and the WRA (Ponds 7, 8, 17 and 18). Indirect impact arising from construction activities (i.e. site runoff) and operation of the residential area and Wetland Restoration Area (i.e. sewage and runoff).
Size of affected area	Direct loss of fish pond involved 1.8 ha, which amounts to only 0.16% of the overall fish pond area. Indirect impact due to deterioration of water quality may affect active fish ponds to the northwest of the Assessment Area.
Loss of fisheries resources/ production	The potential for the pond residue to be converted to active pond will be lost. This accounts for only < 0.16% of the overall fish pond area. With good site practices, impacts arising from construction activities will be insignificant.
Destruction and disturbance of nursery and spawning grounds	No
Impact on fishing activity	No
Impact on aquaculture activity	Insignificant (loss of abandoned fish ponds within the Project Area and construction runoff, domestic sewage discharge and runoff from wetland would be contained and controlled, and the area impacted is very small compared to the overall fish pond area).

9.7 Cumulative Impacts

Of the five concurrent projects mentioned in **Section 1.9**, EIA reports are available to the public for the sewerage and sewage disposal project, cycle tracks project and “REC Site” development, while only Study Briefs could be obtained online for “RD Site” development and “Kam Pok Road Site” development. Hence the cumulative impacts are evaluated based on such information, and the loss of fish ponds duo to these projects is summarised in **Table 9-5**. As no impact assessment has been carried out for the “Kam Pok Road Site” project and “RD Site” project, the loss of fish pond is estimated based on the approved planning application of the two sites (application no. A/YL/MP/202 for the “Kam Pok Road Site” and and application no. A/YL-MP/205 for the “RD Site”). There is no pond within the the “RD

Site", while the area of the pond within the "Kam Pok Road Site" project boundary is about 0.27ha.

Table 9-5 Temporary Loss and Permanent Loss of Fish Pond Area in the Current Project and other Concurrent projects

Project	Active Fish Pond		Abandoned Fish Pond	
	Tempoary	Permanent	Tempoary	Permanent
Comprehensive Development and Wetland Protection near Yau mei San Tsuen (the Project)	-	-	-	1.8 ha
Sewerage and Sewage Disposal Project (EIA-094/2004)[1]	-	-	-	-
Cycle Tracks Project (EIA- 159/2008)	-	-	-	-
REC Site Project (EIA-220/2014)	-	-	-	<0.5 ha
Kam Pok Road Site Project (ESB - 210/2009)	-	-	-	0.27 ha[2]
RD Site Project (ESB - 204/2009)	-	-	-	-
Total	-	-	-	2.57 ha

Notes:
1. Only "Ngau Tam Mei and San Tin Areas" of the sewerage and sewage dispoposal project is discussed here, as the other works areas (i.e. Tin Shui Wai and San Wai Areas, Lau Fau Shan and Mong Tseng Areas, and Shap Pat Heung Area) is in long distance from the current Project Area.
2. While no EIA report is available for the "Kam Pok Road Site" project, an approval has been obtained on its relevant planning application no. A/YL-MP/202. The abandoned fish pond (about 0.27ha in area) within the application site will be filled based on the approved scheme.

Thus, the accumulated fish pond area to be affected by the current Project and other nearby projects amounts to approximately 2.57 ha, and all of them are abandoned fish ponds. The affected total area accounts for a loss of 0.23% of the overall fish pond area in Hong Kong, none of which is active fish pond; fisheries impact is therefore not considered to be significant.

In terms of the cumulative indirect fisheries impact due to potentially increased suspended solids-loaded surface runoff, it will be controlled by mitigation measures of each project and is expected to be insignificant given the small scale of the works envisaged for all these projects.

9.8 Mitigation Measures

With the measures for mitigating the impacts from construction activities through standard good site practice, indirect impact during the construction phase would be insignificant. During the operation phase, no significant impact is anticipated and thus no specific measure for fisheries impact has to be implemented.

9.9 Environmental Monitoring and Audit Programme

No significant fisheries impacts are predicted as a result of the proposed Project; hence the development and implementation of a monitoring and audit programme for assessing the effects on fisheries resources and operations is not considered necessary. However, an emergency response plan for any water pollution in the fish ponds surrounding the Project Area will be implemented. Measures are detailed in Chapter 5 (Water Quality Impact Assessment) of this EIA report.

9.10 Conclusion

Though there will be loss of potential fisheries resources permanently, the area involved is insignificant to the overall fish pond area (<1%). When other concurrent projects are taken into consideration, the cumulative fisheries impact remains insignificant and acceptable. Hence, no significant adverse fisheries impact is predicted. Further, with the implementation of good site practices and water quality and construction and operational sewerage and

drainage measures, indirect impacts during construction and operation phases would also be insignificant.

9.11 References

AFCD. 2013. AFCD Annual Reports. (http://www.afcd.gov.hk). Downloaded on 28th November 2013.

AFCD's website on aquaculture. Assessed on 15th March 2013.

(http://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu.html)

Profit Point Enterprises Limited. 2008. Proposed Comprehensive Development at Wo Shang Wai, Yuen Long. EIA report submitted to EPD. (http://www.epd.gov.hk/eia). Downloaded on 9th February 2009.

10. CULTURAL HERITAGE

10.1 Summary

A cultural heritage impact assessment has been carried out for the Project. The assessment has been undertaken according to *Technical Memorandum on the Environmental Impact Assessment Process* (EIAO-TM) and Section 3.9.8 of the Project EIA Study Brief. The assessment covers the Project Site and an Assessment Area of 500m from the boundary of the Project.

10.2 Relevant Legislation & Guidelines

The following legislation and guidelines are relevant to the cultural heritage impact assessment (CHIA) in Hong Kong:

- Environmental Impact Assessment Ordinance (Cap. 499);
- Technical Memorandum on EIA Process (Annex 10 and 19, EIAO-TM);
- Guidelines for Cultural Heritage Impact Assessment;
- Hong Kong Planning Standards and Guidelines (HKPSG); and
- Antiquities and Monuments Ordinance (Cap. 53);

10.2.1 Environmental Impact Assessment Ordinance (EIAO) and Technical Memorandum on EIA Process (EIAO-TM)

The Ordinance provides additional legislative protection to sites of cultural heritage which are threatened by development and the Environmental Protection Department is its authority. The associated Technical Memorandum contains related guidelines and criteria for the assessment of sites of cultural heritage interest.

10.2.2 Hong Kong Planning Standards and Guidelines (HKPSG)

Chapter 10 of the HKPSG covers planning considerations relevant to general guidelines and measures for conservation of historical buildings, archaeological sites and other antiquities.

10.2.3 Antiquities and Monuments Ordinance

It provides statutory protection against threat of development on declared monuments and archaeological sites to enable their preservation for posterity. The Ordinance also establishes statutory procedures to be followed in marking such a declaration.

10.3 Assessment Methodology

10.3.1 Study Area

The assessment followed the criteria and guidelines set out in Annexes 10 and 19 of the TM. The Assessment Area covers an area within a distance of 500 m from the boundary of the Project Site.

10.3.2 Identification of Baseline Cultural Heritage Conditions

A desktop search was carried out to identify any known or potential sites of cultural heritage interest within the Assessment Area. The search included the review of:

- The list of sites of archaeological interest published by the Antiquities and Monuments Office (AMO);
- The list of declared monuments protected by the AM Ordinance (Cap. 53);
- The lists of proposed monuments and graded historic buildings published and maintained by the AMO; and
- Published and unpublished papers, records, archival and historical documents through public libraries, archives and tertiary institutions.

Based on the information of desktop study, site visits were also conducted to confirm the findings and identify any site of cultural heritage.

10.4 Baseline Conditions and Sensitive Receivers

The Project Site is located to the southwest of the existing residential developments at Royal Palms and Palm Springs, and to the east of the existing residential development at Fairview Park. The existing Yau Pok Road and Ngau Tam Mei Drainage Channel are located to the immediate south of the Project Site. The Project Site is relative flat and has been used primarily as farmland in adjacent to Yau Pok Road.

A desktop review has been carried out to identify the sites of cultural heritage within the Assessment Area, field visits were also conducted to confirm the findings. Based on desktop reviews as well as field survey findings, no historical settlement has been recorded within the Project Site. No historical events or other cultural elements such as fung shui woodlands, clan graves sites, and landscape features carrying cultural meaning were identified within the Project Site or immediately adjacent to the Site. The Project Site has been historically exploited for agricultural use, thus no built heritage resources are identified within the Project Site.

There is a planned cycle tracks project along the Yau Pok Road in adjacent to the Project Site (see Figure 10-2). A cultural heritage impact assessment has been undertaken for that cycle track project[19], which covered a study area of 500m from the proposed cycle tracks (including the whole Project Site of this Project and its surrounding areas) (Figure 10-2 refers). According to the approved EIA report, no built heritage was reported to be situated within or immediately adjacent to this Project Site.

10.4.1 Sites of Archaeological Interest

Based on the latest list of sites of archaeological interest published and maintained by the AMO, there are no records of such sites within the Assessment Area.

10.4.2 Declared Monuments

There are no records of declared monuments published and maintained by the AMO within the Assessment Area.

10.4.3 Graded Historic Buildings

The list of graded historic buildings published and maintained by the AMO was consulted as part of the desktop review and no graded historic buildings were found within the Assessment Area.

19 Chapter 11, Construction of Cycle Tracks and Associated Facilities from Sha Po Tsuen to Shek Sheung River, Final Environmental Impact Assessment Report, December 2008 (EIA-159/2008).

Based on the desktop review, a common ancestral hall is located in the multi-clan Wo Shang Wai Village at about 450 m north of the Project Area beyond the existing residential development at Palm Springs. The concerned ancestral hall is not a graded historic building. According to the approved Wo Shang Wai EIA report[20], the building of this ancestral has already been modified with some modern structures. Site visit was carried out and the findings were the same as the desktop review. Site photo of the ancestral hall taken during the site visit in November 2012, is provided in **Appendix 10-1**.

10.4.4 Other Cultural Elements

Groups of fish ponds were located within the Assessment Area of the Project Area and within the Project Site. These ponds were no longer operated for aquaculture of fish and had been invaded by vegetation. Some of the ponds have been undergone vegetative succession and become reed. Based on the site visits, these ponds were typical fishponds commonly identified in the new territories, which are constructed with soil materials on all sides and the bottom (site photos are shown in Figures 11-03 and 11-05). As discussed earlier, the Project area was historically exploited for agricultural use, there are no landscape features of cultural importance/ meaning identified. According to the approved Wo Shang Wai EIA report[19], some of the ponds mentioned above were assessed and regarded as inactive/ abandoned ponds, and none of these were identified as cultural heritage resources/ landscape features in that EIA. In addition, the approved cycle track EIA report[18] also didn't identify any of these ponds as cultural heritage resources/ landscape features. Thus, these ponds are not landscape features with particular cultural meaning. In addition, based on the current proposed development, there will be a planned wetland restoration area within the northern portion of the Project Site and the ponds over there will be retained.

The concerned ponds are also identified as landscape resources in Chapter 11 (Landscape and Visual Impact Assessment (LVIA)) and are classified as LR05B and LR05A. According to the LVIA results, these landscape resources are of low sensitivity and no adverse impact due to this Project is anticipated.

10.5 Impact Assessment

10.5.1 Construction Phase

No archaeological sites, declared monuments and graded historical buildings were identified within the 500m Assessment Area. The Wo Shang Wai ancestral hall is located within the Assessment Area but outside the Project Area and beyond the existing residential development of Palm Springs. It has been modified with modern structures and is not a graded historic building. Given the ancestral hall is far away from the Project Site with a separation distance of about 450m and no percussive piling works will be undertaken at the Project Site during construction, the Project is not expected to affect the building in any way.

The fish ponds identified as landscape resources are not active fish ponds and will not be impacted by the Project. In addition, the fish ponds and wetlands within the WRA to be provided in the northern and eastern portions of the Project Area will also serve as the buffer between the proposed residential development and the fish ponds. As a result, the Project is not expected to affect these ponds.

20 Chapters 10 and 9, EIA Studies for the Proposed Comprehensive Development at Wo Shang Wai, Yuen Long (EIA-144/2008), Mott Connell Ltd, 2008.

10.5.2 Operational Phase

The fish ponds in adjacent to the Project (outside the Project boundary) are not landscape features with particular cultural importance/ meaning, which will not be affected by the Project. Ponds within the Project Site will be retained as part of the proposed wetland. During the operation, a planned wetland restoration area will act as buffer between these ponds and the proposed residential development area within the Project Site. Thus, no operational impact is anticipated.

10.6 Mitigation Measures

As there were no associated impacts identified, no mitigation measure is required.

10.7 Conclusion

From the surveys and review of relevant records, no sites of cultural heritage were identified in the 500m Assessment Area. The only potential cultural resource identified in the 500m Assessment Area is the Wo Shang Wai ancestral hall which has already been modified with modern structures and is located beyond the Project Area and an existing major residential development. It is therefore concluded that no cultural heritage resources will be affected by the Project.

10.8 Reference

Ove Arup & Partners Hong Kong Limited, 2004. EIA & TIA Studies for the Stage 2 of PWP Item No. 215DS – Yuen Long and Kam Tim Sewerage and Sewage Disposal, EIA (Final). Drainage Services Department, Hong Kong.

Mott Connell Ltd, 2008. EIA Studies for the Proposed Comprehensive Development at Wo Shang Wai, Yuen Long. Profit Point Enterprises Limited, Hong Kong (EIA-144/2008).

Construction of Cycle Tracks and Associated Facilities from Sha Po Tsuen to Shek Sheung River, Final Environmental Impact Assessment Report, December 2008 (EIA-159/2008)

11. LANDSCAPE AND VISUAL

11.1 Summary

This chapter of the report outlines the landscape and visual impacts associated with the **Comprehensive Development and Wetland Protection near Yau Mei San Tsuen, Yuen Long, N.T** in accordance with the Environmental Impact Assessment Ordinance (EIAO) which became law in Hong Kong on 1st April 1998. Both construction and operation impacts are assessed in accordance with the requirements of the Study Brief section 3.9.9.

This assessment includes the following items:

- A listing of the relevant environmental legislation and guidelines;
- A definition of the scope and contents of the study, including a description of the assessment methodology;
- A review of the relevant planning and development control framework;
- A review of comments on landscape and visual issues received during previous consultation with the public and/or advisory bodies and how these have been addressed in the design;
- A baseline study providing a comprehensive and accurate description of the baseline landscape and visual character;
- Identification of the potential landscape and visual impacts and prediction of their magnitude and potential significance, with and without the mitigation measures; and
- Recommendation of appropriate mitigation measures and associated implementation programmes

All potential impacts and proposed mitigation measures are mapped in colour and illustrated with clear annotation and cross-referencing between text, tables and illustrations. Colour photographs showing baseline conditions, photomontages and illustrative materials supporting conclusions are provided and the locations of all viewpoints are clearly mapped. Photomontages at representative locations provide comparison between existing views; proposals on day 1 of operation without mitigation; on day 1 with mitigation; and after year 10 with mitigation.

Not unexpectedly, during construction of the boundary and proposed planting of the buffer zone, the visual impacts on recreational users of the proposed cycle track (C2) are defined as Substantial Negative. Similarly, construction will result in Substantial impacts on some of the landscape resources within the Project Site, namely Agricultural Field (LR.4A). However, once operational these impacts will be largely mitigated through extensive new landscape buffer and street tree planting as well as wetland restoration. Furthermore, there will be Slight Positive impacts on the landscape character of Rural Open Landscape at Active/ Abandoned Agricultural Lands/ Fish ponds (LCA1), due to the wetland restoration works. The overall conclusion is that the landscape and visual impacts associated with the Project are acceptable with mitigation measures.

11.2 Alternative Development Scenarios Considered During the Design Process

A variety of alternative development scenarios have been evaluated as part of the design process and are presented in **Chapter 2** of this Report, together with an explanation of the development of each option and providing a comprehensive evaluation of each. These include*, Scenario 1: Without the Project and Scenario 2: With the Project.,* Under the "With the Project" scenario, alternative layout options are generated, compared and assessed for recommending a preferred layout option for further refinement and conducting detailed assessment (refer to **Chapter 2**).

In terms of their effects on landscape character, landscape resources (particularly their mitigation effects) and on the views of VSRs, these scenarios were evaluated in terms of performance (Good / Medium / Poor) against a series of landscape and visual criteria, as follows:

- Location of Development Boundary (relative to adjoining developments);
- Wetland Restoration (in landscape and visual terms, not ecological);
- Provision of Landscape Buffer (between Project development area and adjoining developments);
- Provision of Wetland;
- Consistency with CPI Comments; and
- Compliance with OZP Requirements, particularly with regard to WRA.

It should be reiterated that this evaluation considers only landscape and visual issues with regard to the different options, and not other factors such as ecological mitigation, which are detailed in Chapter 8 of this Report. The options are discussed below in terms of their landscape and visual performance. A tabulation of their performance is provided in **Table 11-1**.

11.2.1 Scenario 1: Without the Project

Although, from a landscape and visual viewpoint it obviously has the least impact, the option of “do nothing” was not considered to be appropriate given the planning intention for the Project Site, that is to encourage enhancement and conservation of fish ponds and wetland. Additionally, “no development” does not necessary mean the Project Area will maintain as status quo. It is likely that the existing fish pond landscape resources within the Project Site would revert to marsh and eventually grassland without wetland conservation efforts. In the long term, natural succession could lead to these becoming terrestrial habitats with reduced ecological value and with little or no benefit to the fauna, especially wetland birds, of the Deep Bay area. Furthermore, existing farmland may evolve following market forces for intensification or abandonment.

The ecological value of farmlands for large water birds or most other species of conservation importance is limited, and potential runoff will bring chemical fertilizers or pesticides into the Deep Bay wetland area and introduce toxic material to the ecosystem.

According to information from the TPB records, 88 applications have been submitted to the TPB since 2001 for permission for uses including open storage, parking area, workshops, etc. on various OU(CDWRA) zones within Yuen Long; of which 25 applications have been approved (up to March 2012). Most of the planning applications were approved on a temporary basis for up to 3 years. Under the statutory OZP, there is no requirement for submission and implementation of Wetland Restoration Plan for application for temporary use. There is no guarantee that the Project Area would be restored to its original condition or that any negative impacts would be mitigated after the interim uses are completed. In theory the potential for such interim uses therefore presents serious environmental risks. If the subject site remains undeveloped, similar kinds of interim uses could be present on site and their associated environmental impacts would reduce the ecological value and further degrade the ecology of the habitats.

In summary, if there were no development, the Project Area may continue to be occupied by farming or other environmental unfriendly interim uses. The ecological value of the site generally may decline. Additionally, there are limited controls on the appearance of temporary use structures and facilities. Together, the visual quality of the site may also decline given this ‘Without the Project’ option.

Therefore, based on the requirements of the EIA Study Brief and the Statutory Plan (i.e. maximum building height, layout of the WRA and providing at least adequate compensation of exiting wetland), a number of layout options were explored. During this process, a wide variety of broad layout forms were developed. A number of these were not selected to go forward to more detailed assessment for various reasons (see **Chapter 2** for details).

11.2.2 Scenario 2: With the Project

Town Planning Board visions that proactive intervention is required to protect and conserve continuous and contiguous fish ponds in Deep Bay Area. Guideline No. TPB PG-No. 12C, it set out a framework to encourage committed long term conservation and management of fish ponds in Deep Bay Area by allowing appropriate level of residential/recreational development. The Project adopts this conservation framework and proposes residential development in the Project Area. Based on the permittable development parameters in the statutory outline zoning plan, three alternative layout options has been proposed. Details of each alternative layout option are presented in paragraphs 2.6.3 to 2.6.6 and are evaluated against identified project objectives in section 2.7.

11.2.3 Option A: Sub-urban Layout Option

Sub-urban Layout Option was considered in order to evaluate the effect of implementing a similar model of “suburban development” as seen in neighbouring developments (see **Chapter 2**). This scenario would see villa development over the entire site, which would entail land formation to a minimum of 5.5mPD and the attendant high retaining walls at the boundary. The landscape impacts of this scenario would be substantial due to the complete loss of all trees and ponds within the site.

Without buffer zones such as the amphibian corridor and the wetland restoration area to separate VSRs from the development area, and with no buffer planting at the development boundaries, the visual impacts would likewise be substantial for all surrounding VSRs. This option would not meet the planning requirements for the site.

11.2.4 Option B: Conformed Layout Option

Conforming Layout Option (see **Chapter 2**) maximises the developable area while restoring former farm land to contiguous wetland and enhancing the existing Area 40 as amenity wetland. Although it fulfils the planning intentions for the area, it has greater adverse effects on visual receivers, especially on residents in Fairview Park (R1) and Palm Springs (R2) arising from development up to the site boundary within the developable area. This means that VSRs will be closer to the houses of the new development. The landscape character of the Rural Open Landscape at Active/ Abandoned Agricultural Lands/ Fish ponds (LCA1), would also be negatively affected by replacing open, undeveloped (albeit cultivated) land with villa development. **See Figures 2.2-2.3**

11.2.5 Option C: Enhanced Layout Option

Enhanced Layout Option (see **Chapter 2**) has advantages of increased wetland restoration areas within the developable zone, resulting in reduced impacts on VSRs in Fairview Park (R1), Palm Springs (R2) and Royal Palms (R3) in comparison to Conforming Layout Option. In particular, visual impacts on Yau Mei San Tsuen (R4) are reduced due to the enhancement of Area 40. This option still has adverse impacts on the landscape character of the Rural Open Landscape at Active/ Abandoned Agricultural Lands/ Fish ponds (LCA1) by replacing open, undeveloped (albeit cultivated) land with villa development. **See Figures 2.4-2.5**

Table 11-1 Assessment of Development Options against Landscape / Visual Criteria

Landscape / Visual Factor		Metrics (Good/Medium / Poor)			
	Scenario 1: Without the Project	Scenario 2: With the Project			
		Option A: Sub-urban Layout Option	Option B: Conforming Layout Option	Option C: Enhanced Layout Option	Option D: Recommended Layout Option
Visual Impact	G	P	P	M	M
Location of Development Boundary	G	P	P	M	G
Wetland Restoration	P	P	M	G	G
Provision of Landscape Buffer	G	P	P	G	G
Wetland	P	P	G	G	G
Compliance with OZP Requirements with regard to WRA	P	P	M	G	G

11.2.6 Option D: Recommended Layout Option

The recommended Layout Option features the clubhouse located at the west of the development in order to maximise the landscape buffer and minimize the development height at this relatively sensitive boundary. While the distance to houses north of Fairview Park was maximised, the view corridor between the fish pond area and the eastern ridgelines was opened up to the maximum practicable extent by straightening the internal road layout.

This Recommended Layout Option is therefore the preferred layout option taken forward in this assessment as the design which minimizes visual impacts to the most sensitive visual receivers while at the same time addressing all other development and ecological criteria. This option provides a low-rise residential development, sensitively co-located with an ecological wetland design which will enhance and protect the fish ponds of the area. The carefully considered layout minimizes the views of VSRs while making the most of surrounding views from within the site.

Generally, it can be seen from **Table 11-1** that the Option D was considered the most appropriate option given that:

- It scored more 'Good' performances than the other three options;
- It did not score 'Poor' against any criterion;
- It scored at least 'Moderate' against every criterion.

The Option D is shown in **Figure 11-18**.

11.3 Environmental Legislation and Guidelines

The following legislation, standards and guidelines are applicable to the evaluation of landscape and visual impacts associated with the construction and operation of the Proposed Residential development at Yau Mei San Tsuen Development Project:

- Environmental Impact Assessment Ordinance (Cap 499, section 16) and the Technical Memorandum on EIA Process (EIAO-TM), particularly Annexes 10, 11, 18, 20 and 21;
- Environmental Impact Assessment Ordinance Guidance Note (EIAO GN) 8/2010;
- ETWB TC No. 29/2004 – Registration of Old & Valuable Trees and Guidelines for their Preservation;

- ETWB TC No. 3/2006 – Tree Preservation;
- Land Administration Office Guidance Note (LAO GN) No. 7/2007 – Tree Preservation and Tree Removal Application for Building Development in Private Projects;
- Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/6; and
- Town Planning Board Guidelines No.12C - Application for Developments within Deep Bay Area.

11.4 Scope and Content of the Study

The study makes reference to the Approved Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/6, an extract of which is shown in **Figure 11-01**. The landscape impact assessment area includes all areas within 500m from the boundary of the Project Site as shown in **Figures 11-02** and **11-07**. The limit of the visual impact assessment area is the Zone of Visual Influence (ZVI) of the Works, which is illustrated in **Figure 11-10**.

11.5 Methodology for Assessment of Landscape and Visual Impacts

Landscape and visual impacts have been assessed separately for the construction and operational phases, following the methodology set out in EIAO GN 8/2010 and as detailed below.

11.5.1 Assessment of Landscape Impacts

The assessment of landscape impacts has involved the following procedures:

Identification of the baseline physical and cultural landscape resources (LR's) and landscape character areas (LCA's) found within the assessment area: This is achieved by site visits and desk-top study of topographical maps, information databases and photographs.

Assessment of the degree of sensitivity of the landscape resources and character: This is influenced by a number of factors including whether the resource/character is common or rare, whether it is considered to be of local, regional, national or global importance, whether there are any statutory or regulatory limitations/ requirements relating to the resource, the quality of the resource/character, the maturity of the resource, and the ability of the resource / character to accommodate change. The sensitivity of each landscape feature and character area is classified as follows:

High:	Important LR or LCA of particularly distinctive character or high importance, sensitive to relatively small changes.
Medium:	LR or LCA of moderately valued landscape characteristics reasonably tolerant to change.
Low:	LR or LCA, the nature of which is largely tolerant to change.

Identification of potential sources of landscape impacts: These are the various elements of the construction works and operational procedures that will generate landscape impacts.

Identification of the magnitude of change: The magnitude of the impact depends on a number of factors including the physical extent of the impact, the landscape and visual context of the impact, the compatibility of the Project with the surrounding landscape; and the time-scale of the impact - i.e. whether it is temporary (short, medium or long term),

permanent but potentially reversible, or permanent and irreversible. Landscape impacts have been quantified wherever possible.

The magnitude of landscape impacts is classified as follows:

Large: The LR or LCA would undergo a major change.

Intermediate: The LR or LCA would undergo a moderate changes.

Small: The LR or LCA would undergo slight or barely perceptible changes.

Negligible: The LR or LCA would undergo no discernible change.

Identification of potential landscape mitigation measures, and programme for implementation **:** These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimize negative impacts; remedial measures such as colour and textural treatment of building features; and compensatory measures such as the implementation of landscape design measures (e.g. tree planting, creation of new open space, etc.) to compensate for unavoidable negative impacts and to attempt to generate potentially positive long term impacts. A programme for the mitigation measures is provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are identified in **Tables 11-5A, 11-5B, 11-8A** and **11-8B** and they are illustrated in **Figures 11-18** to **11-27** and **11-34** to **11-42.**

Prediction of Acceptability of Landscape Impacts: Landscape impacts are products of magnitude of change and the relative sensitivity of the landscape sensitive receiver. Ultimately, the acceptability of the Project is dependent upon the significance of the residual impacts in accordance with the five criteria set out in Annex 10 of the EIAO-TM, namely 'beneficial', 'acceptable', ' acceptable with mitigation measures', 'unacceptable' and 'undetermined'.

Prediction of the significance of landscape impacts before the implementation of the mitigation measures**:** By synthesising the magnitude of the various impacts and the sensitivity of the various landscape resources it is possible to categorise impacts in a logical, well-reasoned and consistent fashion. **Table 11-2** shows the rationale for dividing the degree of significance into four thresholds, namely insubstantial, slight, moderate, and substantial, depending on the combination of a negligible-small-intermediate-large magnitude of change and a low-medium-high degree of sensitivity of landscape resource/character. Impact significant is taken to be adverse unless stated otherwise as beneficial.

Table 11-2 Evaluation of Significance of Landscape and Visual Impacts

Magnitude of Impact	**Large**	Moderate	Moderate / Substantial	Substantial
	Intermediate	Slight / Moderate	Moderate	Moderate / Substantial
	Small	Slight	Slight / Moderate	Moderate
	Negligible	Insubstantial	Insubstantial	Insubstantial
		Low	**Medium**	**High**
Sensitivity (of Landscape Resource, Landscape Character Area or VSR)				

The degree of Impact significant thresholds are defined as follows:

Substantial: Adverse / positive impact where the proposal would cause significant deterioration or improvement in existing landscape quality.

Moderate: Adverse / positive impact where the proposal would cause a noticeable deterioration or improvement in existing landscape quality.

Slight: Adverse / positive impact where the proposal would cause a barely perceptible deterioration or improvement in existing landscape quality.

Insubstantial: No discernible change in the existing landscape quality.

11.5.2 Assessment of Visual Impacts

The assessment of visual impacts has involved the following procedures:

Identification of the Zones of Visual Influence (ZVI) during the construction and operational phases: This is achieved by site visit and desk-top study of topographic maps and photographs, and preparation of cross-sections to determine visibility of the Project from various locations. The ZVI is shown in **Figure 11-10**.

Identification of the Visually Sensitive Receivers (VSRs) within the ZVI at construction and operational phases: These are the people who would reside within, work within, play within, or travel through, the ZVI.

Assessment of the degree of sensitivity to change of the VSR's: This includes a consideration of the following factors:

- Value and quality of existing views;
- Availability and amenity of alternative views;
- Type and estimated number of receiver population;
- Duration or frequency of view; and
- Degree of visibility.

The type of VSR is classified according to whether the person is at home, at work, at play, or travelling. Those who view the impact from their homes are considered to be highly sensitive

as the attractiveness or otherwise of the outlook from their home will have a substantial effect on their perception of the quality and acceptability of their home environment and their general quality of life. Those who view the impact from their workplace are considered to be of low sensitivity as the attractiveness or otherwise of the outlook will have a less important, although still material, effect on their perception of their quality of life. The degree to which this applies may vary depending on whether the workplace is industrial, retail or commercial. Those who view the impact whilst taking part in an outdoor leisure activity may display varying sensitivity depending on the type of leisure activity. Those who view the impact whilst travelling on a public thoroughfare will also display varying sensitivity depending on the speed of travel. The degree to which this applies is also influenced by the value and quality of existing views; the availability and amenity of alternative views; the duration or frequency of view, the degree of visibility and the numbers of receivers. The sensitivity of each VSR is classified as follows:

High: The VSR is highly sensitive to any change in their viewing experience.

Medium: The VSR is moderately sensitive to any change in their viewing experience.

Low: The VSR is only slightly sensitive to any change in their viewing experience.

Identification of potential sources of visual impacts: These are the various elements of the construction works and operational procedures that would generate visual impacts.

Assessment of the potential magnitude of change: This includes consideration of the following factors:-

- the compatibility with the visual character of the surrounding landscape;
- the duration of the impact;
- scale of the development in the view;
- the reversibility of the impact;
- the distance of the source of impact from the viewer; and
- the change / blockage to the character of existing views.

The magnitudes of change of visual impacts are classified as follows:

Large: The VSR's would experience a major change in the character of their viewing experience.

Intermediate: The VSR's would experience a moderate change in the character of their viewing experience.

Small: The VSR's would experience a small change in the character of their viewing experience.

Negligible: The VSR's would experience no discernible change in the character of their viewing experience.

Identification of potential sources of visual impacts: These are the various elements of the construction works and operational procedures that would generate visual impacts.

Identification of potential visual mitigation measures and programme for implementation **:** These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimize negative impacts; remedial measures such as colour and textural treatment of building features; and compensatory measures such as the implementation of landscape design measures (e.g. tree planting, creation of new open space, etc.) to compensate for unavoidable negative impacts and to attempt to generate potentially positive long term impacts. A programme for the mitigation measures is provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are identified in **Tables 11-5A, 11-5B, 11-8A** and **11-8B** and they are illustrated in **Figures 11-18** to **11-27** and **11-34** to **11-42**.

Prediction of Acceptability of Visual Impacts: Visual impacts are products of magnitude of change and the relative sensitivity of the visual sensitive receiver. Ultimately, the acceptability of the Project is dependent upon the significance of the residual impacts in accordance with the five criteria set out in Annex 10 of the EIAO-TM, namely 'beneficial', 'acceptable', ' acceptable with mitigation measures', 'unacceptable' and 'undetermined'

Prediction of the significance of visual impacts before and after the implementation of the mitigation measures**:** By synthesising the magnitude of the various visual impacts, the sensitivity of the VSRs and the numbers of VSRs that are affected, it is possible to categorise the degree of significance of the impacts in a logical, well-reasoned and consistent fashion. **Table 11-1** shows the rationale for dividing the degree of significance into four thresholds, namely, Insubstantial, Slight, Moderate and Substantial, depending on the combination of a Negligible-Small-Intermediate-Large magnitude of change and a Low-Medium-High degree of sensitivity of VSRs. Consideration is also given to the relative numbers of affected VSRs in predicting the final impact significance - exceptionally low or high numbers of VSRs may change the result that might otherwise be concluded from **Table 11-2**. Photomontages showing views of the Project from key VSRs at day 1 without mitigation, and at day 1 and year 10 with mitigation, are shown in **Figures 11-34** to **11-41**.

The significance of the visual impacts are categorised as follows:

Substantial: Adverse / positive impact where the proposal would cause significant deterioration or improvement in existing visual character.

Moderate: Adverse / positive impact where the proposal would cause a noticeable deterioration or improvement in existing visual character.

Slight: Adverse / positive impact where the proposal would cause a barely perceptible deterioration or improvement in existing visual character.

Insubstantial: No discernible change in the existing visual character.

11.6 Planning and Development Control Framework

A review has been undertaken of the current planning goals and objectives, statutory land-use and landscape planning designations for the assessment area.

11.6.1 Outline Zoning Plan

The relevant OZP is the Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/6, an extract of which is shown in **Figure 11-01**. Under this Plan the Project Site is zoned as Other

Specified Uses (Comprehensive Development and Wetland Protection Area) – OU (CDWPA). In the statutory notes, the planning intention of the OU (CDWPA) is as follows

"The planning intention of this zone is to allow the consideration of comprehensive low-density residential development or redevelopment provided that all the existing continuous and contiguous fish ponds within the zone are protected and conserved. The "no-net-loss in wetland" principle is adopted for any change in use within the zone. Development or redevelopment within this zone should involve no pond filling and no decline in wetland function of the fish ponds. Any new development should be located on the formed land and as far away from the existing fish pond within the development site."

It states under Remarks (b) that:

"No new development, or addition, alternation and/or modification to or redevelopment of an existing building shall result in total development and/or redevelopment in excess of a maximum plot ratio of 0.2 and maximum building height of 3 storeys including car park, or the plot ratio, site coverage and height of the building which was in existence on the date of the first publication in the Gazette of the notice of the interim development permission area plan, whichever is the greater."

The Explanatory Statement further states that:

(Paragraph 9.9.9) "[…] The planning intention of this zone is to allow the consideration of comprehensive low-density residential development or redevelopment provided that all the existing continuous and contiguous fish ponds within the zone are protected and conserved. The "no-net-loss in wetland" principle is adopted for any change in use within the zone. Development or redevelopment within this zone should involve no pond filling and no decline in wetland function of the fish ponds. Any new development should be located on the formed land and as far away from the existing fish pond within the development site."

(Paragraph 9.9.11) "To be in line with the rural setting which are mainly low-rise houses, scattered village houses and cultivated farmland, to minimize visual impact and to take into account the capacities of local road network and infrastructure in the area, development or redevelopment shall not result in a total development density in excess of a maximum plot ratio of 0.2 and a maximum building height of 3 storeys including car park.

(Paragraph 9.9.12) "An area near Yau Mei San Tsuen located to the south of Palm Springs is zoned "OU(CDWPA)". The northern portion of this area comprises fish ponds which form an integral part of the Deep Bay wetland ecosystem. The southern portion of this area comprises mostly of cultivated land with some on-farm domestic structures and a few temporary structures."

11.6.2 Town Planning Board Guidelines

In addition, reference has been made to the Town Planning Board Guidelines for Application for Developments within Deep Bay Area under Section 16 of the Town Planning Ordinance (TPB PG-No.12C). These state that:

(paragraph 6.4) "The intention of the WBA is to protect the ecological integrity of the fish ponds and wetland within the WCA and prevent development that would have a negative off-site disturbance impact on the ecological value of fish ponds. A buffer area of about 500m along the landward boundary of the WCA is thus designated as a WBA. As a substantial amount of the fish ponds within the WBA have already been lost over time through filling and certain areas have been degraded by the presence of open storage use, these degraded areas may be considered as target areas to allow an appropriate level of residential/recreational development so as to provide an incentive to remove the open storage use and/or to restore some of the fish ponds lost.

(paragraph 6.7) "Proposals for residential/recreational developments on degraded sites to remove/replace existing open storage or container back-up uses and/or to restore lost wetlands may be given sympathetic consideration by the Board subject to satisfactory ecological and other impact assessments. For those disturbed areas directly abutting the WCA, the development should provide a wetland and visual buffer to separate the development from the WCA to minimize its impact on the wetland and to restore some of the lost fish ponds to an appropriate form of wetland adjoining the WCA. Within these degraded areas targeted for upgrading, the following types of activities may be considered:

"Wetland Restoration"

(paragraph 6.7.1) Development proposals to restore lost fish ponds or to replace existing undesirable uses by wetland habitats are encouraged…"

"Residential"

(paragraph 6.7.3) Residential development projects which include replacement of existing open storage and port back-up uses and/or proposals of detailed wetland restoration may be given special consideration subject to satisfactory ecological and other impact assessments. These developments should be compatible with the surrounding land uses and the rural setting of the area."

11.6.3 Compatibility of the Project

It is considered that the Yau Mei San Tsuen Development Project would be in accordance with the planning goals and objectives for the assessment area, as set out in the Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/6 in that the layout of the Project provides a wetland restoration area adjacent to existing fish ponds and surrounded by a number of low-rise residential developments and village settlements, these include Fairview Park to the west; Recreation" zones (within "REC" and "R(c)") (within planning permission for residential and recreational developments) to the south west; two R(D) sites (with planning permissions for residential developments) and a number of existing villages to the south; and Palm Springs, Royal Palms, Yau Mei San Tsuen and Wo Shang Wai to further north and east. It is therefore considered that the Project would be compatible with the residential developments in the locality.

The Yau Mei San Tsuen Development Project would also be in accordance with the Town Planning Board Guidelines for Application for Developments within Deep Bay Area (TPB PG-No.12C) under Section 16 of the Town Planning Ordinance in that the Project provides a wetland and visual buffer to separate the development from the WCA and results in no-net-loss of wetland.

Nevertheless, the Project must be very carefully designed to minimize any potentially adverse impacts on the landscape and visual amenity of the area.

11.7 Consideration of Concurrent Projects

A review of concurrent projects in the area indicates that the Construction of Cycle Tracks and the Associated Supporting Facilities from Sha Po Tsuen to Shek Sheung River (EIA-159/2008) will have some impact on the landscape and visual assessment of this Project. Another project in the area is described under Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2 (EIA-094/2004); however, this is not expected to affect this LVIA. Furthermore, there are a number of other residential projects in planning within the immediate area which will be considered as future VSRs (Approved Application Nos. A/YL-MP/170 & A/YL-MP/202, and A/YL-MP/205). In the longer term, the character of the area is likely to become more residential than rural as a result of these other residential projects, a change with which the Project will be compatible. Overall Residential Planning Applications

near the project area is illustrated on ***Figure 4.1 – Residential Planning Application near the Project Area***.

11.7.1 Proposed Cycle Track from Sha Po Tsuen to Shek Sheung River

The cycle track project forms part of the New Territories Cycle Track Network which connects local cycle track networks in various new towns and is primarily intended for recreational purposes. There is currently no committed construction programme based on CEDD's website for the cycle track as outlined in EIA report (EIA-159/2008), therefore this assessment assumes that the cycle track will be implemented and that cyclists will constitute VSRs.

11.7.2 Yuen Long and Kam Tin Sewage Disposal Stage 2

It is not considered that the public sewerage works, (PWP No. 4235DS), located along Yau Pok Road outside the Project boundary, would be affected by the proposed Project in terms of landscape and visual impacts, and has therefore not been included in this assessment.

11.7.3 Other Planned Residential Developments

Approved Planning Application Nos. A/YL-MP/170 & A/YL-MP/202 and A/YL-MP/205 lie within the "Residential (Group D)" ("R (D)") zone lie to the east of the Ngau Tam Mei Channel and "Recreation" zones (within "REC" and "R(c)") to the south-west of the Project Site. Residents in these developments will constitute potential VSR's for the project. However, the developments will also block some existing views of the Project from other existing VSRs. Over time these developments will collectively contribute to a transition towards a more suburban residential landscape character for the area with which the Project would be compatible.

11.8 Landscape and Visual Baseline Study

11.8.1 Physical, Human and Cultural Landscape Resources

The baseline physical landscape resources that will be affected during the construction phase and operation phase, together with their sensitivity to change, are described below. The locations of the landscape resources are mapped in **Figure 11-02A** to **11-2B**. Photo-views showing the landscape resources are illustrated in **Figures 11-03** to **11-05** inclusive. For ease of reference and co-ordination between text, tables and figures, each landscape resource is given an identity number. The on-site and off-site landscape resources within the assessment area are described separately below (as there will be no impact on the latter).

11.8.2 Broad Brush Tree Survey

A broad brush tree survey has been undertaken within the Project Site and surrounding assessment boundary and has identified the following;

Within the Project Site – **Six (6)** tree groups (namely TG1 to TG6, approximately 168 nos. of trees in total) are identified within the Project Site. Although all identified as groups, some exhibit strong pattern of grouping while others are rather randomly scattered over the site. The tree locations and the species distribution reflect the mixed-use nature of the Project Site. Most of the existing trees are predominant of fruit tree species. ***[Refer to TSP-01 and Schedule 1 in Appendix 11-1 for broad brush tree survey plan and broad brush tree survey schedule within Project Site]***

Table 11-3 Summary of existing trees within the Project Site *(in order of decreasing abundance)*

Botanical Name	**Quantity**	**Percentage** *(rounded to 1 decimal place)*
Litchi chinensis	84	50%
Artocarpus macrocarpus	22	13%
Clausena lansium	21	12.5%
Mangifera indica	21	12.5%
Dimocarpus longan	15	9.0%
Carica papaya	3	1.8%
Citrus maxima	1	0.6%
Macaranga tanarius	1	0.6%
GRAND TOTAL	**168**	**100.0%**

Most of existing trees within the Project Site are generally in poor condition with low amenity. Tree grouped TG7 and TG8 are located in raised ridges or slope between ponds and vegetable fields, which result in difficulties for tree to be retained or transplanted.

Within the Project Site, no protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found within the Site. No "Old and Valuable Trees" or "Champion Trees", defined respectively in "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) and in the book "Champion Trees in Urban Hong Kong", were found. **Outside the Project Site but within the Assessment Area** - Approximately **3,950 nos.** of existing trees lie outside the Project Site but within the Assessment Area. Most of them are found along major roads and highways, residential and village settlements, and surrounding areas of ponds. The tree's condition is mostly poor with some fair and they have low amenity value. **One (1) no.** "Old and Valuable Tree" (OVT), as defined under the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004), is found on Castle Peak Road. The tree (no. LCSD YL/7) is a *Melaleuca cajuputi* subsp. *cumingiana* and has a height of 17m and spread of 13m. ***[Refer to TSP-02 and Schedule 2 in Appendix 11-1 respectively for broad brush tree survey plan and broadbrush tree survey schedule outside Project Site but within Assessment Area]***.

No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found within Assessment Area outside the Project Site.

11.8.3 Landscape Resources within Project Site

Several (LRs) are identified within the Project Site and will potentially be affected by the proposed development. ***[Refer to Figure 11-02A for map of the LRs within Project Site, and Figures 11-03 for photos of the LRs within the Project Site. Refer to TSP-01 and Schedule 1 in Appendix 11-1 for broad brush tree survey information within Project Site].***

- ***LR.4A – Agricultural Land (within Project Site):*** This LR consists of 4.9 ha located from the centre to south western portion of the Project Site and are mostly cultivated with common fruit trees and vegetable crops in active dry agricultural land used for cultivation of Lettuce *Lactuca sativa* and Chinese White Cabbage *Brassica chinensis* with are generally in poor condition, and a few scattered tree species. Trees within this LR are grouped into TG1, TG3, and TG4 consist approximately **57 nos.** trees (7 nos. in TG1, 36 nos. in TG3 and 14 nos. in TG4) with range from 1.5–6m in height and with canopies that have a spread from 1-5m spread and are generally poor to fair condition. These comprise mainly *Litchi chinensis* and *Mangifera indica,* left by villagers that can still be found on these fields. The ecological diversity of species in this LR is considered to be low due to its current derelict nature, therefore changing this LR into a residential use will not cause significant change in both the local and regional contexts. As noted above, the existing trees and other vegetation are generally of only poor to fair condition. The trees can be easily replaced by compensatory planting. The sensitivity of this LR is considered to be ***Low***.

- ***LR.6A – Grassland/ Shrubland (within Project Site):*** This LR cover an area of 0.9 ha of grassland/shrubland located at the north western corner of the Project Site. Over time, this LR became abandoned and tall grass and weeds have colonized them and dominated by common grass species such as *Brachiaria mutica* and *Panicum maximum,* that are generally in poor condition, and a few scattered of other shrub planting, no existing trees was found. Overall, this resource has a relatively low landscape and amenity value due to its abandoned nature and the predominance of common species.

- This type of rural landscape resource is fairly common in the New Territories, and has no particular significance in a local or regional context. Furthermore, this LR has a high tolerance to change due to its abandoned and unkempt nature. Therefore, this LCA is considered to have ***Low*** sensitivity.

- ***LR.7A – Pond and Pond Edge (within Project Site):*** Most ponds (approx. 1.2ha) are located in the north and western portion of the Project Site including 0.8ha of abandoned pond and naturalised fish ponds and 0.4ha of other colonisation by local vegetation with low ecological diversity value along the pond edge comprised common grass species, including *Brachiaria mutica* and *Panicum repens,* with some common herbs including *Bidens alba* and *Euphorbia hirta* and native *Eleusine lansium* that are generally in poor condition. A few scattered tree species comprise some fruit trees, such as *Artocarpus macrocarpus, Clausena lansium, Dimocarpus longan, Mangifera indica* and *Litchi chinensis* with range from 1.5-8m in height and with canopies that have s spread from 1-7m and generally poor to fair form and health and low amenity values still be found on the edge of the pond. All these trees are within TG5 which has approximately **48nos**. of medium sized trees.

- Since these ponds are within the WRA the landscape resource and the dominance of fruit trees and other vegetation species with generally poor to fair form and health and low to medium amenity value gives this LR a medium landscape quality. This LR is considered to have a ***Medium****) sensitivity.

- ***LR.8A – Marsh/Reedbed (within Project Site):*** There are two abandoned ponds (approx. 1.1ha) located to the north of the Project Site (0.9 ha) and small pond (0.2 ha) to the south-eastern corner of the project site. The abandoned pond located on north dominated with marsh habitat species and reedbed habitat for the small pond with emergent vegetation such as *Typha angustifolia, Mikania micrantha* and *Brachiaria mutica*. The bund vegetation is dominated by grassy vegetation including *Panicum maximum* and *Brachiaria mutica,* common exotic herbaceous species such as *Wedelia trilobata* and *Bidens alba* and isolated common fruit trees. There is approximately 63 nos. of existing trees within this LR which are grouped into TG2 and TG6. TG2 located on the small pond on the south-eastern corner consist approximately **6 nos.** of trees with range from 5-9m in height and with canopies that have a spread from 1.5-6m that are in poor to fair condition. They include some fruit tree species such as *Dimocarpus longan, Litchi chinensis* and *Mangifera indica*, as well as species that are commonly found on cultivated fields, like *Macaranga tanarius*. TG6 located to the northern part of the Project Site and consist approximately **57 nos**. of trees with range from 1.5-6m in height and with canopies that have a spread from 1-5m and generally poor to fair condition. Mostly dominated by fruit trees species include *Artocarpus macrocarpus, Clausena lansium, Litchi chinensis* and *Mangifera indica.* The ecological diversity of species in these areas is low. In the context of the area within the WRA, the sensitivity of this landscape resource is ***Medium****)*.

  ***)* Note**: *All existing abandoned ponds with the Project Area will be retained as wetland within the WRA (Wetland Reservation Area), and these will be managed to increase their ecological value.*

For all LRs within the Project Site, no protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found.

11.8.4 Landscape Resources outside Project Site but within Assessment Area

The following LRs are located outside the Project Site but within the Assessment Area. They will not be affected by the proposed development.

[Refer to Figure 11-02B for map of the LRs outside the Project Site, and Figures 11-03 and 11-05 for photos of the LRs. Refer to TSP-02 and Schedule 2 in Appendix 11-1 for broad brush tree survey information outside Project Site but within Assessment Area].

- ***LR1.B – Local Roads:*** Approx. 6.2 ha of major roads outside the Project Site but within the Assessment Area include Yau Pok Road, Kam Pok Road, and Castle Peak Road. Approximately **400 nos.** of existing trees were identified with range from 3-12m in height and with canopies that have a spread from 2-8m with generally Poor form, Poor to Fair health and have Low amenity value. These trees comprise mostly ornamental species like *Bauhinia spp., Bischofia javanica, Bombax ceiba, Cassia fistula, Cleistocalyx nervosum, Delonix regia, Eucalyptus citiodora, Ficus microcarpa, Hibiscus tiliaceus, Lagerstroemia speciosa, Leucaena leucocephala, Macaranga tanarius var. tomentosa, Melia azedarach, Melaleuca cajuputi subsp. cumingiana, Peltophorum pterocarpum, Pterocarpus indicus, Spathodea campanulata,* and *Syzygium jambos.* Several large mature *Melaleuca cajuputi* subsp. *cumingiana* were found along Castle Peak Road (one of which is identified as "Old and Valuable Trees" (OVT) (registration no. LCSD YL/7) as defined in ETWB TC (W) No. 29/2004 - "Registration of Old and Valuable Trees") ***[refer to Schedule 2 in Appendix 11-1 for information on this OVT]***. No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Champion Trees" as defined in the

book "Champion Trees in Urban Hong Kong" were found. Overall, this landscape resource has relatively low landscape and amenity value and is able to accommodate extensive change. Moreover, considering the presence of a large amount of roadside vegetation of common species in the vicinity, the existence of only one roadside OVT will not significantly raise the overall landscape and amenity value of the LR. Therefore, overall this LR is considered to have a ***medium*** sensitivity.

- ***LR2.B1 – Comprehensive Residential Settlements (outside Project Site):*** This LR consists of approx. 57.6ha outside the Project Site but within the Assessment Area and has a total of around **1,300** nos. of trees, in various comprehensive residential developments as describe below.

  Planting located outside the Project Site to the north within Palm Springs and Royal Palms residential developments including approximately **700** roadside trees comprising mainly *Aleurites moluccana, Araucaria heterophylla, Archontophoenix alexandrae, Bauhinia spp., Ficus benjamina, Ficus microcarpa, Hibiscus tiliaceus, Macaranga tanarius* var*. tomentosa, Melaleuca cajuputi* subsp. *cumingiana, Michelia* x *alba*, *Musa spp.* and *Roystonea regia*. and approximately **100** others trees in the water feature and pocket parks which comprise: *Acacia confusa*, *Albizia lebbeck, Araucaria heterophylla, Archontophoenix alexandrae, Bauhinia spp., Bombax ceiba, Callistemon viminalis, Celtis sinensis*, *Chrysalidocarpus lutescens, Delonix regia, Ficus microcarpa, Ficus virens var. sublanceolata, Hibiscus tiliaceus, Juniperus chinensis, Khaya senegalensis, Lagestromia speciosa, Macaranga tanarius* var*. tomentosa*, *Melaleuca cajuputi* subsp. *cumingiana, Melia azedarach*, *Phoenix roebelenii, Roystonea regia, Salix babylonica, Sapium sebiferum* and *Taxodium distichum.* The trees have range from 3-13m in height and with canopies that have a spread from 3-10m, Poor form, Poor to Fair health and have Low amenity value.

  Planting located within Fairview Park residential development including approximately **300** roadside trees comprising mainly *Aleurites moluccana*, *Bauhinia spp.*, *Cinnamomum burmannii*, *Delonix regia*, *Juniperus chinensis, Grevillea robusta* and *Melalueca cajuputi* subsp. *cumingiana* with range from 3-13m in height and with canopies that have a spread from 3-10m, Poor form, Poor to Fair health and have Low amenity value.

  Additionally, there are approximately **200** nos. of trees scattered around Casa Paradiso, Green Crest and La Maison Vineyard with range from 4-13m in height and with canopies that have a spread from 3-10m, comprising: *Araucaria heterophylla, Archontophoenix alexandrae*, *Bauhinia spp., Bischofia javanica*, *Bombax ceiba*, *Cinnamomum camphora*, *Ficus benjamina*, *Ficus microcarpa, Hibiscus tiliaceus, Juniperus chinensis var.kaizuca, Lagerstroemia speciosa*, *Livistona chinensis Mangifera indica*, *Melaleuca cajuputi* subsp. *cumingiana, Michelia* x *alba*, and *Terminalia mantaly.*

  All the species within these residential developments were planted for amenity purposes and are maintained by the private residential management. No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Tree" as defined in the book "Champion Trees in Urban Hong Kong" were found. No trees are affected by the proposed development. Overall, this landscape resource has a relatively low landscape and amenity value and is considered to have ***medium*** sensitivity.

- ***LR2.B2 – Village Settlements (outside Project Site):*** This LR consists of approx. 9.1 ha of Village settlements outside the Project Site but within the Assessment Area and comprising clusters of two to three-storey houses in organic, ad-hoc layouts are scattered along the edge of eastern and southern portions of the assessment area.

There are approximately **350** nos. of trees scattered around the village at Chuk Yuen Tsuen (Hang Fook Garden) and Yau Mei San Tsuen comprising *Averrhoa carambola*, *Bombax ceiba*, *Celtis sinensis*, *Citrus maxima*, *Clausena lansium*, *Delonix regia*, *Dimocarpus longan*, *Dracontomelon duperreanum*, *Ficus microcarpa*, *Hibiscus tiliaceus*, *Litchi chinensis, Macaranga tanarius* var. *tomentosa*, *Mangifera indica*, *Melaleuca cajuputi* subsp. *cumingiana, Melia azedarach*, *Michelia* x *alba*, *Morus alba, Psidium guajava*, *Sapium sebiferum* and *Syzygium jambos* with range from 3-10m in height and with canopies that have a spread from 4-8m. Planting within this village area is predominantly of fruit trees and indigenous vegetation.

No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found. No trees are affected by the proposed development and this landscape resource comprises common species and is considered to have ***low*** sensitivity.

- ***LR3.B – Open Storage/Vacant Lot (outside Project Site):*** This LR is consists of approx. 12.6ha outside the Project Site but within the Assessment Area and mostly hard-paved open storage / vacant sites outside the Project Site, parts of them are covered with grass and naturally seeded vegetation. Approximately **250 nos. of** existing trees were identified with range from 4-12m in height and with canopies that have a spread from 3-8m, Poor form, Poor to Fair health and Low amenity value. Planting species comprise *Archontophoenix alexandrae, Artocarpus heterophylla, Bauhinia spp., Bombax ceiba, Casuarina equisetifolia, Ficus microcarpa, Leucaena leucocephala, Macaranga tanarius* var. *tomentosa and Melaleuca cajuputi* subsp. *cumingiana*. Trees, mainly *Bombax ceiba* and *Ficus microcarpa* are in a degraded condition, having been persistently disturbed by human activities. Self-seeded *Macaranga tanarius* var. *tomentosa* and *Leucaena leucocephala* are also occasionally found at the fringe of these areas. No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found. As planting lies within an area of temporary storage use, it is considered that this landscape resource has a ***low*** sensitivity.

- ***LR4.B – Agricultural Fields (outside Project Site):*** This LR of Agricultural fields consists of approx. 1.6ha outside the Project Site within the Assessment Area and lie in the southern portion of the study area either side of the Ngau Tam Mei Channel and eastern edge of the study area and cultivated with common fruit trees and vegetable crops. The fields contain approximately **80 nos. of** existing trees with range from 4-6m in height and with canopies that have a spread from 5-7m spread with Poor to Fair form, Poor to Fair health and Low amenity value. They are cultivated with common fruits and vegetable crops. These comprise *Albizia lebbeck*, *Artocarpus heterophylla*, *Celtis sinensis*, *Dimocarpus longan*, *Litchi chinensis* and *Macaranga tanarius* var. *tomentosa* planted by local villagers. Some self-seeded species like *Macaranga tanarius* var. *tomentosa* and *Leucaena leucocephala* can also be found. No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found.

  The landscape quality of this LR is considered to be medium due to the expansive, rural and open environment. However, abandoned and active agricultural lands are in fact fairly common in New Territories, and so changes to this LR will not be of any significance in a regional context. Furthermore, agricultural lands are reasonably easy

to re-establish, and have a high ability to accommodate changes. Given these factors, this LR is considered to have ***medium*** sensitivity.

- ***LR5.B – Plantation (outside Project Site):*** This LR consists of approx. 2.4ha outside the Project Site but within the Assessment Area and this takes the form of buffer planting between village settlements and major corridors such as Kam Pok Road and Castle Peak Road. The arrangement of this planting contributes to the local landscape by providing green edges and buffers. Approximately **250 nos. of** existing trees were surveyed with range from 3-12m in height and with canopies that have a spread from 3-13m spread and generally Poor form, Poor to Fair health and Low amenity value. The planting comprises *Averrhoa carambola, Bombax ceiba, Celtis sinensis, Clausena lansium, Cleistocalyx nervosum, Delonix regia, Eucalyptus spp., Ficus altissima, Ficus benjamina, Ficus binnendijkii, Ficus microcarpa, Hibiscus tiliaceus, Lagestromia speciosa, Leucaena leucocephala, Litchi chinensiss, Macaranga tanarius var.tomentosa, Melaleuca cajuputi* subsp. *Cumingiana, Spathodea campanulata*, and *Syzygium jambos*. The predominant species are *Bombax ceiba*, *Eucalyptus spp.*, *Ficus benjamina*, *Hibiscus tiliaceus, Lagerstroemia speciosa* and *Melaleuca cajuputi* subsp. *cumingiana*. No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found. This landscape resource is considered to have a ***low*** sensitivity as it comprises common species that could easily be reinstated.

- ***LR6.B – Grassland/Shrubland (outside Project Site):*** This LR consist of approx.17.3ha of grassland area outside the Project Site but within the Assessment Area and located to the south west of the Project Site and to the east of the nullah channel comprises disturbed former agricultural land which has been colonised by common grass species such as *Brachiaria mutica, Miscanthus sinensis, Neyraudia reynaudiana, Panicum maximum* and *Pennisetum purpureum*, with some shrubs and trees, mainly the invasive *Leucaena leucocephala*, growing around the margins. Approximately **200** trees with range from 3-12m in height and with canopies that have a spread from 4-10m and generally Poor form, Poor health and Low amenity value. These comprise mainly *Cinnamomum champhora, Dimocarpus longan, Leucaena leucocephala,* and *Macaranga tanarius* var. *tomentosa*. No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found. The resource has a relatively low amenity value and its disturbed and incidental nature makes it reasonably tolerant to change and hence, is considered to have *a* ***low*** sensitivity.

- ***LR7.B – Ponds and Pond Edge (outside Project Site):*** Much of the land covering 24.1 ha of ponds outside the Project Site but within the Assessment Area and including fishponds were once commonplace in the Northwest New Territories and are now becoming significant landscape resources due to their increasing loss. There are several areas of existing ponds within the assessment area. Most of them are abandoned and are colonized by local vegetation. There are approximately **380** nos. of trees surrounding the ponds with range from 2-10m in height and with canopies that have a spread from 3-9m and generally Poor form, Poor to Fair health and Low amenity value. Approximately 26 species were surveyed:- *Acacia auriculiformis, Albizia lebbeck, Aleurites moluccana, Annona squamosa, Artocarpus heterophyllus, Bauhinia spp., Bombax ceiba, Callistemon viminalis, Carica papaya, Casuarina equisetifolia, Celtis sinensis, Cinnamomum camphora, Citrus maxima, Clausena lansium, Dimocarpus longan, Diospyros kaki, Ficus hispida, Ficus microcarpa, Khaya senegalensis, Litchi chinensis, Macaranga tanarius* var. *tomentosa, Mangifera indica, Melia azedarach,*

Peltophorum pterocarpum, Syzgium cumini, and *Syzgium jambos*. All the trees are exotic except for *Celtis sinensis, Cinnamomum camphora, Ficus microcarpa and Macaranga tanarius* which are native to Hong Kong. All the trees are on embankment environments and have been planted for quite some time. *Macaranga tanarius* var. *tomentosa* can be found at the fringe of the ponds, while pond embankments are used by local villagers as spaces for cultivating fruit trees, predominantly *Litchi chinensis* and *Dimocarpus longan*. No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found.

Freshwater ponds are often associated with agricultural lands and are used for irrigation. Although most of the trees of this LR are common fruit trees that are in poor conditions, the landscape quality of this LR is considered to be high due to the relationship of pond and planting. Its aquatic nature also makes this LR very intolerant to change despite the fact that these pond areas are largely manmade. Given these factors, this LR's sensitivity is considered to be ***high***.

- ***LR.8B – Marsh/Reedbed (outside boundary)***: This LR consists approx. 1.4ha include a few abandoned ponds outside the Project Site but within the Assessment Area and located within the rural landscape predominantly in the west of Palm Spring Residential and southern of the Project Area dominated with marsh habitat species and others abandoned ponds are located to south-western and east of project site dominated with reedbed habitat species. These areas include some shrubs and trees, approximately **80** nos. of existing trees with range from 1-2m in height and with canopies that have a spread from 3-4m and Poor form, Poor health and Low amenity value. Predominantly species around the margins such as *Ficus hispida* and *Macaranga tanarius* var. *tomentosa* (refer to Summary Broad Brush Tree Survey Schedule in **Appendix 11-1**). The ecological diversity of species in these areas is low. In the context of the area within the WRA, the sensitivity of this landscape resource is ***Medium**).**

  ***) Note**: *All existing abandoned ponds with the Project Area will be retained as wetland within the WRA (Wetland Reservation Area), and these will be manage to increase their ecological value.*

- ***LR9.B – Modified Watercourse (outside Project Site):*** Two watercourses have approx. 7.1ha outside the Project Site but within the Assessment Area and namely a channel flowing through the area (about 35m wide and 1000m length) and a nullah cutting through Fairview Park (about 20m wide and 700m length), are former natural watercourses that were modified to reduce flooding hazards in the low-lying district. They are now essentially man-made channels which vary in width and edge treatment. Banks of the channel flowing through the area are largely covered with grass and understory shrubs, with some weedy *Leucaena leucocephala* occasionally found. There are approximately **100** nos. of trees with range from 1-2m in height and with canopies that have a spread 3-4m with generally Poor form, Poor health and Low amenity value, consisting mainly of *Leucaena leucocephala*. No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found.

  Although artificial in nature, this LR is considered to have medium landscape quality due to the pleasant environment created by the combination of water and edge planting. Its quality is also augmented by the growth of grass and weeds which have naturalized the artificial banks of the water channels. However, such landscape is not of any particular

importance and is fairly commonly seen in Hong Kong. Furthermore, the artificial nature of the water channels can be easily reinstated. Therefore, this LR is considered to have a ***medium*** sensitivity.

- ***LR10.B – Public Amenity Area (outside Project Site):*** There is a triangular public amenity area with approx. 0.8ha outside the Project Site but within the Assessment Area and located at the corner between the Kam Pok Road and the nullah watercourse channel in the south-eastern portion of the assessment area. This public amenity area is maintained by the District Office and has been planted for quite some time. There are approximately **60** nos. of trees in this area. The predominant species comprise *Cassia fistula, Melaleuca cajuputi* subsp.*cumingiana* and *Peltophorum pterocarpum* with range from 3-5m in height and with canopies that have a spread from 2-4m with generally Good form, Good health and Medium amenity value. No protected species listed under Forestry Regulations (Cap. 96 Forestry and Countryside Ordinance sub. leg.) were found. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found. The area and associated planting are considered to have a ***medium*** sensitivity due to its amenity value within the landscape.

- ***LR11.B – Highways:*** The only feature of this LR outside the Project Site is the San Tin Highway and the associated slip roads and roundabouts (approx. 3.4ha outside the Project Site but within the Assessment Area). There are approximately **500 nos.** of existing trees, with the majority of them being *Eucalyptus* spp. with range from 12-15m in height and with canopies that have a spread from 6-8m that are densely planted along both sides of San Tin Highway. There are also a few *Lagerstoremia speciosa* and *Bombax ceiba* that are planted as ornamental trees at the slip road area. No "Old and Valuable Trees" as defined in the "Registration of Old and Valuable Trees" (ETWB TC(W) No. 29/2004) were found. No "Champion Trees" as defined in the book "Champion Trees in Urban Hong Kong" were found.

  Although the existing trees in this LR are generally large, the vast majority of them are *Eucalyptus* species which are fast-growing and short lived species. The generally large size of these trees indicates that they have already reached maturity. They are mostly in generally poor condition with low amenity values and are an excotic species that can be replaced relatively easily. Therefore this LR is considered to have a ***low*** sensitivity.

11.8.5 Landscape Character Areas

Several landscape character areas (LCAs) have been identified within the assessment area which will potentially be affected by the Project. These areas and their sensitivity to change are described below. ***[Refer to Figure 11-06 for map of the LCAs. Refer to Figures 11-07 to 11-09 for photographs of the LCAs].***

- ***LCA1 – Rural Open Landscape at Active / Abandoned Agricultural Lands / Fish Ponds:*** This LCA, which occupies a total area of approximately 57 ha, is characterized by a combination of active and inactive agricultural lands, including cultivated fields and fish ponds. Crops, ponds, grasses, trees, and a few temporary structures/ shelters are found on flat, open areas. Some areas that have been long abandoned have been heavily invaded by tall grasses, shrubs and weeds, concealing much of the traces of previous agricultural activities. This rural landscape character is relatively common in New Territories nowadays.

  8.1 ha out of the total 57 ha of this LCA will be affected by the proposed development. Due to its high percentage of abandoned and generally unkempt areas, the landscape quality of this LCA is considered to be medium and it is largely tolerant to change. Overall, the sensitivity of this LCA is assessed as ***medium***.

- ***LCA2 – Semi-Rural Open Landscape along Manmade Water Channels:*** This LCA has a total area of approximately 10 ha and is characterized by open landscape along major water channels (or nullahs). Although manmade in nature, grasses and weeds have colonized some of the dry banks and on some of the wetted areas inside the water channels where sufficient silt has deposited. Roadways with low traffic flow and amenity planting are often found along both sides of the water channels, providing a pleasant landscape experience when travelling (whether on foot, on bicycle or in cars) through the semi-rural space.

  Although this LCA is artificial in nature, this LCA is considered to have medium to high landscape quality due to the pleasant environment created by the vast and open landscape and predominance of roadside amenity planting in a semi-rural setting. Its quality is also augmented by the growth of grass and weeds which have naturalized the artificial banks of the water channels. Despite its qualities, the artificial water channels and the roadways and the associated amenity plantations can be reinstated. This LCA is therefore assessed as having a ***medium*** sensitivity.

- ***LCA3 – Comprehensive Low Density Residential Areas:*** This LCA is approximately 52 ha in total and is characterized by built structures and residential landscape in major low-rise residential developments, such as Fairview Park, Palm Springs, Royal Palms, Casa Paradiso, Green Crest and La Maison Vineyard. Residential dwellings of similar architectural design, colour scheme and building height lie within a rectilinear network of roadways creating a well-defined and structured character area. Common facilities such as schools, shops and clubhouses within these developments create a self-contained community. Roadways of low vehicular and pedestrian usage are landscaped with amenity planting such as palm and ornamental tree species, creating a sense of tranquillity.

  As this LCA is not particularly unique and is entirely man-made, its sensitivity is assessed as ***medium***.

- ***LCA4 – Village House Areas:*** This LCA, which has a total area of approximately 13 ha, consists of various small to medium scale village settlements commonly seen in New Territories. The buildings are typically two to three-storeys, varying in height, architecture, colour and age, and are arranged in an irregular form. Village houses and temporary (some possibly illegal) structures, alongside other structures such as temples and schools, are built along rather random footpaths or lanes of varying widths. Small informal restaurants, stores, car parks and sitting areas with temporary structures are occasionally found at the edge of the village facing public roads.

  Unlike some historical villages found in other places of the New Territories, this kind of relatively recent disorganized village development is very common, and thus it is not of any particular landscape significance in the local and regional context. Therefore, this LCA is assessed as having a ***low*** sensitivity

- ***LCA5 – Major Transportation Corridors:*** This LCA is defined by the San Tin Highway and associated slip roads and roundabouts, occupying a total of approximately 5 ha. Although fairly large amenity and screen tree planting are found, extensive road surfaces and the high volume of vehicular traffic flow make the space rather unpleasant and unfriendly for pedestrians and cyclists.

  The unpleasant, noisy, dusty environment along the roads causes the overall landscape character to be low. Also, given the generally urbanized environment of Hong Kong, major transportation corridors with associated planting on both sides are common and not of any particular significance in both local and regional contexts. Therefore, this LCA is assessed as having a ***low*** sensitivity.

- ***LCA6 – Open Storage / Workshops / Utility Areas:*** This LCA is approximately 14 ha and is characterized by hard-paved areas and disorganized temporary structures that are used as open storage, workshops, and parking lots. It also includes public service

facilities, most notably the Chuk Yuen Floodwater Pumping Station, which has a rather dull, utilitarian design. The LCA is mostly disturbed, with little planting, and the fringes are occasionally invaded by grasses, weeds and weedy tree species.

The disjointed mix of industrial and human activities, overall greyish tone and general lack of greenery together give this LCA a low landscape quality. Thus this LCA is assessed as having a ***low*** sensitivity.

11.8.6 Zone of Visual Influence (ZVI)

Given the generally flat topography of the Project Site and surroundings, the small-scale developments of the surrounding area and the relatively low height of the proposed development, the ZVI has been mapped based on the limited exposure of the Project Site to surrounding VSR's.

The extent of the ZVI is illustrated in **Figure 11-10**, and a section showing the derivation of the ZVI is illustrated in **Figure 11-11**. The ZVI is described below:

To the south-east, the ZVI is defined largely by the proposed cycle track, Yau Pok Road and Ngau Tam Mei channel, the embankments of which are slightly elevated above surrounding landscape.

To the south, the edge of the ZVI is defined by an adjoining area of rough grass.

To the west, the edge of the ZVI is defined by the 2 and 3-storey buildings of the Fairview Park development. The intervening landscape between the Project Site and the retaining wall at the edge of Fairview Park consists of a landscape channel and a strip of grassland.

To the north-west of the Project Site, bounded on either side by the Fairview Park and Palm Springs developments, the land is flat and open except for occasional scattered groups of trees and other vegetation, consisting mainly of fish ponds extending as far as the Mai Po Nature Reserve. The internal road and house layout at the north western end of the development area are also adjusted to form an additional northwest-southeast view corridor towards Kai Kung Leng. The distance to houses north of Fairview Park is maximised and the view corridor between the fish pond area and the eastern ridgelines of Kai Kung Leng is opened up to the maximum practicable extent.

To the north of the Project Site, the ZVI is defined by the 3-storey buildings of the Palm Springs and Royal Palms developments, with intervening fish ponds and occasional huts.

To the east of the Project Site the ZVI is defined by village buildings at Yau Mei San Tsuen and cottage areas with Castle Peak Road and San Tin Highway beyond. Views to the Project Site are very broken by intervening vegetation and occasional huts around the fish ponds.

11.8.7 Visually Sensitive Receivers (VSRs)

Within the ZVI, key Visually Sensitive Receivers (VSRs) have been identified. In addition, planned developments have been included in the assessment as potential VSRs. For ease of reference, each VSR is given an identity number, which is used in the text tables and figures. These VSRs are mapped in **Figure 11-10**. The VSRs are listed in **Table 11-4** below, together with an assessment of their sensitivity according to **Section 11.4** and GN 8/2002. The views currently experienced by VSRs are shown in **Figures 11-12** to **11-17**.

11.8.8 Photomontages

Photomontages have been prepared from 8 viewpoints to illustrate a range of scenarios from key VSR's. The eight photomontage viewpoints are mapped in Figure 11-10.

The viewpoints include public/ local vantage points for both kinetic and static VSR's. The viewpoints also include a representative range of distances within the ZVI. The views currently experienced by VSRs are shown in **Figures 11-34** to **11-41.**

Table 11-4 Sensitivity of VSR's

ID No.	Visually Sensitive Receiver	VSR Type & Number (Very Few, Few, Many, Very Many)	Quality of Existing Views (Good, Fair, Poor)	Alternate Views & Amenity (Poor, Fair, Good)	Frequency of View (Very Frequent, Frequent, Occasional, Rare)	Degree of Visibility (Full, Partial, Glimpse)	Sensitivity (Low, Medium, High)
R1	Residents in Fairview Park	Residential (Few)	Good	Yes (Fair)	Very Frequent	Full	High
R2	Residents in Palm Springs	Residential (Few)	Good	Yes (Fair)	Very Frequent	Full	High
R3	Residents in Royal Palms	Residential (Few)	Good	Yes (Fair)	Very Frequent	Partial	High
R4	Residents in Yau Mei San Tsuen	Residential (Very Few)	Good	Yes (Fair)	Very Frequent	Full	High
R5	Residents in Chuk Yuen Tsuen, Tai Yen Villa and Hang Fook Garden	Residential (Few)	Fair	Yes (Fair)	Occasional	Partial	Medium
R6	Residents in Helene Terrace, Villa Camellia and Ha San Wai	Residential (Few)	Fair	Yes (Fair)	Occasional	Partial	Medium
R7	Future Residents under Approved Planning Application A/YL-MP/205	Residential (Few)	Good	Yes (Fair)	Frequent	Full	High
R8	Future Residents under Planning Application A/YL-MP/170 & A/YL-MP/202	Residential (Few)	Fair	Yes (Fair)	Occasional	Partial	Medium
R9	Future Residents cum Passive Recreational (within REC Zone and R(D) zone)	Residential (Few)	Fair	Yes (Fair)	Rare	Glimpse	High
T1	Travellers on Yau Pok Road, Kam Pok Road and Bridges across Ngau Tam Mei Channel	Travelling (Few)	Good	Yes (Fair)	Frequent	Full	High
T2	Travellers on Castle Peak Road	Travelling (Many)	Fair	Yes (Fair)	Rare	Glimpse	Low
T3	Travellers on San Tin Highway	Travelling (Very Many)	Fair	Yes (Fair)	Rare	Glimpse	Low
T4	Pedestrians on San Tin Highway Footbridges	Travelling (Very Few)	Fair	Yes (Fair)	Occasional	Partial	Medium
O1	Workers at Fairview Park Petrol Station	Occupational	Fair	Yes	Rare	Glimpse	Low

ID No.	Visually Sensitive Receiver	VSR Type & Number (Very Few, Few, Many, Very Many)	Quality of Existing Views (Good, Fair, Poor)	Alternate Views & Amenity (Poor, Fair, Good)	Frequency of View (Very Frequent, Frequent, Occasional, Rare)	Degree of Visibility (Full, Partial, Glimpse)	Sensitivity (Low, Medium, High)
		(Very Few)		(Poor)			
O2	Staff and Pupils at Bethel High School	Occupational (Few)	Good	Yes (Fair)	Rare	Glimpse	Low
O3	Workers at Chuk Yuen Floodwater Pumping Station	Occupational (Very Few)	Good	Yes (Fair)	Occasional	Partial	Low
O4	Workers in Fish Ponds West of the Project Site	Occupational (Very Few)	Good	Yes (Good)	Frequent	Full	Low
O5	Workers in Fish Ponds south of Royal Palms	Occupational (Very Few)	Good	Yes (Fair)	Very Frequent	Full	Low
O6	Staff at Christian Ministry Institute	Occupational (Very Few)	Good	Yes (Fair)	Occasional	Partial	Low
O7	Workers in Yau Mei San Tsuen	Occupational (Very Few)	Good	Yes (Poor)	Occasional	Partial	Low
O8	Workers in Storage Areas South of Chuk Yuen Tsuen	Occupational (Very Few)	Fair	Yes (Fair)	Rare	Partial	Low
O9	Staff and Pupils at Wong Chan Sook Ying Memorial School and Commercial Premises	Occupational (Very Few)	Fair	Yes (Fair)	Rare	Partial	Low
C1	Visitors to Mai Po Nature Reserve	Recreational (Few)	Good	Yes (Good)	Rare	Partial	High

11.9 Potential Sources of Landscape and Visual Impact

The proposed Project development will be the source of impacts inducing adverse landscape and visual impacts during the construction phase and the operation phase. It should be noted that some sources may actually induce positive impact.

11.9.1 Potential Sources of Construction Impact

Construction period under the preliminary implementation programme for the Project will begin in third quarter 2015 and complete in later 2018 (see **Appendix 1-1**). During this time, the Project will involve the following sources of temporary and reversible construction phase impacts:

- Presence of the construction sites and the commencement of construction activities (e.g. site clearance/ removal of existing vegetation/ vegetated surface and conversion to bare soil, gravel or hard paved surface, site formation works/ excavation works/ basement works, presence of construction equipment, machinery and plant, temporary storage of construction materials, setting up of construction site offices, parking and yards, and night-time security lighting etc.);
- Erection of temporary site hoarding with varies high and length of noise barrier of 3m (H) with approx. 108 (L); 4.5m (H) with approx. 249 (L) and 6m (H) with approx. 437 (L). Whilst the barriers will create temporary visual obstruction, they will effectively screen adverse views of the construction activity. Provided the barriers are sensitivity designed and soft planting will be incorporated in front of the barrier to minimise the visual impact, the overall visual benefit should be positive (refer to **Figure 11-18**);
- Wetland/Pond enhancement works within WCA portion of the Project Site;
- Presence of incomplete structures; and
- Presence of construction traffic near Project Site entrance.

11.9.2 Potential Sources of Operational Impact

Impacts during the operational phase will be permanent and irreversible, i.e. none of the landscape or visual resources affected by the project are irreplaceable. Sources of operation phase impact will include:

- A general reduction in overall greenery due to tree felling and insufficient compensatory trees in terms of quantity and quality;
- A general reduction in vegetated surface due to areas used for buildings and roads in the southern portion of the site and for the wetland/pond enhancement in the northern and eastern portions of the site;
- Presence of new building structures (e.g. residential houses, residents' communal clubhouse) and roads in the center to southern portion of the site;
- Presence of 1.8 m high perimeter wall between the residential areas and the WRA and the presence of a 1.8 m high wire mesh site boundary fence along the western and northern side of the WRA (refer to **Figure 11-18**);
- Presence of restored ecological wetland area;
- Presence of landscape buffer planting at the Project Site boundary; and
- Night-time domestic and street lighting;

11.10 Landscape Impact Assessment

11.10.1 Landscape Impacts Before Mitigation

There will be a number of impacts on landscape resources during the construction and operation phases. However, these impacts will be confined to areas within the Project Site. They are described below and are tabulated in **Table 11-9**:

LR4.A – Agricultural Fields (within Project Site): The sensitivity for this LR is low. The proposed development will cause permanent loss of all (approx. 4.9 ha) of this LR.

This LR has 57 nos. of trees that are separated into three (3) tree groups, namely TG1, TG3 and TG4 due to their geographical location. A total of these 54 nos. of trees (7 nos. on TG1 + 36 nos. in TG3 + 14 nos. in TG4) will be directly affected by the proposed development and will need to be felled.

Proposed treatments to existing trees within LR4.A are as follows:

	Retain (nos.)	Fell (nos.)	Transplant (nos.)	Total (nos.)
TG1	0	7	0	7
TG3	6	30	0	36
TG4	0	1	0	14
Total	**6**	**51**	**0**	**57**

During construction before mitigation, the entire 4.9 ha area of the LR will be converted from agricultural field to a construction site with no vegetation cover when site formation/ building works for the proposed houses commence. The Magnitude of Change is considered to be **Large** and the resulting Impact Significance before mitigation is considered to be **Moderate.**

During operation before mitigation, the entire area of the LR will have been converted from agricultural fields to a residential house development. Although there will be a reduction of total vegetated surface due to the hard paving of the proposed internal roads and footpath, the proposed trees and shrubs in good health and higher amenity values will be provided and will to some extent offset the negative effects of the loss of existing vegetation. Therefore, the Magnitude of Change is considered to be **Intermediate**, and the Impact Significance before mitigation is considered to be **Moderate.**

***LR6.A – Grassland/Shrubland (within Project Site)*:** This LR has low sensitivity. The proposed development will cause permanent loss of all (approx. 0.9 ha) of this LR.

This LR has tall grass and weeds which have colonized them and dominated by common grass species such as *Brachiaria mutica* and *Panicum maximum,* and other shrub planting, and will need to be removed. No existing trees were found in this LR.

Proposed treatments to existing tree and grass species within LR6.A are as follows:

	Retain (nos.)	Fell (nos.)	Transplant (nos.)	Total (nos./ha)
Tree	0	0	0	0
Grass				
Brachiaria mutica and *Panicum maximum*				**0.9 ha (loss)**

During construction before mitigation, the entire 0.9 ha area of the LR will become part of the construction site when site formation and wetland restoration works commence. The existing grassland/ shubland have a low sensitivity. Its conversion to a construction site will result in **Large** Magnitude of Change, producing a **Moderate** Impact Significance before mitigation.

During operation before mitigation, the entire area of the LR will have been converted from grassland/ shrubland to a wetland restoration area. The Magnitude of Change is considered to be **Large** and the resulting Impact Significant is considered to be **Moderate.**

LR7.A – Pond and Pond Edge (within Project Site): This LR has medium sensitivity. Works in this area will involve enhancement and enlarging the wetland/pond (approx. from 3.0 ha to 3.8 ha).

All 48 nos. of existing trees within this LR are grouped within TG5. Most of these trees are growing in raised ridges or slope between ponds and vegetable fields, will be directly affected by the proposed wetland restoration works and will need to be felled.

Proposed treatments to existing trees within LR7.A are as follows:

	Retain (nos.)	**Fell (nos.)**	**Transplant (nos.)**	**Total (nos.)**
TG5	0	48	0	48
Total	**0**	**48**	**0**	**48**

During construction before mitigation, the excavation work for enlarging the pond will adversely affect the quality of the existing abandoned pond. The Magnitude of Impact is considered to be **Large**, and the Impact Significance before mitigation is considered to be **Moderate.**

During operation before mitigation, the enlarged pond will have a greater quality than the existing abandoned pond, which will be managed and enhancing the amenity and wildlife value of the pond. The Magnitude of Change is considered to be **Intermediate** and the resulting Impact Significance before mitigation is considered to be **Moderate (Positive).**

LR8.A – Marsh/Reedbed (within Project Site): The sensitivity of this LR is medium. Marsh/ Reedbed has developed on abandoned ponds (approx. 1.1 ha) following the process of natural succession of vegetation. Works in these areas will involve enhancement and enlarging the existing abandoned ponds.

Approx. 63 nos. of existing trees within this LR are grouped within TG2 and TG6 (6 nos. on TG2 + 57 nos. in TG6). Most of these trees are growing in raised ridges or slope between ponds and vegetable fields, will be directly affected by the proposed wetland restoration works and will need to be felled.

Proposed treatments to existing trees within LR8.A are as follows:

	Retain (nos.)	**Fell (nos.)**	**Transplant (nos.)**	**Total (nos.)**
TG2	3	3	0	6
TG6	0	57	0	57
Total	**3**	**60**	**0**	**63**

During construction before mitigation, the excavation work for enlarging the marsh/reedbed will adversely affect the quality of the existing abandoned pond. The Magnitude of Impact is considered to be **Large**, and the Impact Significance before mitigation is considered to be **Moderate.**

During operation before mitigation, the enlarged pond will have a greater quality than the existing abandoned pond, which will be managed and enhancing the amenity and wildlife value of the pond. The Magnitude of Change is considered to be **Intermediate** and the resulting Impact Significance before mitigation is considered to be **Moderate (Positive).**

Unaffected LRs: All other LRs inside the Assessment Area (i.e. LR1.B, LR2.B1, LR2.B2, LR3.B, LR4.B, LR5.B, LR6.B, LR7.B, LR8.B, LR9.B, LR10.B and LR11.B) are located entirely outside the Project Site and will not be affected by the works. The magnitude of change for those LRs outside the project site should be **Negligible**, and need not be assessed for impact significant.

The impacts on LCAs as a result of the proposed development are assessed as follows and are tabulated in **Table 11-7.**

LCA1 – Rural Open Landscape at Active / Abandoned Agricultural Lands / Fish Ponds – This LCA has medium sensitivity and occupies a total of around 57 ha within the Assessment Area. Approx. 8.1 ha of this LCA lies within the Project Site and will be permanently converted to residential development with houses, private communal landscape areas, and internal roads from the center to south and western portion of the Project Site, and to enhancement of wetland restoration area in the north and western portion.

During construction before mitigation, the entire area of the LCA within the Project Site will be converted to a construction site where site formation/ building works for the proposed house development from the center to south and western portion of the Project Site and a wetland restoration works to the north and eastern portion of the site commence. This represents approx.14% of the LCA as a whole. Therefore, the Magnitude of Change is considered to be **Intermediate**, and the Impact Significance before mitigation is considered to be **Moderate.**

During operation before mitigation, the entire area of the LCA will have been converted to Comprehensive Low Density Residential Area in the southern west portion of the site and to extensive wetland restoration area in the northern east portion of the site. Although the new landscape character will be substantially different from the existing one, it is compatible with the landscape character of adjacent Comprehensive Low Density Residential Areas (LCA3) which forms a large part of the Assessment Area (and beyond). Therefore, the Magnitude of Change is considered to be **Intermediate**, and the Impact Significance before mitigation is considered to be **Moderate.**

Unaffected LCAs: All other LCAs (i.e. LCA2, LCA3, LCA4, LCA5 and LCA6) within the Assessment Area are entirely outside the Project Site and therefore will not be affected by the works. The magnitude of construction and operation phase impacts for these LCAs is therefore **Negligible**, and the resulting impact significance is thus **Insubstantial** during the construction and operation phases.

11.10.2 Landscape Mitigation Measures

To minimize impacts on landscape resources, a number of specific mitigation measures are proposed to be implemented, including consideration of design options and the provision of mitigation measures to directly offset unavoidable impacts associated with the construction and operational phases. These are further detailed below.

Mitigation measures including strategies for reducing, offsetting and compensating impacts are proposed to be implemented during construction and operation phases. These are identified in **Tables 11-5A and 11-5B** below and are illustrated in **Figures 11-16** to **11-26.**

The assumption has been made in the assessment that all mitigation proposals in this Report are practical and achievable within the known parameters of funding, implementation, management and maintenance. The suggested agents for the funding and implementation (and subsequent management and maintenance, if applicable) are also indicated in **Tables 11-5A and 11-5B.**

Table 11-5A Proposed Landscape Enhancement/ Mitigation Measures – Construction Phase

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency
CM1	**Proper protection of existing trees designated to be retained in-situ** Existing trees designated to be retained in-situ will be properly protected. This may include the clear demarcation and fencing-off of tree protection zones, tight site supervision and monitoring to prevent tree damage by construction activities, and periodic arboricultural inspection and maintenance to uphold tree health. A total of 6 nos. of trees will be retained in-situ (refer to Appendix 11-1; Broadbrush Tree Schedule 1). Other trees mostly are growing in raised ridges or slopes between ponds and vegetable fields, which result in difficulties for tree to be retained or transplanted.	Project Proponent	Project Proponent (via Contractor)
CM2	**Enhancement of Wetland/Pond Area Expansion** Existing abandoned wetland/ pond area will be expanded and enhanced into a larger and comprehensive wetland restoration area. The enhancement works of wetland/pond will be commenced in early stage to establish the migration of some ecological habitats. Along the interfaces between the proposed residential areas and the WRA, it is proposed to erect a 3m high perimeter temporary fence/ hoarding to define the site and prevent unauthorized access. This perimeter temporary fence/hoarding will be buffered by planting of moderate to tall sized trees and shrub. Enhancement of the wetland/pond will result in the increase of the wetland/pond area from its current 3.0 ha to around 3.8 ha.	Project Proponent	Project Proponent (via Contractor)

Table 11-5B Proposed Landscape Enhancement/ Mitigation Measures – Operation Phase

ID No.	Landscape and Visual Mitigation Measure	Funding Agency	Implementa-tion Agency	Management Agency	Maintenance Agency
OM1	**Maximizing Tree Preservation Effort** Healthy existing trees that are not affected by the proposed development will be retained in-situ. Affected existing trees that are of high to medium amenity value and high to medium survival rate after transplanting will be transplanted.	Project proponent	Project proponent	Project Proponent	Project Proponent
OM2	**Provision of New Trees** Compensatory tree planting shall be provided for soft landscape in the proposed development. The tree compensation to tree loss ratio shall be at least 1:1 in term of quantity and quality within the Project Site. Required numbers and locations of compensatory trees shall be determined and agreed separately with Government during the Tree Felling Application process under ETWBTC 3/2006.	Wetland Restoration Area Project Proponent	Wetland Restoration Area Project Proponent	Wetland Restoration Area Project Proponent	Wetland Restoration Area Project Proponent
		Residential Area Project Proponent	Residential Area Project Proponent	Residential Area Project Proponent	Residential Area Project Proponent
OM3	**Suitable Design for WRA and Residential Development** The landscape design for the wetland restoration area in the north and western portion of the Project Site will be maximized for wetland habitat restoration consistent with achieving other parameters and the design on the residential development on the center to south western portion of the Project Site will adopt a rural, naturalistic approach with open space to compliment the original landscape character. Emphasis will be placed on a balanced approach between trees and grass/herbs. Use native species will be proposed for the planting design theme. No access is allowed for unauthorized person. Along the interfaces between the proposed residential area and the WRA, it is proposed to erect a 1.8m high fence wall. Natural materials, such as timbers, will be mostly used for landscape hardworks. Management and maintenance of the WRA shall be carried out by a separate unit from the residential estate and follow the specifications in Section 5.5 of Appendix 8-10.	Project Proponent	Project Proponent	Competent Conservation Agent identified by Project Proponent	Competent Conservation Agent identified by Project Proponent
OM4	**Provision of Buffer Planting along WRA** Tree and shrub planting will be provided at strategic locations along the WRA to ensure connectivity with the adjacent habitats while minimising potential disturbance impact to the wetland.	Project Proponent	Project Proponent	Competent Conservation Agent identified by Project Proponent	Competent Conservation Agent identified by Project Proponent

11.10.3 Programme of Implementation of Landscape Enhancement & Mitigation Measures

The Construction Phase measures listed in **Table 11-5A** & **11-8A** shall be adopted from the commencement of construction and shall be in place throughout the entire construction period.

The Operation Phase measures listed in **Table 11-5B** and **11-8B** shall be adopted during the detailed design, and be built as part of the construction works so that they are in place at the date of commissioning of the Project. However, it should be noted that the full effect of the soft landscape mitigation measures will not be realised for several years until planting matures.

Project Funding

A programme for the mitigation measures is provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are identified in **Tables 11-5A, 11-5B, 11-8A** and **11-8B.**

11.10.4 Mitigation Planting

A list of species appropriate for mitigation planting is provided in **Table 11-6** below. The planting list is subject to specialist design and investigation at the detailed design stage to maintain a suitable ecological enhancement plant community. The planting will comprise principally of native trees and shrubs selected for their ecological value to the area.

Table 11-6 Indicative Mitigation Planting Species for Different Areas

Screen/Buffer Planting (Boundary)		
Trees	Palms / Bamboos	Shrubs
Acacia auriculiformis	*Chrysalidocarpus lutescens*	*Schefflera arboricola*
Casuarina equisetifolia	*Bambusa textilis*	*Gardenia jasminoides*)*
Celtis sinensis)*	*Bambusa vulgaris* 'Striata'	*Ligustrum sinensis *)*
Eucalyptus citriodora		*Ficus microcarpa* 'Golden Leaves'
Sapium sebiferum)*		*Murraya paniculata*
Sterculia lanceolata)*		*Melastoma candidum*)*
		Rhaphiolepis indica)*
		Rhodomyrtus tomentosa)*
Street Trees		
Aleurites moluccana	*Elaeocarpus balansae*	*Melaleuca quinquenervia*
Bauhinia variegata	*Grevillea robusta*	*Peltophorum pterocarpum*
Bischofia javanica)*	*Spathodea campanulata*	
Cinnamomum burmanii +)		
Garden and Amenity Planting		
Trees	Shrubs	Groundcover
*Bauhinia blakeana *)*	*Breynia nivosa*	*Asclepias curassavica*
Bombax ceiba	*Buddleja asiatica*)*	*Asparagus sprengeri*
Cassia surattensis	*Camellia japonica*	*Hymenocallis littoralis*)*
Crateva unilocularis	*Cuphea hyssopifolia*	*Lantana montevidensis*
Delonix regia	*Gardenia jasminoides*)*	*Liriope spicata*)*
Elaeocarpus hainanensis	*Hibiscus tiliaceus*)*	*Nephrolepis hirsutula*)*
Ficus benjamina	*Hypericum chinense*	*Portulaca oleracea*)*
*Gordonia axillaris *)*	*Iris tectorum*	*Rhoeo discolor*
*Litsea glutinosa *)*	*Ixora stricta*	*Setcreasea purpurea*

*Machillus breviflora *)* *Magnolia grandiflora* *Mallotus paniculatus *)* *Melia azedarach* *Michelia alba* *Plumeria rubra var. Acutifolia* *Reevesia thyrsoidea *)* *Schefflera heptaphylla *)* *Schima superba *)* *Spathodea campanulata*	*Jasminum sambac* *Ligustrum sinensis *)* *Melastoma candidum*)* *Osmanthus fragrans* *Russelia equisetriformis* *Rhaphiolepis indica*)* *Rhododendron simsii*)* *Rhodomyrtus tomentosa*)* *Spathiphyllum* sp.	*Syngonium* sp. *Tracheloepermum jasminioides*)* *Zephyranthus carinata*
Planting Within Wetland Restoration Area		
Shallow Water Mix *Cyperus malaccensis*)* *Eleocharis spiralis*)* *Juncus effusus*)* *Ludwigia adscendens*)* *Polygonum barbatum*)* *Schoenoplectus triangulatus*)* Reed bed Species *Phragmites australis* Marsh Mix *Bacopa monnieri*)* *Commelina diffusa*)* *Eleocharis spiralis*)* *Panicum repens*)* *Ludwigia adscendens*)* *Ludwigia octovalvis*)* *Polygonum barbatum*)* *Polygonum glabrum*)*	Grassy Bund Mix *Paspalum paspaloides*)* *Cynodon dactylon*)* Bamboo Clump *Bambusa eutuldoides* Wooded Bund (between residential area and proposed marsh and reed habitats at Areas 17, 18, A3, A1 and A2) Shrub: *Gardenia jasminoides*)* *Ilex asprella*)* *Ilex pubescens*)* *Ligustrum sinensis *)* *Melastoma candidum*)* *Rhaphiolepis indica*)* *Rhodomyrtus tomentosa*)* Trees: *Hibiscus tiliaceus*)* *Livistona chinensis*	Wooded Bund (along herpetofauna corridor buffer) Shrub *Rhodomyrtus tomentosa*)* *Gardenia jasminoides*)* *Ilex pubescens*)* *Melastoma candidum*)* *Ligustrum sinensis *)* Tree *Hibiscus tiliaceus*)* *Livistona chinensis* *Sapium sebiferum*)* *Sterculia lanceolata*)* Wooded Bund (around Area 40) *Shrub:* *Hibiscus tiliaceus*)* *Rhodomyrtus tomentosa*)* *Melastoma candidum*)* *Trees:* *Celtis sinensis*)* *Cleistocalyx operculatus* *Sapium sebiferum*)* *Sterculia lanceolata*)* *Ligustrum sinensis *)*

*) Native species

11.10.4.1 Residual Landscape Impacts After Mitigation

The significance of residual landscape impacts after mitigation is evaluated below. All impacts are Adverse unless otherwise specified**.**

The potential significance of the impacts on landscape resources and landscape character areas during the construction and operation phases, before and after mitigation, are provided below in **Table 11-9** and mapped in **Figures 11-28** and **11-30**. This assessment follows the methodology outlined above and assumes that the appropriate landscape mitigation measures identified in **Tables 11-5A** and **11-8A** will be implemented, and that the full effect of the soft landscape mitigation measures will be realised after 10 years.

11.10.4.2 Residual Landscape Impacts during Construction

Proposed landscape enhancement/ mitigation measure during construction are listed in Table 11-6A. Residual landscape impacts on the LRs are mapped in **Figure 11-28**. Residual impacts on the LCAs are mapped in **Figure 11-31.**

LR4.A – Agricultural Fields (within Project Site): Proposed treatments to existing trees within LR4.A are as follows:

Retain	6 nos.
Transplant	0 nos.
Fell	51 nos.
Total	**57 nos.**

Of the 57 nos. of existing trees in TG1, TG3 and TG4 of this LR, **6 nos**. of existing trees will retained in situ and the remaining 51 **nos.** will be felled.

Feasibility of transplanting trees that spaced very close to each other and severe overlapping of tree crowns will make difficult to transplant and difficulties in formation of rootball for transplantation. Some of them also growing in raised ridges or slope between ponds and vegetable fields, which also makes them difficult to transplant. The trees that are designed for retention will be properly protected by means of demarcation and fencing off of tree protection zones, tight site supervision and monitoring to prevent tree damage by construction activities and periodic arboriculture inspection and maintenance to uphold tree health (CM1).

Apart from preserving and transplanting trees, the residential development is proposed in the central and southern portions of the Project Site. Proposed works in this area mainly along the adjacent to the Wetland Restoration Area (WRA) which will be commencement in early stage to establish the migration of some ecological habitats. Along the interfaces between the proposed residential areas and the WRA, around 150 nos. of trees are properly vegetated, so that impacts arising from the construction works of the Project Site will be somewhat offset by the vegetation plantation listed under **Table 11-8** which is subject to specialist design and investigation at the detailed design stage to maintain a suitable ecological enhancement plant community (CM2) and around 0.2ha of edge planting which consists lawn/shrub/groundcover area to compensate for the loss of dry agricultural field.

The enhancement works of wetland/pond will be to erect a 3m high perimeter temporary fence/ hoarding to define the site and prevent unauthorized access. This perimeter temporary fence/hoarding will be buffered by planting of moderate to tall sized trees and shrub.

The impact significance for this LR will remain to be **Moderate** after mitigation measures as compensatory planting will have a limited effect due to lack of maturity during the construction phase.

LR6.A – Grassland/ Shrubland (within Project Site): No existing trees were found in this LR. All existing tall grass and weeds in this LR which have colonized them and dominated by common grass species such as *Brachiaria mutica* and *Panicum maximum* will be affected by the proposed development, particularly by enhancement of wetland restoration area and will be replaced by compensatory planting listed under **Table 11-8** which is subject to specialist design and investigation at the detailed design stage to maintain a suitable ecological enhancement plant community (CM2).

	Retain (nos.)	Fell (nos.)	Transplant (nos.)	Total (nos./ha)
Tree	0	0	0	0
Grass				
Brachiaria mutica and *Panicum maximum*				**0.9 ha (loss)**

With these mitigation measures implemented, the Moderate impact significance of this LR before mitigation will remain to be **Moderate** after mitigation measures as compensatory planting will have a limited effect due to lack of maturity during the construction phase.

LR7.A – Pond and Pond Edge (within Project Site): Proposed treatments to existing trees within LR7.A are as follows:

Retain	0 nos.
Transplant	0 nos.
Fell	48 nos.
Total	**48 nos.**

The primary landscape proposal for this LR is the enhancement of the existing 2.4 ha abandoned pond into a 3.9 ha high visual amenity landscape pond. The pond will be enhanced and incorporated into a comprehensive large ecological pond for wetland restoration area (CM2).

In the process of enhancing the pond into wetland restoration area, all 48 nos. of the existing common fruit trees species within tree group TG5, which are growing in raised ridges or slope between ponds and vegetable fields, which result in difficulties for tree to be retained or transplanted and are proposed to be felled. All 48 nos. of felled trees will be replaced by compensatory planting listed under **Table 11-8** which is subject to specialist design and investigation at the detailed design stage to maintain a suitable ecological enhancement plant community.

The Moderate unmitigated impact significance during construction phase will be reduced to **Slight** after mitigation.

LR8.A – Mash/Reedbed within Project Site: Proposed treatments to existing trees within LR8.A are as follows:

Retain	3 nos.
Transplant	0 nos.
Fell	60 nos.
Total	**63 nos.**

The existing mash/reedbed area (approx.1.1ha) which has developed on abandoned ponds will be retained and enhanced into a comprehensive ecological pond for wetland restoration area (CM2). Enhancement works will result in the same area of 1.1ha.

In the process of enhancing the abandoned pond into wetland restoration area, all 63 nos. of existing common fruit trees and self-seeded species within tree group TG2 and TG6 which are growing in raised ridges or slope between ponds and vegetable fields which will be affected by the proposed development. Of these trees, 3 nos. will be retained while 60 nos. will be felled. Those felled trees have low ecological value at present and are proposed to be removed.

The trees that are designated for retention will be properly protected by means of demarcation and fencing off of tree protection zones, tight site supervision and monitoring

to prevent tree damage by construction activities and periodic arboriculture inspection and maintenance to uphold tree health. The remaining 60 nos. will be felled and will be replaced by compensatory planting listed under **Table 11-8** which is subject to specialist design and investigation at the detailed design stage to maintain a suitably ecologically sustainable plant community.

The Moderate unmitigated impact significance during construction phase will be reduced to **Slight** after mitigation.

Unaffected LRs: All the other Landscape Resources (i.e. LR1.B, LR2.B1, LR2.B2, LR3.B, LR4.B, LR5.B, LR6.B, LR7.B, LR8.B, LR9.B, LR10.B and LR11.B) are outside the Project Site, and thus will not be affected by the works. Therefore, the residual impact during construction for those LRs will be **Negligible** and will not show in **Table 11-9 note [4].**

Residual impacts on Landscape Character Areas [LCAs] during the Construction Phase will be as follows:

LCA1 – Rural Open Landscape at Active / Abandoned Agricultural Lands / Fish Ponds: The proposed development will cause irreversible changes to approx. 14% of this LCA. However, part of this loss will be replaced by a residential development with houses, private communal landscape areas, and internal roads from the center to south and western portion of the Project Site, and to enhancement of wetland restoration area in the north and western portion. Works on the enhancement of wetland/pond will commence and be completed early. The proposed enhancement wetland/pond will be properly vegetated early, such that somewhat negative impacts arising from the construction works in the center to south and western portions of the Project Site will be somewhat offset by the vegetation plantation(CM2). Approx. 100 nos. of trees (refer to **Annex 1**. *Proposed plant list of Wetland Restoration Area at Yau Mei San Tsuen* in **Appendix 8-10** for the proposed ecological planting proportion (%) table) are proposed in the wetland restoration area to compensate for the loss of 4.9 ha of abandoned dry agricultural land (with emphasis placed on a balance approached between trees and grass/herb).

Apart from provision of the enhancement of wetland/pond, some trees of this LCA will be unaffected and will be retained in-situ. These trees will be properly protected by tree protection zones with site supervision and monitoring, and periodic arboriculture inspection and maintenance (CM1).

It is expected that the wetland restoration area and proposed trees will provide some greenery and positive landscape character enhancement during the construction period, and so the Moderate impact significance before mitigation will be reduced to **Slight** after mitigation.

Unaffected LCAs: All the other LCAs (i.e. LCA2, LCA3, LCA4, LCA5 and LCA6) are entirely outside the Project Site and are therefore not affected by the works. Therefore they will experience **Negligible** residual impacts during construction phase and it will not show in **Table 11-9 note [4].**

11.10.4.3 Residual Landscape Impacts during Operation

Landscape mitigation measures employed to enhance the landscape resources are listed in **Table 11-5B** and **11-8B**. Residual impacts on the landscape resources and landscape character during the operation phase are mapped in **Figures 11- 29** and **11-31.**

LR4.A – Agricultural Fields within Project Site: 3 nos. of existing trees within this LR will be unaffected by the proposed development works and can be retained in-situ (OM1). Approx. 9 nos. of existing trees within this LR are proposed to be transplanted within the

site (OM1) and the felled trees (approx. 45nos.) which are in poor condition and will be compensated by the provision of new tree planting, with compensatory ratio being no less than 1:1 in terms of quantity and quality (OM2).

Apart from maximizing tree preservation, the proposed development will adopt a rural, naturalistic landscape design with native species and natural hardworks material and open space, to match the surrounding landscape character (OM3). Emphasis will be placed on a balanced approach between trees and grass/herbs at strategic location along the WRA to ensure connectivity with the adjacent habitats while minimising potential disturbance impact to the wetland (OM4). With these mitigation measures in place, the residual impact significance will remain **Slight** on day 1 and become **Slight (beneficial)** in year 10 of the operation phase as the compensatory planting matures.

LR6.A – Grassland/shrubland within Project Site: The wetland restoration area enhancement works (OM3) in this LR will provide sufficient tree planting with largely native species (refer to **Annex 1**. *Proposed plant list of Wetland Restoration Area at Yau Mei San Tsuen* in **Appendix 8-10** for the proposed ecological planting proportion (%) table) this will contribute and improved wildlife sustainability. Tree and shrub planting will be provided at strategic locations along the WRA to ensure connectivity with the adjacent habitats while minimising potential disturbance impact to the wetland (OM4). Residual impact after implementation of this mitigation measure is expected to be **Slight** on day 1 and **Slight (beneficial)** at year 10 of the operation phase with the maturing of the compensatory tree planting.

***LR7.A – Pond and Pond Edge (within Project Site)*:** Approx. 48 nos. of felled trees within this LR will be affected by the wetland restoration enhancement works (OM3) and will be compensated by the provision of new tree planting (refer to **Annex 1**. *Proposed plant list of Wetland Restoration Area at Yau Mei San Tsuen* in **Appendix 8-10** for the proposed ecological planting proportion (%) table) this will contribute and improved wildlife sustainability. Tree and shrub planting will be provided at strategic locations along the WRA to ensure connectivity with the adjacent habitats while minimising potential disturbance impact to the wetland (OM4). Residual impact after implementation of this mitigation measure is expected to be **Slight** on day 1 and **Slight (beneficial)** at year 10 of the operation phase with the maturing of the compensatory tree planting.

***LR8.A – Marsh/Reedbed (within Project Site)*:** Approx. 63 nos. of felled trees within this LR will be affected by the wetland restoration enhancement works (OM3) and will be compensated by the provision of new tree planting (refer to **Annex 1**. *Proposed plant list of Wetland Restoration Area at Yau Mei San Tsuen* in **Appendix 8-10** for the proposed ecological planting proportion (%) table) which will contribute and improved wildlife sustainability. Tree and shrub planting will be provided at strategic locations along the WRA to ensure connectivity with the adjacent habitats while minimising potential disturbance impact to the wetland (OM4). Residual impact after implementation of this mitigation measure is expected to be **Slight** on day 1 and **Slight (beneficial)** at year 10 of the operation phase with the maturing of the compensatory tree planting.

Unaffected LRs: All other LRs within the Assessment Area (i.e. LR1.B, LR2.B1, LR2.B2, LR3.B, LR4.B, LR5.B, LR6.B, LR7.B, LR8.B, LR9.B, LR10.B and LR11.B) are entirely outside the Project Site and thus will not be affected by the works. Therefore, the residual impact during construction for those LRs will be **Negligible** and will not show in **Table 11-9 note [4].**

Residual impacts on Landscape Character Areas during the Operational Phase following the implementation of the proposed mitigation measures will be as follows:-

***LCA1 – Rural Open Landscape at Active / Abandoned Agricultural Lands / Fish Ponds*:** The impacted portion of this LCA within the Project Site will be replaced with a residential development with houses, private communal landscape areas, and internal roads from the center to south and western portion of the Project Site, and to enhancement of wetland restoration area in the north and western portion. The design in the north and western site of the Project Site will be maximised for wetland habitat restoration consistent with achieving other parameters. The design in the north will adopt a rural, naturalistic landscape design with native species (emphasis on planting will be placed on a balanced approach between trees and grass/herbs). Natural hardworks materials and open space, to match the original landscape character will be utilised (OM3). Together with the tree preservation measure to retain and transplant existing trees where practicable (OM1) and the planting of new trees to compensate for the loss of existing trees (OM2), the Moderate residual impacts before mitigation during the operation phase will become **Slight** on day 1. By year 10 of the operation phase, the residual impacts will become **Slight (beneficial)** due to the maturing existing trees within the proposed development and maturing vegetation in the recreational ground and planting in and around the residential area, providing established greenery.

Unaffected LCAs: All the other LCAs within the Assessment Area (i.e. LCA2, LCA3, LCA4, LCA5 and LCA6) are entirely outside the Project Site and are therefore not affected by the works. Therefore they will experience **Negligible** residual impacts during operation phase and it will not show in **Table 11-9 note [4]**.

Table 11-7 Significance of Landscape Impacts in Construction and Operational Phases

ID	Landscape Resource / Landscape Character Area	Sensitivity (Low, Medium, High) [1]	Total Area of LR/LCA (Approx. ha)	Affected Area (Approx. Ha) (Affected %)	Magnitude of Impact BEFORE Mitigation (Negligible, Small, Intermediate, Large) [1][4]		Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial) [2][4]		Recommended Mitigation Measures [5]	Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial) [3][4]		
										Construction	Operation	
					Construction	Operation	Construction	Operation			DAY 1	YEAR 10
Part 1 – Landscape Resources												
LR4.A	Agricultural Field (within Project Site)	Low	4.9 ha	4.9 ha (100%)	Large	Intermediate	Moderate	Moderate	CM1, OM1 - OM2,	Moderate	Slight	Slight (beneficial)
LR6.A	Grassland/Shrubland (within Project Site)	Low	0.9 ha	0.9 ha (100%)	Large	Intermediate	Moderate	Moderate	CM2, OM2 – OM4	Moderate	Slight	Slight (beneficial)
LR7.A	Ponds and Pond Edge (within Project Site)	Medium	1.2 ha	1.2 ha (100%)	Large	Intermediate	Moderate	Moderate (beneficial)	CM2, OM2 – OM4	Slight	Slight	Slight (beneficial)
LR8.A	Marsh/ Reedbed (within Project Site)	Medium	1.1 ha	1.1 ha (100%)	Large	Intermediate	Moderate	Moderate (beneficial)	CM1 – CM2, OM1 – OM4	Slight	Slight	Slight (beneficial)
Part 2 – Landscape Character Areas												
LCA1	Rural Open Landscape at Active / Abandoned Agricultural Lands / Fish Ponds	Medium	57 ha	57 ha/ 8.1 ha (14%)	Intermediate	Intermediate	Moderate	Moderate	CM1 – CM2, OM1 – OM4	Slight	Slight	Slight (beneficial)

[1] Detailed description of the other key aspects of the Project contributing to the Magnitude of Impact are provided in the written descriptions of impacts for each LR and LCA
[2] Detailed description of the other key aspects of the Project contributing to LR and LCA sensitivity are provided in the written descriptions of impacts for each LR and LCA
[3] All impacts are adverse unless otherwise stated
[4] Not applicable to LRs outside the Project Site.
[5] Recommended Landscape Mitigation Measures: Refer to Table 11-5A, 11-5B, 11-6

11.11 Visual Impact Assessment

An assessment of the potential significance of the visual impacts during the construction and operation phases, before and after mitigation, is briefly described below, and listed in detail in **Table 11-10**. This follows the methodology outlined above and assumes that the appropriate mitigation measures identified in **Tables 11-8A** and **11-8B** will be implemented, and that the full effect of the soft landscape mitigation measures will be realised after ten years. Photomontages of the proposed development before and after mitigation are illustrated in **Figures 11-34** to **11-41** inclusive.

All impacts are Adverse unless otherwise specified.

11.11.1 Significant of Visual Impacts Before Mitigation during The Construction and Operation Phases

There will be a number of visual impacts during the construction and operation phases. However, these impacts will be confined to areas within the Project Site.

Key issues determining the magnitude of change on existing views will be the proximity of the VSRs to the works, the degree of visibility of the site and changes to the character of the existing views of a largely derelict, open and vegetated rural fringe area with village type developments. Rural fringe features include an agglomeration of visually unrelated structures and landscape elements such as village houses, residential development, utilities, tree clumps, etc. Construction work will introduce artificial construction features such as construction machinery, temporary noise barriers, site clearance, site formation and partially completed buildings, as listed in **Table 11-9.**

- ***R1 – Residents of Fairview Park*** – Existing residents located along the eastern boundary of the development have a High sensitivity from the short distance of 10m and will experience **Large** magnitude of impact during the Construction and Operation stage due to proximity of the Project Site to the east. This will result in **Moderate** visual impacts during Construction and Operation Phases before the implementation of mitigation measures.

- ***R2 – Residents of Palm Springs*** – Existing residents located on the southern edges of this development which face directly towards the Project Site will have a High sensitivity form the short distance of 15m and will experience **Large** magnitude of impact during the Construction and Operation stage due to proximity of the Project Site to the south west. This will result in **Moderate** visual impacts during Construction and Operation Phases before the implementation of mitigation measures.

- ***R3 – Residents of Royal Palms*** – Existing residents located on the southern edges of this development will have a High sensitivity form the distance of 75m and will experience **Intermediate** magnitude of impact during the Construction and Operation stage due to proximity of the Project Site to the south west. This will result in **Moderate** visual impacts during Construction and Operation Phases before the implementation of mitigation measures.

- ***R4 – Residents in Yau Mei San Tsuen*** – Existing residents located on the western side of Yau Mei San Tsuen will have a High sensitivity form the short distance of 10m and will experience **Large** magnitude of impact during the Construction and Operation stage due to proximity of the Project Site to the west.

This will result in **Moderate** visual impacts during Construction and Operation Phases before the implementation of mitigation measures.

- ***R5 – Residents of Chuk Yuen Tsuen, Tai Yuen Villa and Hang Fook Garden*** – Existing residents in the upper floors of houses along the western boundary of these villages will have Medium sensitivity form the distance of 250m and will experience **Small** magnitude of impact during the Construction and become **Negligible** during Operation Phase due to obstruction by the future residential development under Approved Planning Application (A/YL-MP/250) is build. This will result in **Slight** visual impacts during Construction and **Insubstantial** during the Operation Phases before the implementation of mitigation measures.

- ***R6 – Residents of Helene Terrace and Villa Camellia*** – A few number of existing residents in the upper floors of houses along the western boundary of this development will have Medium sensitivity from the distance of 700m and will experience **Small** magnitude of impact during the Construction and become **Negligible** during Operation Phase due to distance and obstruction by the future residential developments under Approved Planning Application (A/YL-MP/250 and A/YL-MP/170 & A/YL-MP/202). This will result in **Slight** visual impacts during Construction and **Insubstantial** during Operation Phases before the implementation of mitigation measures.

- ***R7 – Future Residents under Approved Planning Applications A/YL-MP/205*** – The future residents in properties along the north-eastern boundary of this planned development will be few in number and will experience views from short distances (min. 100m) across Ngau Tam Mei Channel. The receptor sensitivity for this VSR is High and the magnitude of impact is **Intermediate** during Construction and Operation Phases due to the distance of view. This is will result in **Slight** visual impacts during Construction and Operation Phases before the implementation of mitigation measures.

- ***R8 – Future Residents under Planning Applications A/YL-MP/170 &*** A/YL-MP/202 – The future residents in properties along the northern boundary of this planned development will experience views from moderate distances (min.375m) across Ngau Tam Mei Channel. The receptor sensitivity for this VSR is Medium and the magnitude of impact is **Small** during Construction and become **Negligible** during Operation Phase due to obstruction by future development under Planning Application (A/YL-MP/170 & A/YL-MP/202) between the VSRs and the Project Site. This is will result in **Slight** visual impacts during Construction and become **Insubstantial** during Operation Phases before the implementation of mitigation measures.

- ***R9 – Future Residents cum Passive recreational (within REC and R(C) zones) –*** The sensitivity of this VSR is High for future residents in properties on the south- western side of this development which face indirectly towards the Project Site, will experience distant (min.450m) and partially views across comprehensive landscape recreational area of wetland restoration works, site formation works, temporary noise barrier and construction machinery. Other residents further away from the boundary to the very southern part are unlikely to have clear views of the Project. The magnitude of change is **Small** during construction and operation phases, resulting impact significant before mitigation is considered to be **Moderate** during the Construction and Operation Phases.

- ***T1 – Travellers on Yau Pok Road, Kam Pok Road and Proposed Cycle Track***– The sensitivity for this VSR is Low as their attention will be directly engaged in active travelling activity. The magnitude of impact will be **Intermediate** during Construction and Operation Phases, resulting impact significant before mitigation is considered to be **Slight** during the Construction and will be reduced to **Insubstantial** during Operation Phases.

- ***O4 – Workers in Fish Ponds west of the Project Site*** and ***O5 – Workers in Fish Ponds south of Royal Palms*** – The sensitivity of these VSRs are Low for those working in fish ponds west of the Project Site (O4) and those working in fish ponds north-east of the Project Site (O5) due to very few worker in the development. The magnitude of change resulting **Large** due to proximity of view during construction and operation phases, resulting impact significant before mitigation is considered to be **Moderate** during the Construction and Operation Phases.

- ***O6 – Staff at Christian Ministry Institute*** – The sensitivity of this VSR is Low and the magnitude of change to this VSRs will be their relative proximity to the source of impacts as well as the limited availability and amenity of alternative views. This will constitute an **Intermediate** magnitude of change during construction and operation phases, resulting impact significant before mitigation is considered to be **Moderate** during the Construction and Operation Phases.

- ***O7 – Workers in Yau Mei San Tsuen*** – The sensitivity for this VSR is Low. These workers will potentially experience views from close distance. The magnitude of change resulting from construction elements will be **Intermediate** for this VSR. Given the low sensitivity of this VSR and the fact that most views will be of the less visually-intrusive pond restoration/ enhancement works, the impact significant before mitigation is consider to be **Moderate** during construction and operation phase

Unaffected VSRs: All other VSRs inside the Assessment Area (i.e. VSR T2, VSR T3, VSR T4, VSR O1, VSR O2, VSR O3, VSR O8, VSR O9 and VSR C1) are not be affected by the works. The magnitude of change for these VSRs is therefore **Negligible**, and the resulting impact significance is thus **Insubstantial** during the construction and operation phases.

11.11.2 Review of Comments on Landscape and Visual Issues during Continuous Public Involvement (CPI)

During the CPI process, a number of comments related to the design of the Project and to landscape and visual aspects were received. Feedback on landscape and visual aspects was limited to one comment from the residents of Royal Palms, who voiced concerns regarding the proposed ground level and building heights of the development. However, proposed mitigation measures at the construction and operation phases as well as the existing ponds and vegetation between the two developments will largely eliminate any adverse residual impacts to residents of Royal Palms (VSR no. R3).

11.11.3 Visual Mitigation Measures

To minimise impacts on visual resources, a number of measures are proposed to be implemented including consideration of different design options and the provision of mitigation measures to directly offset unavoidable impacts associated with the construction and operation phases. These are discussed further below.

Mitigation measures including strategies for reducing, offsetting and compensating impacts are proposed to be implemented during construction and operation phases. These are identified in **Tables 11-8A** and **11-8B** below and are illustrated in **Figure 11-34 to 11-41.**

The assumption has been made in the assessment that all mitigation proposals in this Report are practical and achievable within the known parameters of funding, implementation, management and maintenance. The suggested agents for the funding and implementation (and subsequent management and maintenance, if applicable) are also indicated in **Tables 11-8A** and **11-8B.**

Table 11- 8A Proposed Visual Enhancement / Mitigation Measures – Construction Phase

ID No.	Visual Mitigation Measures	Funding Agency	Implementation Agency
CM3	The height of temporary noise barrier along development boundary is kept to the minimum required. Temporary Noise Barrier finishes and materials will be re-used from the approved existing temporary noise barrier from Wo Shang Wai project which have an opaque and non-reflective material with colour blending in with the environment to minimize visual impact and to avoid bird strike.	Project proponent	Project proponent (via Contractor)
CM4	Advance screen planting of fast growing large shrub and ground cover species to noise barriers and hoardings.	Project proponent	Project proponent (via Contractor)
CM5	Control of night-time lighting by hooding all lights.	Project proponent	Project proponent (via Contractor)
CM6	Reduction of construction period to practical minimum.	Project proponent	Project proponent (via Contractor)

Table 11-8B Proposed Visual Enhancement / Mitigation Measures – Operation Phase

ID No.	Visual Mitigation Measures	Funding Agency	Implementation Agency	Management Agency	Maintenance Agency
OM5	**Continuous belt of screen planting within the Project Site** Continuous buffer planting along the south-western and southern boundary of the Project Site and along the edge of residential area adjacent to WRA will be provided and planted outside the fence/boundary wall by featuring trees capable of reaching a height >10m within 10 years.	Project Proponent	Project Proponent	Incorporated Owners	Management Company
OM6	Use appropriate (visually unobtrusive and non-reflective) building materials and colours in built structures.	Project proponent	Project proponent	Private Owners	Private Owners
OM7	Streetscape elements (e.g. paving, signage, street furniture, lighting etc.) sensitively designed in a manner that responds to the local context, and minimizes potential negative landscape and visual impacts. Lighting units to be directional and minimizing unnecessary light spill.	Project proponent	Project proponent	Owners Committee	Management Company

11.11.4 Programme of Implementation of Visual Enhancement & Mitigation Measures

The construction phase measures listed in **Table 11-8A** shall be adopted from the commencement of construction and shall be in place throughout the entire construction period. The operation phase measures listed in **Table 11-8B** shall be adopted during the detailed design, and be built as part of the construction works so that they are in place at the date of commissioning of the Project. However, it should be noted that the full effect of the soft landscape mitigation measures will not be realised for several years until planting matures.

Project Funding

A programme for the mitigation measures is provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are identified in **Tables 11-5A, 11-5B, 11-8A** and **11-8B.**

11.11.5 Significance of Residual Visual Impacts during Construction

Proposed visual enhancement / mitigation measures during construction are listed in **Table 11-8A**. Residual visual impacts in the construction phase are mapped in **Figure 11-32**. After all visual mitigation measures are implemented; there will be no adverse residual visual impacts of Substantial significance.

The proposed temporary noise barriers that will be provided along Fairview Park, Yau Mei San Tsuen and Yau Pok Road to mitigate the construction noise from project site (refer to Figure 4-6 in Chapter 4), which will be removed after the completion of construction works This section of temporary noise barrier will be approx. 6m, in height with approx. 108m

in length, 4.5m in height with approx. 249m in length and 3 meters in height with approx. 437m in length respectively. Temporary Noise Barrier finishes will be re-used from the approved existing temporary noise barrier from Wo Shang Wai project which have an opaque and non-reflective material with colour blending in with the environment to minimize visual impact and to avoid bird strike.

During Construction, no VSR will be subject to Substantial residual impacts. Residual visual impacts of *Moderate* significance will be experienced by:

- ***R1 – Residents of Fairview Park*** – Only the residents of approx. 50 properties along the eastern boundary of the development and will potentially experience full views from short distances (min.10m) of erection of temporary noise barrier and hoardings, site formation works, slightly enlargement of wetland restoration works and construction machinery. Other residents further away from the boundary may experience more distant, oblique glimpses of the construction works, although these will be largely obscured by the intervening buildings. There will be 6m high of temporary noise barrier and 3m high hoarding provided facing adjacent houses (about 26nos) will be re-used from the approved existing temporary noise barrier from Wo Shang Wai project which have an opaque and non-reflective material with colour blending in with the environment (CM3). Change from existing open views in the foreground with rural fringe features including village housing and open storage in the middle distance to relatively close views of construction elements will constitute a *Large* magnitude of change, resulting ***Moderate*** residual impacts from affected VSR within this group. Residents in properties further away from the boundary will be unaffected.

- ***R2 – Residents of Palm Springs*** – Residents in properties Palm Springs (approx. 50 properties on Cypress Drive) on the southern edges of this development which face directly towards the Project Site will experience full views from short distances (min.15m) of erection of site hoardings, site clearance and formation works, construction machinery, slightly enlargement of wetland restoration works and partially completed 3-storey structures. Other residents further away from the boundary may experience more distant, oblique glimpses of the construction works, although these will be largely obscured by the intervening buildings. There will be 3m high hoarding provided facing adjacent houses (about 40nos). Changes will result from existing open views in the foreground with rural fringe features including village houses/temporary structures, storage facilities, utilities, tree clumps in the middle distance of the landscape amenity feature which will create a *Large* magnitude of change, resulting ***Moderate*** residual impacts on this VSR.

- ***R3 – Residents of Royal Palms*** – Residents in properties Royal Palms (approx. 50 properties) on the southern edges of this development which face moderate distance (min.75m) of erection of site hoardings, site clearance and formation works, construction machinery, slightly enlargement of wetland restoration works and partially completed 3-storey structures. Key issues affecting visual impacts include the panoramic quality of the existing views in which the Project Site is only one element as well as intervening rural fringe features such as fish ponds, abandoned farmland, temporary structures and tree clumps in the middle distance of the landscape amenity feature. The magnitude of change will create an *Intermediate* magnitude of change, resulting ***Moderate*** residual impacts on this VSR.

- ***R4 – Residents in Yau Mei San Tsuen*** – Residents on the western side of Yau Mei San Tsuen and will experience direct (min. 0m) views of erection of site hoardings, site formation works, slightly enlargement of wetland restoration works, construction machinery and partially completed retaining walls and 3-storey structures. The views from these VSRs will be only partly screened by the existing belt of trees at the edge of

the existing Area 40, and some views are unscreened. Most residents will experience some views of construction traffic near the entrance to the Project Site. To the extent that the Project Site is currently visible through intervening rural fringe features such as fish ponds, commercial farmland and temporary structure and given the fact that most views will be of the less visually-intrusive pond restoration/ enhancement works, the magnitude of change resulting from construction elements will be *Large* for this VSR, resulting in ***Moderate*** residual impacts.

During Construction, residual visual impacts of *Slight* significance will be experienced by the following VSRs after mitigation:

- ***R5 – Residents of Chuk Yuen Tsuen, Tai Yuen Villa and Hang Fook Garden*** – Residents in the upper floors of houses along the western boundary of this village will potentially experience views from a moderate distance (min.250m) of erection of temporary site hoarding, site clearance and formation works, construction machinery and partially completed 3-storey buildings. There are no views of the Project Site from the temple or ground floor flats located on the village due to intervening vegetation and existing buildings. The Project Site is currently visible through intervening rural fringe features such as commercial farmland and temporary structures, the magnitude of change resulting from construction elements will be *Small* for this VSR. Residual impacts after implementation of visual mitigation measures will be ***Slight.***

- ***R6 – Residents of Helene Terrace and Villa Camellia*** – Residents in the upper floors of houses along the western boundary of this development will experience views from moderate distances (min.700m) across Ngau Tam Mei Channel of site hoarding erection, site clearance and formation works, construction machinery and partially completed 3-storey buildings. The views will be limited to the upper floors once the future development within Future Residents under Planning Applications A/YL-MP/170 & A/YL-MP/202 takes place. There are no views of the Project Site from the temple or ground floor flats located on the village due to intervening vegetation and existing buildings. Changes from existing views of the vacant Project site in the foreground Future Residents under Planning Applications A/YL-MP/170 & A/YL-MP/202, to relatively close views of construction elements will constitute a *Small* magnitude of change, resulting in ***Slight*** residual impacts.

- ***R7 – Future Residents under Approved Planning Applications A/YL-MP/205*** – Future residents in properties along the north-eastern boundary of this planned development will experience views from short distances (min. 100m) across Ngau Tam Mei Channel of site hoarding erection, site clearance and formation works, construction machinery and partially completed 3-storey buildings. Other residents further away from the boundary are unlikely to have clear views of the Project. Changes from existing views of the vacant Project site in the foreground with the Palm Springs behind, to relatively close views of construction elements will constitute an *Intermediate* magnitude of change, resulting in ***Slight*** residual impacts.

- ***R8 – Future Residents under Planning Applications A/YL-MP/170*** & A/YL-MP/202 – Future residents in properties along the northern boundary of this planned development will experience views from moderate distances (min. 375m) across Ngau Tam Mei Channel of site hoarding erection, site clearance and formation works, construction machinery and partially completed 3-storey buildings. Other residents further away from the boundary are unlikely to have clear views of the Project. Future residents in the "Residential (Group D) zone will be somewhat closer (min. 375m), but will be partly blocked by the intervening pumping station. The magnitude of change resulting from construction elements will be *Small*, resulting in ***Slight*** residual impacts.

■ ***R9 – Future Residents cum Passive recreational (within REC and R(C) zones)*** – Future residents in properties on the south-western side of this development which face indirectly towards the Project Site, will experience distant (min.450m) and partially views across comprehensive landscape recreational area of wetland restoration works, site formation works, temporary noise barrier, construction machinery and partially completed 3-storey structures. Other residents further away from the boundary to the very southern part are unlikely to have clear views of the Project. Construction work will constitute a *Small* magnitude of change to the existing views by introducing artificial construction features into them. The result will be a change in the visual character of these views from views across a mixed rural open landscape of farmland, fish ponds and temporary structures, to views which include earthworks, partially completed structures and construction machinery. Residual impacts after implementation of mitigation including treatment of noise barrier and buffer planting along the site perimeter will be ***Slight.***

■ ***T1 – Travellers on Yau Pok Road, Kam Pok Road and Proposed Cycle Track***– Motorists on these roads will experience visual impacts of Large magnitude due to their close proximity to the source of impacts. They will experience direct (min. 10m) and uninterrupted views of construction traffic, temporary noise barriers (about 3m high), site hoarding (about 3m high), site formation works, construction of the entrance road and partially complete structures close to the entrance of the Project Site, which will not be significantly interrupted by any intervening new mitigation planting of the proposed cycle track. There will be 6m high of temporary noise barrier provided facing adjacent Yau Pok Road will be re-used from the approved existing temporary noise barrier from Wo Shang Wai project which have an opaque and non-reflective material with colour blending in with the environment (CM3). Despite the visual impact being of *Intermediate* magnitude, the fact that motorists are travelling parallel to the Project Site rather than towards it, the relatively low traffic levels, the comparatively low sensitivity of travelling VSRs generally and the transient nature of views, resulting in ***Slight*** residual impacts.

■ ***O4 – Workers in Fish Ponds west of the Project Site*** and ***O5 – Workers in Fish Ponds south of Royal Palms*** – Those working in fish ponds west of the Project Site (O4) and those working in fish ponds north-east of the Project Site (O5) will experience close (min. 0m) views across fish ponds of site formation works, site hoardings, construction machinery and partially completed structures. To the extent that the Project Site is currently visible through intervening rural fringe features such as fish ponds, site hoarding and temporary structures. Although lower parts of the works will be hidden behind approx. 3m high screen hoardings, this will nonetheless constitute a *Large* magnitude of change for this VSR group. Given the low sensitivity of these VSRs and the fact that most views will be of the less visual-intrusive pond creation works, the residual impact significant resulting from construction elements after mitigation will be ***Slight.***

■ ***O6 – Staff at Christian Ministry Institute*** – Staff and visitors to the Christian ministry Institute may experience broken, close (min. 150m) views across intervening fencing and vegetation of site hoardings, noise barrier, construction machinery and partially completed structures. Key issues determining the magnitude of change to these VSRs will be their relative proximity to the source of impacts and the relatively *low* sensitivity of these VSRs as well as the limited availability and amenity of alternative views. This will constitute an *Intermediate* magnitude of change, resulting residual impacts on this very small VSR group during the construction phase will be ***Slight.***

During Construction, residual visual impacts after mitigation for all other VSRs will be ***Insubstantial***.

11.11.6 Significance of Residual Visual Impacts during Operation

Proposed visual enhancement / mitigation measures during operation are listed in **Table 11-8B**. Residual visual impacts during the operation phase are mapped in **Figure 11-33**.

At Day 1 of operation, mitigation planting will still be relatively small and there will be visual impacts on a number of VSRs. With the maturing of landscape planting and screening trees, residual impacts will tend to diminish further by Year 10 of operation.

There will be no Substantial residual visual impacts during operation. Residual visual impacts of ***Moderate*** significance will be experienced by three VSRs group at Day 1 after mitigation, reducing to ***Slight Beneficial*** after Year 10:

- ***R1 and R2– Residents in Fairview Park, Palm Springs*** – Residents with views towards the Project Site in upper floors of buildings in Fairview Park (approx. 26 properties at the eastern end of Lychee Road East), Palm Springs (approx. 50 properties on Cypress Drive) will potentially experience views from short distances (min. 10m from Fairview Park and 15m from Palm Springs) of new mitigation planting and wetland restoration, as well as newly completed 3-storey houses beyond. Minimum house-to-house distances will be approximately 35m from Fairview Park and 130m from Palm Springs. Other residents of these developments may experience more distant, oblique views of 3-storey houses. The majority of the residents of Fairview Park and Palm Springs do not live close to the boundary with the Project Site and will experience little or no impact on their views, due to the effects of distance, intervening buildings and existing and new tree planting. Other affected residents will include users of peripheral roads in Fairview Park and Palm Springs; as well as residents using the footpath along the boundary of Palm Springs, although these VSRs are more transitory in nature.

  The Project will constitute a large magnitude of change to the existing views by introducing artificial built features into them. The views of many of these VSRs will be partly screened by the existing belt of vegetation as well as the newly restored wetland which runs along most of the boundary. Views at low level will further be partly screened by a row of approximately 4m high (when first planted) tree screen mitigation planting along most of the residential boundary. For VSRs at higher elevations, to the extent that the Project Site may be currently visible at present through the existing belts of trees, views of new 3-storey buildings will replace open views across the Project Site. The result will be a change in the visual character of these views from views across a mixed rural open landscape of farmland, fish ponds and temporary structures, to views which include new mitigation planting, newly restored wetland, completed 3-storey houses and retaining walls. At night, residential lighting and street lighting is unlikely to be very visible through vegetation. In any case, this will not represent a significant change to the night-time character of the wider landscape which is already characterised by night-time lights from various sources (highways, residential, etc). To the extent that the Project Site is currently visible through existing trees, resulting impacts on this VSR group will be ***Moderate*** at day 1 of operation but will tend to diminish as mitigation planting matures. As mitigation and amenity landscaping matures and buffer trees along the boundary grow to form an effective visual screen, residual impacts will be a ***Slight Beneficial*** visual gain for this visual zone.

- ***T1 – Travellers on Yau Pok Road, Kam Pok Road and Bridges across Ngau Tam Mei Channel*** – Motorists on these roads will experience visual impacts of a Large magnitude due to their close (min. 0m) proximity to the source of impacts and the level of change from the open, undeveloped quality of the existing views. They will experience views newly completed road infrastructure and 3-storey buildings, as well as increased traffic close to the entrance of the Project Site. The fact that for the most part, motorists are travelling perpendicular to the Project Site (rather than towards it), combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, the intervening mitigation planting of the proposed cycle track and the transient nature of views will mean that visual impacts on this VSR group will be ***Moderate*** at day 1 of operation, and residual impact will be ***Slight Beneficial*** after year 10 of operation, and will tend to diminish further over time.

At Day 1 of Operation, when mitigation planting is not yet mature, residual visual impacts of *Slight* significance will be experienced by the VSRs within this group after mitigation. This will reduce to *Insubstantial* after Year 10 as buffer and landscape planting matures:-

- ***R3 – Residents in Royal Palms*** – Residents in properties on the southern edges of this development which face directly towards the Project Site will experience partial views (min. 75m) between site boundaries, or about 180m house-to-house) of the completed Project, including newly restored wetland and completed 3-storey buildings beyond, across low-lying open land with ponds and intervening trees and shrubs. Key issues determining the magnitude of change to these VSRs will be their moderate distance from the source of impacts, the limited availability of alternative views for the affected residents, the quality of many views within which several features are observed in the foreground of the Project Site and changes to the rural fringe character of existing views. Rural fringe features include an agglomeration of visually unrelated structures and landscape elements such as village houses, temporary structures, plant nurseries, utilities, tree clumps, etc. There would be ***Slight*** residual impacts on these affected VSRs within this group at day 1 of operation. As amenity landscaping and landscape pond matures, and buffer trees along the boundary grow, there would be a ***Slight Beneficial*** visual gain for this visual zone after Year 10.

- ***R4 – Residents in Yau Mei San Tsuen*** – With the removal of the noise barrier and site hoardings, residents on the south-western side of Yau Mei San Tsuen will experience what are close (min. 0m), uninterrupted views of immature mitigation planting at the periphery of the wetland and partial views of completed 3-storey structures beyond. Key issues determining the magnitude of change to the existing views will be the relative proximity of these VSRs, the limited availability of alternative views and changes to the character of existing views comprising a wide variety of rural fringe features. Rural fringe features include an agglomeration of visually unrelated structures and landscape elements such as open pond, village houses, industrial and storage facilities, utilities, tree clumps etc. Residents may also experience views of increased traffic near the entrance to the Site. This will constitute an Intermediate magnitude of change to the existing views by introducing artificial built elements into them. Resulting impacts on this VSR group will be ***Slight*** at day 1 of operation, but will tend to diminish over time as mitigation planting around the amenity wetland matures and residual impact will be ***Slight Beneficial*** after year 10 of operation.

- **R7 – Future Residents under Approved Planning Applications A/YL-MP/205** – Residents in properties on the north-eastern side of this planned development which face directly towards the Project Site, will experience a minimum distance of approximately 100m across the intervening bunds and vegetation of Ngau Tam Mei Channel. Key issues determining the magnitude of change for this VSR include the

relatively short distance from the source of impacts, the panoramic quality of many views (a broad, expansive view within which several, distant features are observed and where the Project Site is only one element) and changes to the rural fringe character of existing views. Rural fringe features include an agglomeration of visually unrelated structures and landscape elements such as village houses, residential development, utilities, tree clumps etc. Lower parts of the Project will be in part hidden behind existing intervening planting and new mitigation planting outside the site boundary along the proposed cycle track. The existing developments of Fairview Park and Palm Springs are already visible in these views and this will tend to reduce the significance of impacts further. This will resulting in ***Slight*** residual impacts on Day 1 Operation after mitigation and gradually reduces to ***Slight Beneficial*** after Year 10.

- ***R9 – Future Residents cum Passive recreational (within REC and R(C) zones) –*** Future residents in the southern portions of this development on higher floor will experience a 'glimpse view' (min.450m) with a comprehensive landscape area on the foreground in the northern portion with the Project Site directly behind, to relatively close views of the completed project will constitute an small magnitude of change. This will resulting in ***Slight*** residual impacts on Day 1 Operation after mitigation and gradually reduces to ***Slight Beneficial*** after Year 10.

- ***C2 – Users of Proposed Cycle Track at Yau Pok Road*** – With the removal of the noise barrier and site hoardings, users of the cycle track at this portion of Yau Pok Road will experience what are close (min. 5m), uninterrupted views of new mitigation planting along the wetland and outside the Project Site along the cycle track, and partial views of completed 3-storey structures at the far side of the amenity wetland. Key issues determining the magnitude of change to the existing views will be the relative proximity of these VSRs, the availability of alternative views along other sections of the track and changes to the character of existing views comprising a wide variety of rural fringe features. Rural fringe features include an agglomeration of visually unrelated structures and landscape elements such as open ponds, village houses, industrial and storage facilities, utilities, tree clumps etc. Cyclists and pedestrians on the new cycle track will also experience some views of increased traffic near the entrance to the Project Site. This will constitute an Intermediate magnitude of change to the existing views by introducing artificial built elements into them. Resulting impacts on this VSR group will be ***Slight*** at day 1 of operation and will tend to diminish further over time as proposed screen planting outside the development matures and residual impact will be ***Slight Beneficial*** after Year 10.

  At Day 1 of Operation, when mitigation planting is not yet mature, residual visual impacts of ***Slight*** significance will be experienced by the VSRs within this group after mitigation, reducing to ***Insubstantial*** after Year 10 as buffer and landscape planting matures:-

- ***O4 – Workers in Fish Ponds west of the Project Site*** – Those working in fish ponds west of the Project Site will experience close (min. 0m) views across fish ponds of newly restored wetland and new mitigation planting in the foreground, and completed 3-storey houses beyond. Key issues determining the magnitude of change to these VSRs will be their relative proximity to the source of impacts, the panoramic quality of many views (a broad, expansive view within which several, distant features are observed and where the Project is only one element) and changes to the rural fringe character of existing views. Rural fringe features include an agglomeration of visually unrelated structures and landscape elements such as village houses, residential development, utilities, tree clumps etc. Although parts of the Project Site will be hidden behind new mitigation and wetland planting, this will nonetheless constitute a Large magnitude of

change to the existing views, by introducing artificial built elements into the middle distance thereof. The existing developments of Fairview Park and Palm Springs are already visible in these views and this will tend to reduce the significance of impacts to some extent. Resulting in ***Slight*** residual impacts on Day 1 Operation after mitigation and gradually reduces to ***Insubstantial*** after Year 10.

- ***O5 – Workers in Fish Ponds south of Royal Palms*** – Those working in fish ponds north-east of the Project Site may experience broken, close (min. 0m) views across intervening fish ponds and vegetation of newly restored wetland and new mitigation planting in the foreground and completed 3-storey houses beyond. Key issues determining the magnitude of change to these VSRs will be their relative proximity to the Project Site and the availability of alternative views to the west as well as the relatively low sensitivity of these VSRs. Given the fact that the largely open views will be replaced by views of development, this will nevertheless constitute a Large magnitude of change to the existing views. Residual impacts on this very small VSR group will be ***Slight*** at day 1 of operation, decreasing with time as mitigation and wetland planting matures and residual impact will be ***Insubstantial*** after Year 10.

- ***O6 – Staff at Christian Ministry Institute*** – Staff and visitors to the Christian Ministry Institute may experience broken, relatively close (min. 150m) views across intervening fencing and vegetation of new mitigation planting, with completed 3-storey buildings beyond. This will constitute an Intermediate magnitude of change to the existing views, by introducing built features and new planting into the foreground. Key issues determining the magnitude of change to these VSRs will be their relative proximity to the source of impacts, offset by the relatively low sensitivity of these VSRs. Impacts on this very small VSR group will be ***Slight*** at day 1 of operations, decreasing further as mitigation planting matures over time and gradually reduces to ***Insubstantial*** after Year 10

All other residual visual impacts experienced by concerned VSRs after mitigation at Day 1 of Operation and after Year 10 of Operation will be ***Insubstantial***.

Table 11-9 Magnitude of Change in Views for VSRs

ID No.	Visually Sensitive Receiver	Compatibility of Project with Surroundings (High, Medium, Low)	Scale of Development (Large, Medium, Small)	Reversibility of Change (Yes, No)	Minimum Viewing Distance (Metres)	Blockage of View (Small, Partial, Major)	Duration of Impacts (Short, Long)		Magnitude of Change (Negligible, Small, Intermediate, Large)	
							Construction	Operation	Construction	Operation
R1	Residents in Fairview Park	High	Large	Yes	10	Partial	Short	Long	Large	Large
R2	Residents in Palm Springs	High	Large	Yes	15	Partial	Short	Long	Large	Large
R3	Residents in Royal Palms	High	Large	Yes	75	Small	Short	Long	Intermediate	Intermediate
R4	Residents in Yau Mei San Tsuen	High	Medium	Yes	0	Partial	Short	Long	Large	Large
R5	Residents in Chuk Yuen Tsuen, Tai Yen Villa and Hang Fook Garden	High	Medium	Yes	250	Small	Short	Long	Small	Negligible
R6	Residents in Helene Terrace, Villa Camellia and Ha San Wai	High	Medium	Yes	700	Small	Short	Long	Small	Negligible
R7	Future Residents under Planning Applications A/YL-MP/205	High	Large	Yes	100	Small	Short	Long	Intermediate	Intermediate
R8	Future Residents under Planning Applications A/YL-MP/170 & A/YL-MP/202	High	Large	Yes	375	Small	Short	Long	Small	Negligible
R9	Future Residents cum Passive Recreational (within REC Zone and R(c) zone)	High	Large	Yes	450	Small	Short	Long	Small	Small
T1	Travellers on Yau Pok Road, Kam Pok Road and Bridges across Ngau Tam Mei Channel	Medium	Small	Yes	0	Major	Short	Long	Large	Large
T2	Travellers on Castle Peak Road	Medium	Small	Yes	200	Small	Short	Long	Negligible	Negligible
T3	Travellers on San Tin Highway	Medium	Small	Yes	250	Small	Short	Long	Negligible	Negligible
T4	Pedestrians on San Tin	Medium	Small	Yes	350	Small	Short	Long	Small	Negligible

ID No.	Visually Sensitive Receiver	Compatibility of Project with Surroundings (High, Medium, Low)	Scale of Development (Large, Medium, Small)	Reversibility of Change (Yes, No)	Minimum Viewing Distance (Metres)	Blockage of View (Small, Partial, Major)	Duration of Impacts (Short, Long)		Magnitude of Change (Negligible, Small, Intermediate, Large)	
							Construction	Operation	Construction	Operation
	Highway Footbridges									
O1	Workers at Fairview Park Petrol Station	Medium	Small	Yes	750	Small	Short	Long	Negligible	Negligible
O2	Staff and Pupils at Bethel High School	Medium	Small	Yes	500	Small	Short	Long	Negligible	Negligible
O3	Workers at Chuk Yuen Floodwater Pumping Station	Medium	Small	Yes	350	Partial	Short	Long	Negligible	Negligible
O4	Workers in Fish Ponds West of the Project Site	Medium	Small	Yes	0	Partial	Short	Long	Large	Large
05	Workers in Fish Ponds south of Royal Palms	Medium	Small	Yes	0	Major	Short	Long	Large	Large
O6	Staff at Christian Ministry Institute	Medium	Small	Yes	150	Partial	Short	Long	Intermediate	Intermediate
O7	Workers in Yau Mei San Tsuen	Medium	Small	Yes	150	Partial	Short	Long	Intermediate	Intermediate
O8	Workers in Storage Areas South of Chuk Yuen Tsuen	Medium	Small	Yes	450	Small	Short	Long	Negligible	Negligible
O9	Staff and Pupils at Wong Chan Sook Ying Memorial School and Commercial Premises	Medium	Small	Yes	750	Small	Short	Long	Negligible	Negligible
C1	Visitors to Mai Po Nature Reserve	Medium	Small	Yes	1,750	Small	Short	Long	Negligible	Negligible

Table 11-10 Significance of Visual Impacts in Construction and Operational Phases

VSR Type & ID	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, Partial, Glimpse) & Min Distance Between VSR & Nearest Source(s) of Impact [1]		Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large) [1]		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many) [2]		Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial) [3]		Recommended Mitigation Measures	Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial) [3]		
											Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
Residential VSRs													
R1	Residents in Fairview Park	Full 10m	Full 10m	Large	Large	High Few	High Few	Moderate	Moderate	CM3 – CM6, OM2 – OM3, OM5 - OM7	Moderate	Moderate	Slight positive
R2	Residents in Palm Springs	Full 15m	Full 15m	Large	Large	High Few	High Few	Moderate	Moderate	CM3 – CM6, OM2 – OM3, OM5 - OM7	Moderate	Moderate	Slight Positive
R3	Residents in Royal Palms	Partial 75m	Partial 75m	Intermediate	Intermediate	High Few	High Few	Moderate	Moderate	CM3 – CM6, OM2 – OM3, OM5 - OM7	Moderate	Slight	Slight positive
R4	Residents in Yau Mei San Tsuen	Full 0m	Full 0m	Large	Large	High Very Few	High Very Few	Moderate	Moderate	CM1, CM3 – CM6, OM1 – OM2, OM5 - OM7	Moderate	Slight	Slight positive
R5	Residents in Chuk Yuen Tsuen, Tai Yuen Villa and Hang Fook Garden	Partial 250m	Partial 250m	Small	Negligible	Medium Few	Medium Few	Moderate	Moderate	CM3 – CM6, OM5 - OM7	Slight	Insubstantial	Insubstantial
R6	Residents in Helene Terrace, Villa Camellia and Ha San Wai	Partial 700m	Partial 700m	Small	Negligible	Medium Few	Medium Few	Moderate	Slight	CM3 – CM6, OM5 - OM77	Slight	Insubstantial	Insubstantial

VSR Type & ID	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, Partial, Glimpse) & Min Distance Between VSR & Nearest Source(s) of Impact [1]		Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large) [1]		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many) [2]		Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial) [3]		Recommended Mitigation Measures	Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial) [3]		
											Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
R7	Future Residents under Approved Planning Applications A/YL-MP/205	Full 100m	Full 100m	Intermediate	Intermediate	High Few	High Few	Moderate	Moderate	CM1, CM3 – CM6, OM1 – OM2, OM5 - OM7	Slight	Slight	Slight positive
R8	Future Residents under Planning Applications A/YL-MP/170 & A/YL-MP/202	Partial 375m	Partial 375m	Small	Negligible	Medium Few	Medium Few	Moderate	Slight	CM3 – CM6, OM5 - OM7	Slight	Insubstantial	Insubstantial
R9	Future Residents cum Passive Recreational (within REC Zone and R(c) zone)	Glimpse 450m	Glimpse 450m	Small	Small	High Few	High Few	Moderate	Moderate	CM1, CM3 – CM6, OM1 – OM2, OM5 - OM7	Slight	Slight	Slight positive
Travelling VSRs													
T1	Travellers on Yau Pok Road, Kam Pok Road and Bridges across Ngau Tam Mei Channel	Full 0m	Full 0m	Large	Large	High Few	High Few	Moderate	Moderate	CM1, CM3 – CM6, OM1 – OM2, OM5 - OM7	Moderate	Moderate	Slight positive
T2	Travellers on Castle Peak Road	Glimpse 200m	Glimpse 200m	Negligible	Negligible	Low Many	Low Many	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial

VSR Type & ID	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, Partial, Glimpse) & Min Distance Between VSR & Nearest Source(s) of Impact [1]		Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large) [1]		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many) [2]		Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial) [3]		Recommended Mitigation Measures	Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial) [3]		
											Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
T3	Travellers on San Tin Highway and Fairview Park Boulevard	Glimpse 250m	Glimpse 250m	Negligible	Negligible	Low Very Many	Low Very Many	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial
T4	Pedestrians on San Tin Highway Footbridges	Partial 350m	Partial 350m	Negligible	Negligible	Medium Very Few	Medium Very Few	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial
Occupational VSRs													
O1	Workers at Fairview Park Petrol Station	Glimpse 750m	Glimpse 750m	Negligible	Negligible	Low Very few	Low Very few	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial
O2	Staff and Pupils at Bethel High School	Glimpse 500m	Glimpse 500m	Negligible	Negligible	Low Few	Low Few	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial
O3	Workers at Pumping Station at Ngau Tam Mei Channel	Partial 350m	Partial 350m	Negligible	Negligible	Low Very few	Low Very few	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial
O4	Workers in Fish Ponds west of the Project Site	Full 0m	Full 0m	Large	Large	Low Very few	Low Very few	Moderate	Moderate	CM3 – CM6, OM5 - OM7	Slight	Slight	Insubstantial
O5	Workers in Fish Ponds south of Royal Palms	Full 0m	Full 0m	Large	Large	Low Very few	Low Very few	Moderate	Moderate	CM3 – CM6, OM5 - OM7	Slight	Slight	Insubstantial

VSR Type & ID	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, Partial, Glimpse) & Min Distance Between VSR & Nearest Source(s) of Impact [1]		Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large) [1]		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many) [2]		Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial) [3]		Recommended Mitigation Measures	Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial) [3]		
											Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
O6	Staff at Christian Ministry Institute	Partial 150m	Partial 150m	Intermediate	Intermediate	Low Very few	Low Very few	Moderate	Moderate	CM3 – CM6, OM5 - OM7	Slight	Slight	Insubstantial
O7	Workers in Yau Mei San Tsuen	Partial 150m	Partial 150m	Intermediate	Intermediate	Low Very few	Low Very few	Moderate	Moderate	CM3 – CM6, OM5 - OM7	Insubstantial	Insubstantial	Insubstantial
O8	Workers in Storage Areas south of Chuk Yuen Tsuen	Partial 450m	Partial 450m	Negligible	Negligible	Low Very few	Low Very few	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial
O9	Staff and Pupils at Wong Chan Sook Ying Memorial School and Commercial Premises	Partial 750m	Partial 750m	Negligible	Negligible	Low Very few	Low Very few	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial
Recreational VSRs													
C1	Visitors to Mai Po Nature Reserve	Partial 1,750m	Partial 1,750m	Negligible	Negligible	High Few	High Few	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial

[1] Detailed description of the other key aspects of the project contributing to the Magnitude of Impact are provided in the written descriptions of impacts for each VSR
[2] Detailed description of the other key aspects of the project contributing to VSR sensitivity are provided in the written descriptions of impacts for each VSR
[3] All impacts are negative unless otherwise stated

11.12 Summary of Landscape and Visual Assessment

The detailed landscape and visual assessment above is briefly summarised below:

11.12.1 Summary of Landscape and Visual Impacts during Construction

Residual landscape impacts in the Construction Phase are listed in **Table 11-9** and mapped in **Figures 11-28** and **11-30**. Residual visual impacts in the Construction Phase are listed in **Table 11-10** and mapped in **Figure 11-32**.

During the construction phase, there will *Slight* residual impacts experienced within Project Site by **LR.4A** (Agricultural Fields); **LR.6A** (Grassland/shrubland); **LR.7A** (Pond and Pond Edge); **LR.8A** (Marsh/ Reedbed) and **LCA1** (Rural Open Landscape at Active/ Abandoned Agricultural Lands/ Fish Ponds).

Potentially the most significant visual impacts during the construction phase will be *Moderate* impacts on **R1** – Residents in Fairview Park; **R2** – Residents in Palm Spring; **R3 –** Residents in Royal Palms; **R4** – Residents in Yau Mei San Tsuen.

In addition, there will be impacts of *Slight* significance on **R5**– Residents in Chuk Yuen Tsuen, Tai Yuen Villa and Hang Fook Garden; **R6**– Residents of Helene Terrace, Villa Camellia and Ha San Wai; **R7** – Future Residents under Planning Applications A/YL-MP/205; **R8** – Future Residents under Planning Applications A/YL-MP/170 & A/YL-MP/202; **R9** – Future Residents cum Passive Recreational (within REC Zone and R(c) Zone); **T4** – Pedestrian on San Tin Highway Footbridge; **O4** – Workers in Fish Ponds west of the Project Site; **O5** – Workers in Fish Ponds south of Royal Palms and **O6** – Staff at Christian Ministry Institute.

All other visual impacts will be *Insubstantial*.

11.12.2 Summary of Landscape and Visual Impacts during Operation

Residual landscape impacts in the Operation Phase are listed in **Table 11-9** and mapped in **Figures 11-29** and **11-31**. Residual visual impacts in the Operation Phase are listed in **Table 11-10** and mapped in **Figure 11-33**.

There will be no adverse landscape impacts on landscape resources during the operation phase. In fact, the Project will result in the net gain of trees (including mitigation and compensation planting) and a substantial landscape pond area. Impacts on landscape resources will therefore be *Slight Positive* for **LR.4A** (Agricultural Fields), **LR.6A** (Grassland/shrubland), **LR.7A** (Pond and Pond Edge), **LR.8A** (Marsh/ Reedbed). Impact on **LCA1** (Rural Open Landscape at Active/ Abandoned Agricultural Lands/ Fish Ponds) will also be *Slight Positive* due to enhancement of the existing degraded landscape character.

Residual visual impacts after year 10 of operation on almost all receivers will be Insubstantial. For more distant VSRs, this will be because their oblique or distant views of the Projects will be largely screened by a belt of trees or because the Project will appear generally in keeping with the existing residential character of existing views and will not represent a significant change to their character. There will be *Slight positive* adverse visual impacts on a small number of VSRs within **R1–** Residents in Fairview Park; **R2–** Residents in Palm Spings; **R3 –** Residents in Royal Palms; **R4–** Residents in Yau Mei San Tsuen; **R7** – Future Residents under Planning Applications A/YL-MP/205; **R9** – Future Residents cum Passive Recreational (within REC Zone and R(c) Zone); **T1–** Motorist on Yau Pok Road, Kam Pok Road and Bridges across Ngau Tam Mei Channel; and **C2–** Residents in Fairview Park; who look directly onto the site from close proximity.

11.13 Conclusion

In accordance with the criteria and guidelines for evaluating and assessing impacts as state in Annex 10, Clause 1.1(c) of the EIAO-TM, Overall, it is considered that the residual landscape and visual impacts of the proposed development are **acceptable with mitigation** during the construction and operation phases: "*there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures*".

The landscaped pond area, landscape facilities, substantial new tree planting and the coherent development of the currently derelict site will result in a *Slight Positive* impact on the landscape resources within the Project Site, once operational and when mitigation planting has had time to mature. The overall conclusion is therefore that the landscape and visual impacts are acceptable and may contribute a small landscape / visual enhancement effect to the neighbourhood with the implementation of mitigation and landscape improvement measures as detailed above.

12. SUMMARY OF ENVIRONMENTAL OUTCOMES

12.1 Air Quality

Through implementation of dust control measures required under the Air Pollution Control (Construction Dust) Regulation, and recommended specific measures in the EIA report, and good housekeeping practice by the works contractors, short-term construction dust impacts can be controlled to acceptable levels. Practical mitigation measures have already been proposed for this Project to alleviate potential impacts. The concerned site formation works will only be short-term and potential air quality impacts have been reduced to a minimal through recommended mitigation measures and can comply with the relevant air quality criteria/ AQOs. Thus, no adverse construction dust impact is anticipated.

Appropriate precautionary measures (e.g. peripheral setback from the site boundaries) have been incorporated in the Site plan that can satisfy the buffer distance requirements stated in the HKPSG, thus no unacceptable air quality impact upon the development is expected due to vehicular emission. No unacceptable air quality impact due to industrial emissions is expected as no industrial emission source has been identified within 500m from the Project boundary.

There is no major planned dust generating or air pollutant emission source from the proposed development that would contribute to any adverse impact on air quality. Vehicular emissions due to additional traffic generated/ attracted by this Project is found to be insignificant and negligible, thus this Project will not attribute to any deterioration on air quality. During the operational phase, a licensed waste collector will be employed to collect domestic waste on daily basis and Refuse collection points (RCP) will be provided for the residential development. Thus, no adverse odour impact is anticipated.

During the operational stage, an interim sewage treatment plant is proposed within the Project Site before connection to the public sewerage system becomes available. The interim sewage treatment plant comprising a combination of membrane bioreactor system and reverse osmosis system will be located underground within a totally enclosed building. The exhaust will be directed away from nearby ASRs. Environmental conscious design of an effective odour removal system at the exhaust of the STP (with an odour removal efficiency of not less than 99.5%), is proposed. With these measures in place, there will be no adverse odour impact as a result of the STP.

12.2 Noise

The Noise Control Ordinance will be complied throughout the Project. The predicted traffic noise impacts on the proposed development will fully comply with the noise criterion.

12.3 Water Quality

The major impacts during construction of the Project will be surface runoff and soil erosion associated with exposed surfaces. Standard best practices as well as site specific measures have been recommended in order to avoid and minimise potential impacts. Peripheral site drainage system comprising precast concrete u-channels, sedimentation basins, sand traps and similar facilities together with those good site practices stipulated in ProPECC Note PN 1/94, have been recommended. Construction site runoff will be collected. and treated effluent will be discharged into the NTMDC following the existing flow regime. By adopting good site management practices and proposed mitigation measures, adverse water quality impact is not expected. The Contractor will be required to apply for a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence.

During the operation of the Project, sewage generated will be discharge to the planned public sewerage system under the permanent sewage disposal scheme, thus there will be no adverse water quality impact. An interim STP will be provided for treatment of sewage generated from the proposed development site until the public sewerage system becomes available. The STP has been designed in such a way to comply with the no net increase in pollution loading requirement in Deep Bay. The effluent discharge issue has been addressed in Chapter 6 of the EIA report. The discharge from the STP is also subject to a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence as well as the conditions specified in the Environmental Permit of this Project.

Surface runoff from the development site will be discharged to the NTMDC. Pollutants, if any, will be pre-treated and settled before discharge. It was estimated that the increase in surface runoff due to this Project is negligible when compared with the design capacity of the NTMDC. Best Management Practices have been proposed in order to abate first flush pollution in stormwater runoff such as design measures to minimise soil erosion; minimizing paved area; proper managed landscape area; proper site drainage design/control; provision of devices/ facilities to control pollution and to remove pollution source; minimizing the use of fertilizers; and administrative measures for maintenance issues. Screening facilities such as gully grating, trash frille, and road gullies with silt traps and oil interceptor will be incorporated into the drainage design to control pollution. In addition, manhole with sand trap will be incorporated before final discharge.

Specific measures have also been recommended for the design, operation, and management of the WRA such as the operation is self-contained; overflow to be discharged into proper drainage system; and the discharge from residential area is to be diverted away from the WRA. With the recommended measures, there will be no unacceptable impacts to the water quality in the Deep Bay.

12.4 Sewerage and Sewage Treatment

All domestic sewage generated at the Project will be discharged to the planned public sewerage under the permanent sewage disposal scheme. Interim sewage treatment plant will be provided if the planned public sewerage is not available. No net increase in pollution loading will be targeted at in the design and operation of the interim sewage treatment plant.

12.5 Waste Management

No waste related regulatory non-compliance and unacceptable environmental impacts are expected to arise from the proposed residential and wetland nature reserve development. No land contamination and biogas problem is envisaged as no land contaminative activities/ operation has been identified and no pond filling works will be involved.

12.6 Ecology

While most of the potential adverse ecological impacts are mainly very minor, it is predicted that the Project will fully mitigate these impacts with the implementation of mitigation measures. The Project will also be beneficial to other wildlife, which is not expected to be severely impacted. The corollary of this is that the Project will likely result in ecological benefits for the Project Area. In addition to the gain in ecological function of the wetland, the Project is expected to accrue a net gain in wetland. It is considered that there will be moderate but significant beneficial ecological effect arising from the Project.

12.7 Fisheries

No direct impact on fisheries due to the implementation of the Project. Indirect impacts during construction and operation phases would also be insignificant

12.8 Cultural Heritage

From the surveys and review of relevant records, no sites of cultural heritage were identified in the 500m Assessment Area. The only potential cultural resource identified in the 500m Assessment Area is the Wo Shang Wai ancestral hall which has already been modified with modern structures and is located beyond the Project Area. Thus, it is concluded that no cultural heritage resources will be affected by the Project.

12.9 Landscape and Visual

There will be some landscape and negative residual visual impacts on a number of visually sensitive receivers, but these impacts can be minimized with the implementation of mitigation measures.

The restoration of wetland, substantial new tree planting and the coherent development of the currently derelict site will result in a Slight Positive impact on the landscape resources within the Project Site, once operational and once proposed landscape planting has had time to mature. The overall conclusion is therefore that the landscape and visual impacts are acceptable and may contribute a small landscape / visual enhancement effect to the neighbourhood with the implementation of landscape improvement measures as detailed above.

In accordance with the criteria and guidelines for evaluating and assessing impacts as state in Annex 10, Clause 1.1(c) of the EIAO-TM, Overall, it is considered that the residual landscape and visual impacts of the proposed development are **acceptable with mitigation** during the construction and operation phases: "*there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures*"..

13. ENVIRONMENTAL MONITORING & AUDIT (EM&A) REQUIREMENTS

13.1 Overview

A detailed EM&A Manual has been prepared for this Project as required under the Study Brief. The following Chapters provide a summary of the need for monitoring and auditing of the individual environmental aspects.

13.2 Air Quality

Although the Project is not expected to generate excessive dust, an EM&A program is recommended to ensure compliance with air quality criteria and the proper implementation of mitigation measures. The corresponding implementation schedule is tabulated in Table 14-1.

The EM&A program will include monitoring on air quality level during the Project construction phase, and the implementation of good practices by the works contractor. Details of the EM&A requirements are provided in the Project EM&A Manual.

No particular monitoring is required during the Project operational phase.

13.3 Noise

13.3.1 Construction noise

Based on results of the noise assessment, implementation of noise mitigation measures and good site management practices are necessary in order to ensure that the construction noise levels can comply with the relevant noise criteria. EM&A will be carried out for this Project during the construction phase in order to monitor the construction noise level and to verify effectiveness of the proposed noise mitigation measures. An Environmental Team (ET) will be established as part of the EM&A program to closely monitor the contractors' environmental performance and the residual noise level at noise sensitive receivers. Should unacceptable construction noise level be identified, necessary actions will be taken following the Event and Action Plan specified in the EM&A Manual. The type of noise mitigation measures and their implementation schedule are tabulated in Table 14-1.

13.3.2 Operational Noise

Operational phase noise impacts due to road traffic noise and that fixed plants have been examined. As the predicted noise levels can comply with the relevant noise criteria with the precautionary measures in place, no further noise mitigation measures will be considered necessary. The concerned precautionary measures that need to be considered during the detailed design are tabulated in Table 14-1.

13.4 Water Quality

A water quality monitoring and site auditing programme has been proposed and is included in the EM&A Manual to ensure that mitigation measures will be implemented to protect the water bodies in the sensitive area.

Through the implementation of EM&A programme, the water quality will be monitored to ensure that relevant water quality criteria can be complied with and the water quality at the nearby sensitive receivers would not deteriorate.

13.5 Sewerage and Sewage Treatment

There is currently no existing public sewerage system in vicinity of the Project Site. Operation and maintenance requirements of the interim sewage treatment plant have been provided in the EIA and included in the EM&A Manual. With these measures in place, no adverse sewerage impact will be envisaged as a result of the Project. The discharge of treated effluent from the interim STP and its monitoring is subject to a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence, as well as the conditions specified in the Environmental Permit of this Project to be issued under the EIAO. Monitoring on quality of treated effluent that is discharged from the STP has been proposed.

13.6 Waste Management

The waste management implications and potential environmental impacts associated with the handling, transport, and disposal of the identified waste types are evaluated and addressed. An EM&A programme is recommended to check that the waste generated from the construction site will be managed in the accordance with the recommended procedures. Details of the recommended mitigation measures are tabulated in Table 14-1 with the EM&A requirements given in the EM&A Manual.

13.7 Ecology

Ecological monitoring for target species will be required before (baseline ecological monitoring), during (construction phase monitoring) and after (operational phase monitoring) the construction. Details are mentioned in Section 8.12 of the EM&A Manual.

A water quality monitoring programme for the wetlands in WRA during operational phase is also recommended to ensure the effectiveness of the water circulating system and sustainability of the wetland.

13.8 Fisheries

As no significant fisheries impact is anticipated, monitoring of fisheries is not recommended.

13.9 Cultural Heritage

No monitoring is needed.

13.10 Landscape and Visual

It is recommended that EM&A for landscape and visual resources is undertaken during the design, construction and operational phases of the project. The design, implementation and maintenance of landscape mitigation measures should be monitored to ensure that they are fully realised and that potential conflicts between the proposed landscape mitigation measures and any other project works and operational requirements are resolved at the earliest possible stage without compromise to the intent of the mitigation measures. Implementation management and maintenance of the mitigation measures recommended by the EIA will be monitored through the site audit programme. Audits shall be carried out by a Registered Landscape Architect as detailed in the EM&A Manual

Implementation of the recommended mitigation measures are specified in Section 11.10. Details of the recommended EM&A programmes are presented in the EM&A Manual.

14. PROJECT IMPLEMENTATION SCHEDULE

14.1 Proposed Infrastructure and Mitigation Measures

Based on the findings of this EIA, temporary fixed noise barriers together with other noise mitigation measures have been proposed during the construction phase in order to alleviate construction noise impact. The concerned temporary fixed noise barriers will be removed at the end of construction phase. The proposed noise mitigation measures have been summarised and presented in Figure 4-6. During the operational phase, no adverse noise impact is anticipated, thus no noise barriers are necessary.

All domestic sewage generated at the Project will be discharged to the planned public sewerage under the permanent sewage disposal scheme. An interim sewage treatment plant will be provided in case the planned public sewerage is not available at the time of occupation. The interim sewage treatment plant will be inside a totally enclosed building and designed to meet no net increase of pollution loading requirement during operation of the interim sewage treatment plant.

In addition, other mitigation measures have also been proposed for both the construction and operational phase of the Project and are presented in the respective chapters of this EIA report. The implementation schedules for the recommended mitigation measures as well as responsible parties for each environmental aspect covered in the EIA are given in Table 14-1 overleaf.

The Project Proponent will be responsible for funding and implementation of all the mitigation measures, while the operation and maintenance will be carried out by the future property management company and the Incorporated Owners. The Project Proponent would assume the responsibilities of all the mitigation measures contained in the EIA report until an agreement is reached between the Project Proponent and relevant parties on the funding, implementation, management and maintenance of mitigation measures. As for the proposed WRA, the Project Proponent will be responsible for the restoration, enhancement and management of the rehabilitated wetland area during the construction phase and initial operation phase, until the agreement with relevant government authorities is reached on the long-term maintenance, management and monitoring package of the WRA.

Table 14-1 Implementation Schedule of Recommended Mitigation Measures

EIA Ref.	EM&A Manual Ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Objectives of the recommended measures & main concerns to address	Who to implement the measures?	Location / Timing of implementation of Measures	What requirements or standards for the measures to achieve?
Air Quality						
During Detailed Design:						
3.6.2.2	4.10	The interim STP of will be located within a totally enclosed building. Detail design of the interim STP is yet to be carried out, but the exhaust of the totally enclosed interim STP will be equipped with an odour removal system (with an odour removal efficiency of not less than 99.5%). The exhaust will be directed away from the nearby ASRs. Brine disposal during maintenance will be away from residential area as much as possible and close to the vehicular access connecting the nearby road.	Odour control during operation	Project Proponent/ Project Engineer	During detailed design stage	EIAO-TM
3.6.2.1	4.10	During operation, RCP will be provided for the residential development. A licensed waste collector shall be employed to collect domestic waste on daily basis. Localized impact and minimization of odour nuisance will be considered during detailed design.	Odour control during operation	Project Proponent/ Project Engineer	During detailed design stage	EIAO-TM
During Construction Phase:						
3.9.1	4.9	Good site management practices are important in reducing potential air quality impacts. As a general guidance, the contractor shall maintain high standard of housekeeping to prevent emission of fugitive dust emission. Loading, unloading, handling and storage of fuel, raw materials, products, wastes or by-products should be carried out in a manner so as to minimize the release of visible dust emission.	Air Quality (fugitive dust) Control during Construction Phase	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation

3.9.1	4.9	The speed of the trucks travelling on haul roads within the Project Site will be controlled at 10 kph or lower in order to reduce dust impact and for safe movement around the Site. Any stockpiles of materials accumulated at or around the work areas shall be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas shall be carried out at a frequency without generating fugitive dust emissions. The material shall be handled properly to prevent fugitive dust emission before cleaning. If concrete batching is required on-site, the plant should be cleaned and watered regularly as a good practice. Cement and other fine grained materials delivered in bulk should be stored in enclosed silos fitted with high level alarm indicator. Wet mix batching process is preferred over dry mix batching. In addition, concrete batching plant shall comply with the specified process (SP) licence requirements including specified emission limits and dust control measures. All relevant dust control measures stipulated in the Air Pollution Control (Construction Dust) Regulation shall be fully implemented, including • The designated haul road on-site should be hard paved to minimize fugitive dust emission; • During the site formation works, the active works areas should be water sprayed with water browser or manually eight times during day-time from 0800 to 1800 hours. The Contractor(s) should ensure that the amount of water spraying is just enough to dampen the exposed surfaces without over-watering which could result in surface water runoff • Dump trucks for material transport should be totally covered by impervious sheeting; • Any excavated dusty materials or stockpile of dusty materials should be covered entirely by impervious sheeting or sprayed with water so as to maintain the entire surface wet, and recovered or backfilled or reinstated within 24 hours of the excavation or unloading; • Dusty materials remaining after a stockpile is removed should be wetted with water; • The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with e.g. concrete, bituminous materials or hardcore or similar;	Air Quality (fugitive dust) Control during Construction Phase	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation

3.9.1	4.9	• The Contractor(s) shall only transport adequate amount of fill materials to the Project Site to minimize stockpiling of fill materials on-site, thus reducing fugitive dust emission due to wind erosion; • Should temporary stockpiling of dusty materials be required, it shall be either covered entirely by impervious sheeting, placed in an area sheltered on the top and the 3 sides; or sprayed with water so as to maintain the entire surface wet; • All dusty materials to be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty material wet; • Vehicle speed to be limited to 10 kph except on completed access roads; • The portion of road leading only to a construction site that is within 30 m of a designated vehicle entrance or exit should be kept clear of dusty materials;	Air Quality (fugitive dust) Control during Construction Phase	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation

3.9.1	4.9	• Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites; • The load of dusty materials carried by vehicle leaving a construction site should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle; • The working area of excavation should be sprayed with water immediately before, during and immediately after (as necessary) the operations so as to maintain the entire surface wet; and • Use of effective dust screens, sheeting or netting to be provided to enclose dry scaffolding which may be provided from the ground floor level of the building or if a canopy is provided at the first floor level, from the first floor level, up to the highest level (maximum four floors for this Project) of the scaffolding where scaffolding is erected around the perimeter of a building under construction. • In order to minimize potential fugitive dust impacts, particularly when there are concurrent construction activities at the adjacent planned development projects, the Contractor(s) shall carry out site formation works in phases (a total of 21 sub-zones as shown in **Appendix 3-8**, and with an average % active works area of 5% for each sub-zone as shown in **Appendix 3-9)**. Within each of Phases B to D, there will be only one sub-zone under construction in any one time. Once construction for a sub-zone is completed, the works area will be compacted, covered by tarpaulin sheet and hydroseeded before construction of another zone. Watering will also be applied on regular basis (eight times a day during day time from 0800 to 1800 hours for a dust suppression efficiency of 90%). Thus, there will be no cumulative construction dust impact. Works area shall be properly covered at the end of working day to minimize wind erosion.	Air Quality (fugitive dust) Control during Construction Phase	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	Annex 4 and Annex 12 of EIAO -TM, Air Pollution Control (Construction Dust) Regulation

3.6.1.2	4.9	In order to minimize potential odour nuisance, the following control measures are recommended: • Malodorous excavated materials, if any, should be placed as far as possible from any ASRs; • Excavated malodorous materials should be removed from the Project Area within 24 hours or as soon as possible; • Malodorous materials, if stockpiled on site, should be covered entirely by plastic tarpaulin sheets; • Odour patrol will be carried out during the re-profiling works for the WRA. The required odour patrol has been detailed in the EM&A Manual; and • Should disposal of pond sediment be required, if any, it shall follow the requirements stated in Buildings Department's PNAP ADV-21 for "Management Framework for Disposal of Dredged/ Excavated Sediment".	Odour control during Construction	Project Engineer, Contractor	Construction of the Wetland Restoration Area (WRA)	EIAO-TM
During Operational Phase:						
3.6.2.2, 3.9.2	4.10	The proposed interim STP within the Project Site will be located within a totally enclosed building of which the MBR and RO system will be located underground. The exhaust will be directed away from nearby ASRs. Detailed design of the interim STP has yet to be carried out. With environmental conscious design of an effective odour removal system at the exhaust of the STP (with an odour removal efficiency of not less than 99.5%), the odour concentration at the exhaust would be significantly reduced and no odour impact is expected to arise from the operation of the interim on-site STP. Brine disposal during maintenance will be away from residential area as much as possible and close to the vehicular access connecting the nearby road.	Odour control during operation	Project Proponent/ property management company	During operation	EIAO-TM
3.6.2.1, 3.9.2	4.10	During operation, RCP will be provided for the residential development. A licensed waste collector shall be employed to collect domestic waste on daily basis. Localized impact and minimization of odour nuisance will be considered during detailed design.	Odour control during operation	property management company	During operation	EIAO-TM
<u>Noise</u>						
During Detailed Design						

4.3.2	5.8	According to the approved EIA study for Main Drainage Channels for Ngau Tam Mei, the reverberant sound pressure level (SPL) inside typical plant room is Leq 85 dB(A) by applying a combination of acoustic treatment inside the plant room (e.g mineral wools) and acoustic treatment at source (e.g. acoustic shrouds or enclosure at pump). It is recommended that acoustic louvre and silencer with a minimum noise reduction of 11 dB(A) are also provided at the exhaust in order to alleviate the noise impacts (i.e. the maximum noise level at louvre would be 85 – 11 = 74 dB(A)). During detailed design, the acoustic performance of the interim STP should be reviewed and acoustic treatments such as provision of acoustic louvre, acoustic silencer and noise treatments inside the plant room (e.g. acoustic shrouds or enclosure at pump) shall be proposed so that the noise level at louvre of STP should be 74 dB(A) or below in order to meet the noise criteria. To be conservative, the above noise calculation assumes that the louvre of the STP will be facing the nearest NSR. In fact, by directing louvre away from the NSR as far as possible, it could provide additional noise reduction.	Noise control during operation	Project Proponent, Architect	During Detailed Design	EIA, Contractual requirements, NCO.
During Construction Phase:						
4.7.2	5.7	Noise mitigation measure in terms of Quiet Type PMEs (QPMEs) has been proposed. Asides from QPMEs, additional noise mitigation measures in terms of movable noise barriers are also proposed to shield construction plants. The movable noise barriers should have sufficient surface density of at least 10 kg/m^2 or material providing equivalent acoustic performance to block the line of sight from the sensitive receivers. There should not be any gaps and openings at the noise barriers and site hoardings to avoid noise leakage. The design of the noise barriers shall be proposed by the work contractor(s), and approved by the Engineers Representative (RE) and the Environmental Team in accordance with the Project EM&A Manual.	Noise control during construction	Project Engineer, Contractor	During Construction of the Wetland Restoration Area	EIA, Contractual requirements, Annex 5 and Annex 13 of EIAO-TM.
4.7.2	5.7	Minimum amount of QPMEs will be used at Phase A's works area in order to minimize potential noise impact. During the Phase A works, movable noise barriers shall also be erected near the site boundary adjacent to the nearby NSRs at Yau Mei San Tsuen (e.g. N5 and N11) so as to shield construction plant from these NSRs. In addition, 3m tall site hoarding will also be erected along the Project site boundary. After the completion of the re-profiling work of the wetland, minor landscape work will be carried out and that the wetland is assumed to function during the construction phase of the residential portion of the Project Site (i.e. Phase B to D). In view of maintaining the function of the wetland (Phase A), there is a possibility to demolish the site hoarding surrounding the Phase A once the Project Ecologist considers that the wetland is ready to function as it is designed.	Noise control during construction	Project Engineer, Contractor	During construction of the residential portion of Project Site	EIA, Contractual requirements, Annex 5 and Annex 13 of EIAO-TM.

4.7.3	5.7	Fixed temporary noise barrier is proposed near the existing Fairview Park as well as near the existing Yau Mei San Tsuen in order to alleviate elevated construction noise level over there. In addition, when the planned REC Site in adjacent to the Project Site is occupied with sensitive receivers during construction of this Project, , fixed temporary noise barrier will also need to be erected near the concerned development site. Locations of proposed fixed temporary noise barriers are shown in **Figure 4-6**. The exact location is subject to the contractor(s) and the prior approval from the Resident Engineer (RE).	Noise control during construction	Project Engineer, Contractor	During construction of the residential portion of Project Site	EIA, Contractual requirements, Annex 5 and Annex 13 of EIAO-TM.
4.7.3	5.7	In order to ensure construction noise is controlled throughout the construction period, fixed temporary noise barriers shall be erected prior to site formation works of Phases B to D. It is estimated that 6m high temporary fixed noise barriers (with top level at 8mPD level) shall be sufficient to shield the concerned existing/ planned NSRs at Fairview Park and the planned REC Site, while 4.5m high noise barriers is required to be erected adjacent to the existing Yau Mei San Tsuen (**Figures 4-6**). The erection of noise barriers and site hoardings will be subject to the presence of nearby sensitive receivers. Erection of temporary fixed noise barriers will be carried out section by section and precast units will be used for the foundation of the noise barrier as much as possible. Standard site hoarding of 3m tall will also be erected along the site boundary.	Noise control during construction	Project Engineer, Contractor	Construction areas near the specified locations during the construction period	EIA, Contractual requirements, Annex 5 and Annex 13 of EIAO-TM.
4.7.3	5.7	The concerned temporary fixed noise barriers should have sufficient surface density of at least 10 kg/m^2 or material providing equivalent acoustic performance. There should not be any gaps and openings at the noise barriers and site hoardings to avoid noise leakage. The design of the noise barriers shall be proposed by the work contractor(s), and approved by the Engineers Representative (RE) and the Environmental Team in accordance with the Project EM&A Manual.	Noise control during construction	Project Engineer, Contractor	Construction areas near the specified locations during the construction period	EIA, Contractual requirements, Annex 5 and Annex 13 of EIAO-TM.

4.7.4	5.7	It is also recommended that good housekeeping activities shall also be carried out to further minimize the potential construction noise impact, and these are summarised below. The following good site practices are also recommended for incorporation into the contractual requirements : Before the commencement of any work, the Contractor shall submit to the Engineer for approval the method of working, equipment and sound-reducing measures intended to be used at the Project Area; Contractor shall comply with and observe the Noise Control Ordinance (NCO) and its current subsidiary regulations. Contractor shall devise and execute working methods that will minimize the noise impact on the surrounding environment; and shall provide experienced personnel with suitable training to ensure that these methods are implemented; Only well-maintained plants should be operated on-site;	Noise control during construction	Project Engineer, Contractor	Construction areas near the specified locations during the construction period	EIA, Contractual requirements, Annex 5 and Annex 13 of EIAO-TM.
4.7.4	5.7	Plants should be serviced regularly during the construction programme; Machines that may be in intermittent use should be shut down or throttled down to a minimum between work periods; Silencer and mufflers on construction equipment should be utilised and should be properly maintained during the construction programme; Noisy activities can be scheduled to minimize exposure of nearby NSRs to high levels of construction noise. For example, noisy activities can be scheduled for midday or at times coinciding with periods of high background noise (such as during peak traffic hours); Noisy equipment such as emergency generators shall always be sited as far away as possible from noise sensitive receivers; Mobile plants should be sited as far away from NSRs as possible; and Material stockpiles and other structures should be effectively utilised as noise barrier, where practicable.	Noise control during construction	Project Engineer, Contractor	Construction areas near the specified locations during the construction period	EIA, Contractual requirements, Annex 5 and Annex 13 of EIAO-TM.

4.7.4	5.7	The contractor(s) is also encouraged to arrange construction activities with care so that concurrent construction activities are avoided as much as possible. The contractor(s) should closely liaise with the school so that noisy activities are not undertaken during school's examination period.	Noise control during construction	Project Engineer, Contractor	Construction areas near the specified locations during the construction period	EIA, Contractual requirements, Annex 5 and Annex 13 of EIAO-TM.
During Operational Phase:						
Nil	Nil	Nil	Nil	Nil	Nil	Nil
Water Quality						
During Detailed Design						
5.6.1	6.3	All domestic sewage generated will be discharged to the public sewerage system via a terminal manhole located at the southern boundary of the Project Site, which will be further connected to the planned public sewer at Yau Pok Road. An interim STP will be proposed with discharge of the treated effluent to the adjacent NTMDC in case the public sewerage is not available when the Project is in operation. The design of the interim STP will follow the requirement of no net increase of pollution loading.	Sewage and point Source Pollution Control	Project Proponent	During operation	EIA, WPCO, Contractual requirements
5.6.1	6.3	During decommissioning, the interim sewerage system within the development area should be designed in such a way to facilitate the future connection to the planned Ngau Tam Mei sewerage system with the flow direction to be controlled by several flow control devices such as valves or stop-log, etc. Switching over from the interim system to the permanent system will be done by regulating the flow direction through the flow control devices and by abandoning the sewer which connects to the interim STP. Details of which are provided in Section 6.5 of the EIA report and should be implemented. Tank away will be provided for any small amount of sewage remained in the STP for proper disposal at designated sewage treatment works to be assigned by DSD.	Sewage and point Source Pollution Control	Project Proponent	During operation	EIA, WPCO, Contractual requirements
5.6.1	6.3	Precautionary measures in Section 6.10 of the EIA report should be implemented, so that adverse water quality impact due to sewage overflow, emergencies discharge, and change in flow regime is unlikely to occur. In addition, equalization tank will be provided in the STP for temporary storage of sewage in case of outage of the interim STP, and tank away will be provided for proper disposal at designated sewage treatment works to be assigned by DSD.	Sewage and point Source Pollution Control	Project Proponent	During operation	EIA, WPCO, Contractual requirements

5.6.2	6.3	Best Management Practices (BMP) have been proposed for the operational phase of the development:				
5.6.2	6.3	Exposed surface shall be avoided within the proposed development to minimize soil erosion. Development site shall be either hard paved or covered by landscaping area where appropriate.	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	The landscaped open area should be managed and maintained by the property management company (and its contractor) during operation.	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	Paved area of development has been minimized by a simpler and more effective internal road layout, at which proposed houses are allocated on both sides of the road. Thus hard paved area of internal access road as well as increase in surface runoff, can be minimised	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	The roadside channel along Yau Pok Road will be retained to maintain the original flow path. The drainage system will be designed to avoid any case of flooding based on the 1 in 50 year return period	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	Detailed design of the drainage system will be carried out during detailed design stage. Drainage system of the development shall be designed in such a way that surface runoff from the residential area is directed towards the internal access road, where appropriate drainage system with control facilities have been proposed. Additional paved U-channels with screening facilities are also provided along the edge of residential portion to avoid uncontrolled spillage of runoff. **Figure 5-3** of EIA report refers.	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	There should be no discharge of surface runoff into the sensitive areas such as the proposed WRA; ecological corridors; and Fairview Park Nullah	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	Street level tree planting shall be introduced along both sides of the internal access road, which can help to reduce soil erosion and as a buffer zone between the residential area and the drainage system along roadside	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,

5.6.2	6.3	Evergreen trees species, which in general generate relatively smaller amount of fallen leaves, should be selected as far as possible.	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	Fertilizer will only be applied on landscape area when needed. If required, the fertilizer should be applied in early Spring and in later summer in order to avoid major rainy season as far as possible. Slow release fertilizer should be selected as far as possible to minimize the amount of nutrient to be washed out by rain. Application of fertilizer should not be arranged before forecasted heavy rainfall, and over dosing should be avoided. The fertilizer application strategy is to be implemented by an experienced contractor through the property management company during operation	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	Screening facilities such as standard gully grating and trash grille, with spacing which is capable of screening off large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system as well as at upstream location of the u-channels	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	Road gullies with standard design and silt traps and oil interceptors should be incorporated during the detailed design to remove particles present in stormwater runoff	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	Drainage outlet of any covered car park should be connected to foul sewers via petrol interceptors or similar facilities	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
5.6.2	6.3	Subject to detailed design, standard manholes with desilting opening/ sand trap designed for first flush flow (capable of providing at least 5 minutes' detention time) can be provided at final discharge point before discharge into NTMDC. The feasibility of alternative measure such as Vortex grit separator would also be considered during the detailed design stage	Drainage system during operation	Project architect and Project Proponent	During detailed design stage	EIA, WPCO, Contractual requirements,
During Construction Phase:						

5.5	6.3	The Contractor shall apply for a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence.	Stormwater and Non-point Source Pollution Control	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	ProPECC PN1/94, EIA, WPCO, Contractual requirements,
5.5	6.3	Contractor(s) of this Project should submit a Construction Phase Drainage Management Plan with details of the design of the temporary site drainage system for the approval of the Engineers Representative (RE) and the Environmental Team in order to ensure that the above mitigation measures are in place. Regular inspection (weekly) of the site drainage system and the implementation of the Plan shall be carried out by the Contractor(s), RE, and ET in order to ensure no off-site spillage of runoff and that the mitigation measures are effectively implemented. Any deficiencies identified shall be rectified by the Contractor(s)	Stormwater and Non-point Source Pollution Control	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	ProPECC PN1/94, EIA, WPCO, Contractual requirements,
5.5.1	6.3	Besides, the Best Management Practices (BMPs) given in the ProPECC PN 1/94 shall be implemented in controlling water pollution during the whole construction phase. The main practices provided in the above-mentioned document (i.e. ProPECC PN 1/94) are also summarized in the following paragraphs which should be implemented by the contractor during the construction phase, where practicable. • High loading of suspended solids (SS) in construction site runoff shall be prevented through proper site management by the contractor. • The boundary of critical work areas shall be surrounded by ditches or embankment. Accidental release of soil or refuse into the adjoining land should be prevented by the provision of site hoarding or earth bunds, etc. at the site boundary. These facilities should be constructed in advance of site formation works and roadworks; • Consideration should be given to plan construction activities to allow the use of natural topography of the Project Area as a barrier to minimize uncontrolled non-point source discharge of construction site runoff;	Stormwater and Non-point Source Pollution Control	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	ProPECC PN1/94, EIA, WPCO, Contractual requirements,

5.5.1	6.3	• Temporary ditches, earth bunds should be provided to facilitate directed and controlled discharge of runoff into storm drains via sand/ silt removal facilities such as sand traps, and sedimentation basins. Oil and grease removal facilities should also be provided where appropriate, for example, in area near plant workshop/ maintenance areas; • Sedimentation basins and sand traps designed in accordance with the requirements of ProPECC Note PN 1/94 should be installed at the construction site for collecting surface runoff; • Sand and silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly by the contractor, and at the onset of and after each rainstorm to ensure that these facilities area functioning properly; • Slope exposure should be minimized where practicable especially during the wet season. Exposed soil surfaces should be protected from rainfall through covering temporarily exposed slope surfaces or stockpiles with tarpaulin or the like; • Haul roads should be protected by crushed rock, gravel or other granular materials (i.e. hard paved) to minimize discharge of contaminated runoff; • Slow down water run-off flowing across exposed soil surfaces; • Plant workshop/ maintenance areas should be bunded and constructed on a hard standing. Sediment traps and oil interceptors should be provided at appropriate locations; • Manholes (including newly constructed ones) should be adequately covered or temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system;	Stormwater and Non-point Source Pollution Control	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	ProPECC PN1/94, EIA, WPCO, Contractual requirements,

5.5.1	6.3	• Construction works should be programmed to minimize soil excavation works where practicable during rainy conditions; • Chemical stores should be contained (bunded) to prevent any spills from contact with water bodies. All fuel tanks and/ or storage areas should be provided with locks and be sited on hard surface; • Chemical waste arising from the Project Area should be properly stored, handled, treated and disposed of in compliance with the requirements stipulated under the Waste Disposal (Chemical Waste) (General) Regulation; • Drainage facilities must be adequate for the controlled release of storm flows. • During re-profiling of the existing bunds within the WRA, materials requiring temporary storage on-site) will be securely stored and covered, if possible. Dried up mud materials can then be used for marshland formation. • Sewage generated from the construction workforce should be contained in chemical toilets before connection to public foul sewer can be provided. Chemical toilets should be provided at a minimum rate of about 1 per 50 workers. The facility should be serviced and cleaned by a specialist contractor at regular intervals; • Vehicle wheel washing facilities should be provided at the site exit such that mud, debris, etc. deposited onto the vehicle wheels or body can be washed off before the vehicles are leaving the site area; • Section of the road between the wheel washing bay and the public road should be paved with backfill to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains;	Stormwater and Non-point Source Pollution Control	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	ProPECC PN1/94, EIA, WPCO, Contractual requirements

5.5.1	6.3	• Bentonite slurries, if any to be generated, shall be reconditioned and reused as far as practicable. Spent bentonite should be kept in a separate slurry collection system for disposal at a marine spoil grounds subject to obtaining a marine dumping licence from EPD. If used bentonite slurry is to be disposed of through public drainage system, it should be treated to meet the respective applicable effluent standards for discharges into sewers, storm drains or the receiving waters. • Spillage of fuel oils or other polluting fluids should be prevented at source. It is recommended that all stocks should be stored inside proper containers and sited on sealed areas, preferably surrounded by bunds.	Stormwater and Non-point Source Pollution Control	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	ProPECC PN1/94, EIA, WPCO, Contractual requirements
5.5.2	6.3	**Site Specific Measures**				
5.5.2	6.3	<u>Construction of Residential Portion</u> During construction of residential portion, temporary drains, peripheral site drainage comprising precast concrete u-channels, sedimentation basins, sand traps and similar facilities in accordance with the requirements of ProPECC Note PN 1/94 will be provided within the residential portion and along the edge of its boundary as per good practices in order to divert surface runoff away from WRA, temporary wetland enhancement area, ecological links, and nearby sensitive receivers such as Fairview Park Nullah before discharge into NTMDC after passing sand traps. **Figure 5-2** of the EIA report shows the indicative site drainage conceptual layout during construction phase.	Stormwater and Non-point Source Pollution Control	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	ProPECC PN1/94, EIA, WPCO, Contractual requirements

5.5.2	6.3	<u>Construction of WRA</u> During the construction of Wetland Restoration Area of the Project Site, in order to minimize disturbance to the rest of the Project Site it is proposed that : • Through transferring the pond water within the Project Area, the need of discharging pond water into the surrounding water bodies during the construction of the Project can be minimized. • The major construction works involved in Wetland Restoration Area relate to the re-profiling of the bunds. To minimize disturbance to the rest of the Project Area it is proposed that the works are conducted on one pair of ponds at a time. Pond water will be drained to other neighbouring ponds for temporary storage. • Surface runoff in order to avoid from the residential portion will be diverted away from the WRA by drainage channels overflow of the pond under extreme weather condition (e.g. heavy rainfall). • Temporary peripheral site drainage system comprising precast concrete u-channels along site boundary with sedimentation basins, sand traps and similar facilities will be provided in accordance with the requirements stipulated in ProPECC PN 1/94. • Given the proposed mitigation measures above, an EM&A programme is required to ensure the proper implementation of the recommended measures and provide a proactive system to rectify any problem identified There should be no discharge of surface runoff into Fairview Park Nullah; existing stream to the south of Palm Springs; and existing ponds at off-site locations. Treated surface runoff will be diverted away from these locations and discharged into NTMDC after passing through sand traps and sedimentation basins.	Stormwater and Non-point Source Pollution Control	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	ProPECC PN1/94, EIA, WPCO, Contractual requirements

5.5.2	6.3	Construction of Temporary Wetland Enhancement Area During construction of Temporary Wetland Enhancement Area, appropriate temporary peripheral site drainage should be provided which comprises precast concrete u-channels surrounding the construction area, surface runoff is diverted away from nearby existing drainage channels for discharge into NTMDC after passing through sand traps and sedimentation basins. During operation of the temporary enhancement area, appropriate temporary drainage will also be provided surrounding the concerned enhancement area to divert surface runoff away from the enhancement area to avoid any adverse water quality impact on this area. Figure 5-2 of EIA report refers.	Stormwater and Non-point Source Pollution Control	Project Engineer, Contractor	At all construction areas of the site during the entire construction period	ProPECC PN1/94, EIA, WPCO, Contractual requirements
During Operational Phase						
5.6.1	6.3	Permanent Sewage Disposal - All domestic sewage generated will be discharged to the public sewerage system via a terminal manhole located at the southern boundary of the Project Site, which will further connect to the planned public sewer at Yau Pok Road. The discharge from the club house and swimming pool shall apply for a discharge licence under the WPCO, and the discharge shall comply with the terms and conditions of a licence and the standards for effluents specified in the licence, as well as conditions in Environmental Permit. Interim Sewage Disposal - An interim STP will be proposed with discharge of the treated effluent to the adjacent NTMDC in case the public sewerage is not available when the Project is in operation. The design of the interim STP will follow the requirement of no net increase of pollution loading and details of which are shown in Section 6. A discharge licence under the WPCO will be obtained for the interim STP and the discharge shall comply with the terms and conditions of a licence and the discharge standards for effluents specified in the licence as well as the conditions specified in the Environmental Permit of this Project. Samples of treated effluent will be taken regularly and tested according to the discharge licence under the WPCO and the conditions in the Environmental Permit to ensure compliance with discharge standards.	Sewage and point Source Pollution Control	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements

5.6.1	6.3	Precautionary measures in Section 6.10 and 6.6 of the EIA report should be implemented, so that adverse water quality impact due to sewage overflow, emergencies discharge, and change in flow regime is unlikely to occur. In addition, equalization tank will be provided in the STP for temporary storage of sewage in case of outage of the interim STP, and tank away will be provided for proper disposal at designated sewage treatment works to be assigned by DSD.	Sewage and point Source Pollution Control	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements
5.6.1	6.3	The discharge from the club house and swimming pool shall apply for a discharge licence under the WPCO, and the discharge shall comply with the terms and conditions of a licence and the standards for effluents specified in the licence, as well as the conditions in the Environmental Permit.	Sewage and point Source Pollution Control	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements
5.6.1	6.3	During decommissioning, the interim sewerage system within the development area should be designed in such a way to facilitate the future connection to the planned Ngau Tam Mei sewerage system with the flow direction to be controlled by several flow control devices such as valves or stop-log, etc. Switching over from the interim system to the permanent system will be done by regulating the flow direction through the flow control devices and by abandoning the sewer which connects to the interim STP. Details of which are provided in Section 6.6 of the EIA report and should be implemented. Tank away will be provided for any remaining small amount of sewage in the STP for proper disposal at designated sewage treatment works to be assigned by DSD.	Sewage and point Source Pollution Control	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements
5.6.2	6.3	Fertilizer will only be applied on landscape area when needed. If required, the fertilizer should be applied in early Spring and in later summer in order to avoid major rainy season as far as possible. Slow release fertilizer should be selected as far as possible to minimize the amount of nutrient washed out by rain. Application should not be arranged before forecasted heavy rainfall, and over dosing should be avoided. The fertilizer application strategy is to be implemented by an experienced contractor through the property management company during operation.	Stormwater and Non-point Source Pollution Control	Project Proponent / Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements

5.6.2	6.3	Specific measures during operation of the WRA WRA is not designed for pollution abatement but as ecological mitigation measures of the development. All pond water of WRA will be obtained by direct rainfall and will be retained and re-circulated during drain-down periods as necessary. No surface or groundwater supplies will be used for WRA operations. Ponds in the Wetland Restoration Area will be designed in such a way that they are self-contained and there is no outlet connecting to nearby channel/inland water, thus there will be no discharge from the ponds within the WRA. Surface runoff from the residential portion will be diverted away from the WRA by drainage channels in order to avoid overflow of the pond under extreme weather condition (e.g. heavy rainfall). No fertilizers and pesticides will be routinely used for vegetation management in the WRA, hence avoiding the potential source of contamination into the adjacent watercourses which connect to the Deep Bay. The WRA will be designed in such a way that overflow will be diverted into proper drainage system of the development site before discharge into NTMDC through the proposed drainage system. During operation, under the management of Wetland Ecologist, who will advise on the management of wetland, pond water will be transferred between ponds within the WRA, in order to self-contain water within the WRA.	Stormwater and Non-point Source Pollution Control	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements
5.6.2	6.3	In the event of emergency (e.g. car accident) where there is a major spillage of oil, chemical or fuel, dispersants or firefighting foam, etc., a system of contaminant bunding will be implemented as appropriate.	Non-point Source Pollution Control	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements

5.6.2	6.3	Good management measures such as regular cleaning and sweeping of road surface/ open areas is suggested. The road surface/ open area cleaning should also be carried out prior to occurrence of rainstorm	Stormwater and Non-point Source Pollution Control	Project Proponent / Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements
5.6.2	6.3	Manholes, as well as stormwater gullies, ditches provided among the residential development will be regularly inspected and cleaned (e.g. monthly) by the property management company. Additional inspection and cleansing should be carried out before forecast heavy rainfall.	Stormwater and Non-point Source Pollution Control	Project Proponent / Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements
Sewerage and Sewage treatment						
During Detailed Design:						
6.5 & 6.6	7.2	The sewage generated from the Project Area will be conveyed to a terminal manhole located at the southern boundary of the Project Area which will further connect to the 525 mm diameter proposed public sewer at Yau Pok Road. The tentative location of terminal manhole is shown in Figure 6-2 of the EIA report. In this connection, the timing which the sewerage system of the development could only be connected to the public sewerage system is uncertain. Therefore, it is necessary to consider the provision of the on-site sewage treatment facility, as mentioned in Section 3.9.4 of the EIA - Study Brief as an interim measure to handle the sewage generated from the development until connection to public sewerage by DSD is available. The interim STP will be provided by the project proponent while the operation and maintenance will be responsible by the management office of the development and its contractors. The project proponent will also be responsible for connecting the sewerage system of the development to the public system when available and decommission the interim STP.	Sewage Treatment and control.	Project architect and Project Proponent	During detailed design stage	EIA, WPCO

6.6	7.2	It should also be pointed out that the on-site sewage treatment plant is for temporary use during the interim period only in case the public sewerage cannot be commenced on time. The sewerage system within the development area will be designed to facilitate the future connection to the planned Ngau Tam Mei sewerage system with the flow direction to be controlled by several flow control devices such as valves or stop-log, etc. Switching over from the interim system to the permanent system will be done by regulating the flow direction through operations of the flow control devices and abandoning the sewer leading to the interim STP. Residual sewage left in the interim STP would be tanked away and the abandoned STP and downstream sewers will be filled up with soil and concrete. Therefore, there should be no discharge of sewage discharge into the nearby water body during decommissioning of the interim STP. To minimize disturbance to the residents, all sewers for connection to the public system within the development will also be constructed at the initial stage.	Sewage Treatment and control.	Project architect and Project Proponent	During detailed design stage	EIA, WPCO
6.7	7.2	In this regard, membrane bioreactor (MBR) plus reverse osmosis (RO) supplement with denitrification process and coagulation by metal salt to precipitate soluble phosphorus is proposed for the on-site treatment facility. At the downstream of MBR system, Reverse Osmosis (RO) system is proposed to further polish the MBR effluent and eliminate the residual pollution loads of the interim STP. RO system is a proven membrane technology used for the removal of dissolved constituents. RO membrane module with pore sizes from 0.1 to 1nm can act as a barrier to all dissolved salts, inorganic molecules as well as organic molecules with a molecular weight greater than approximately 300 under the high operating pressures up to 100 bars. This treatment technology is well-established for drinking water treatment, wastewater reuse, seawater desalination, and other industrial applications.	Sewage Treatment and control.	Project architect and Project Proponent	During detailed design stage	EIA, WPCO
During Operational Phase						

6.6	7.2	It should also be pointed out that the on-site sewage treatment plant is for temporary use during the interim period only in case the public sewerage cannot be commenced on time. The sewerage system within the development area will be designed to facilitate the future connection to the planned Ngau Tam Mei sewerage system with the flow direction to be controlled by several flow control devices such as valves or stop-log, etc. Switching over from the interim system to the permanent system will be done by regulating the flow direction through operations of the flow control devices and abandoning the sewer leading to the interim STP. Residual sewage left in the interim STP would be tanked away and the abandoned STP and downstream sewers will be filled up with soil and concrete. Therefore, there should be no discharge of sewage discharge into the nearby water body during decommissioning of the interim STP. To minimize disturbance to the residents, all sewers for connection to the public system within the development will also be constructed at the initial stage.	Sewage Treatment and control.	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements
6.8	7.2	Once the government public sewerage system becomes available, the on-site STP will be decommissioned. .	Sewage Treatment and control.	Project Proponent	During operation	EIA, WPCO, Contractual requirements

6.10	7.2	Proper operation and maintenance of interim sewage treatment plant is essential to safeguard the quality of discharge effluent, subject to the following aspects: (i) Only competent technicians to be employed by the property management office to operate the STP. They are to be fully conversant with the operating procedures as stipulated in the operation and maintenance manuals. (ii) The proposed STP only serves the proposed development and thus the operation and maintenance (O&M) cost would be borne by the future management office of the development. The Project Proponent will ensure the design of STP is cost-effective such that the O&M cost imposed is reasonable. (iii) The STP is to be kept in a tidy state. This includes regular hosing down, scraping of the walkways, whitewashing the walls, cleaning and painting the metalwork, and maintaining adequate lighting and ventilation. (iv) Where parts of the STP are sited beneath ground, forced ventilation will be provided. (v) An easily accessible sampling point will be provided for taking samples of the treated effluent. (vi) Samples of treated effluent will be taken regularly and tested according to the discharge licence under the Water Pollution Control Ordinance as well as the conditions in Environmental Permit of this Project under the EIAO, to ensure compliance with discharge standards, which should be same the proposed RO Permeate concentration as stated in Table 6-7 in EIA report. (vii) The production of sludge is estimated to be 6m^3/d and RO concentrate generated is estimated to be 20% of the RO which is 32m^3/d.	Sewage Treatment and control.	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements

6.10	7.2	(viii) Based on reference to other similar projects, the dewatered sludge will be collected by a licensed collector at regular intervals and disposed at the landfill. As an alternative to on-site dewatering of sludge, sludge could be transferred by tankers to Government's STW for off-site treatment due to its small quantity. Provided that the handling, storage and disposal of the wastes are properly managed and accidental release to the surrounding environment does not occur, adverse environmental impacts are not expected. In any case our sludge handling arrangement will be in compliance with requirements of the Water Pollution Control Ordinance (WPCO). Such approach for sludge disposal has also been adopted for some other projects, such as "Liantang / Heung Yuen Wai Boundary Control Point and Associated Works", "Redeveloped Lo Wu Correctional Institution" and "CLP Black Point Power Station". (ix) The Project Proponent will be responsible for the future sewer connection to the public sewer upon its available in the future and STP decommissioning with connection details subject to agreement of DSD. Appropriate conditions could be imposed in the Environmental Permit (EP) to ensure the EP holder to take up the responsibility to ensure connection to public sewer when trunk sewer is ready.	Sewage Treatment and control.	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements
6.10	7.2	(x) The obsolete STP and the connecting sewer will be filled up by soil and concrete once decommissioned. Monitoring requirement - The discharge of treated effluent from the interim STP should follow the licence requirements under the WPCO and the conditions specified in the Environmental Permit of this Project under the EIAO. Samples of treated effluent will be taken regularly and tested by a HOKLAS or other internationally accredited laboratory according to the above-mentioned requirements to ensure compliance with discharge standards.	Sewage Treatment and control.	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements

6.11	7.2	The following measures will be adopted in order to eliminate adverse impact due to potential sewage overflow, emergencies discharge and change in flow regime beyond the expectation of this assessment: (i) Adequate spare parts for the plant will have to be made readily available by storage. (ii) Qualified personnel will be hired to inspect the condition and maintain the plant on a regular basis. (iii) Regular test, maintenance and replacement of membranes, plants and equipment will be carried out in accordance to the recommendations from manufacturers or as recommended by the qualified personnel after inspection. (iv) Equalization tank with capacity of 443 m^3 (i.e. 3 x ADWF) will be provided to withhold the sewage temporarily in case of outage or overflow of the interim STP. (v) Tank away will be provided for prolonged outage of the interim STP, for disposal of sewage at designated sewage treatment works to be assigned by DSD.	Sewage Treatment and control.	Project Proponent/ Property management company/ Incorporated Owners	During operation	EIA, WPCO, Contractual requirements
<u>Waste Management</u>						
During Detailed Design:						
7.4.5	8.2	The demolition and construction work shall be considered in the planning and design stages to reduce the generation of C&D waste where possible. Landfill disposal shall only be considered as the last resort. Construction methods with minimum waste generation quantity and other environmental impacts shall be considered in the detailed design. Refuse collection points (RCP) will be provided for the residential development. In order to comply with Building Regulation, mechanical ventilation will be provided. The odour nuisance to the public can be minimized by incorporating the odour absorption system.	Waste management during construction	Project architect/ engineer, Project Proponent	During detailed design stage	EIA, Contractual requirements
During Construction Phase:						

7.4.2	8.3	• Demolition material would be generated from clearance of a small number of huts on-site. A "selective demolition" approach should be adopted so that reusable material such as wood, metal, and steel can be segregated for reuse or recycling as far as practicable. Inert building debris such as concrete and brick can also be reused on-site as lining or fill material. • Nevertheless, the generation of wastes from these materials should be minimized as far as practicable through recovery, reuse and/ or recycling. Whenever practicable, the production of construction waste due to over-ordering or as "side-products" of construction activities should be minimized by the contractor through careful design, planning, good site management, and control of ordering procedures, segregation and reuse of materials. • Wooden boards can be reused on-site or off-site, though the reusability and quantity of final waste will depend on the quality, size and shape of the boards. Those timbers which cannot be reused again shall be sorted and stored separately from all inert waste before disposed of at landfills. • Should construction site hoarding be erected, metal fencing or building panels, which are more durable than wooden panels, are recommended to be used as far as practicable. Opportunity shall also be sought to re-use any wooden boards used in site fencing on-site or off-site. Concrete and masonry can be crushed and used as fill material if practicable. On-site incineration of wooden waste is prohibited. In order to avoid dust, odour and erosion impacts, all stockpile areas at the Project Area should be covered with tarpaulin or impermeable sheets. Any vehicle carrying C&D waste should have their load covered when leaving the works area. Vehicles should be routed as far as possible to avoid sensitive receivers in the area.	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	EIA, Contractual requirements

7.4.2.3	8.3	• Chemical waste may include fuel, oil, lubricants, cleaning fluids, and solvents arising from leakage or maintenance of on-site equipment and vehicles. Chemical generated from daily operation of the construction works shall be recycled/ reused on-site as far as practicable. • If off-site disposal of chemical waste is required, they should be collected and delivered by licensed contractors to Tsing Yi Chemical Waste Treatment Facility and be disposed of in strict accordance with the Waste Disposal (Chemical Waste) (General) Regulation. Contractors shall register with EPD as chemical waste producers when disposal of chemical waste is anticipated to be required. Chemical waste materials have to be stored on-site with suitable containers and away from water bodies so that leakage or spillage is prevented during the handling, storage, and subsequent transportation. • Handling, storage and disposal of chemical wastes are in accordance with the Waste Disposal (Chemical Waste) (General) Regulation and the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. • The Contractor shall prevent fuel and lubricating oil leakage from plant and storage sites from contaminating the construction site. All compounds in work areas shall be positioned on areas with hard paving and served by drainage facility. Sand/ silt traps and oil interceptors shall be provided at appropriate locations prior to the discharge points. • General refuse generated at the construction site should be stored separate from construction and chemical wastes to avoid cross contamination. A reliable waste collector shall be employed by the Contractor to remove general refuse from the construction site on a daily basis where appropriate to minimize the potential odour, pest and litter impacts.	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	Waste Disposal (Chemical Waste) (General) Regulation

7.4.2.4 & 7.4.5	8.3	Open burning for the disposal of construction waste or the clearance of the Project Area in preparation for construction work is prohibited under the Air Pollution Control (Open Burning) Regulation. To ensure the appropriate handling of the C&D materials, it is recommended that a Waste Management Plan (WMP) shall be developed by the contractor and incorporated in the Environmental Management Plan (EMP) in accordance with ETWB TCW No. 19/2005 – Environmental Management on Construction Sites at the commencement of the construction works. The EMP should be developed taking into account the recommended control measures given in this section where appropriate. The EMP shall be submitted to the Engineer at the commencement of the project for approval and to be implemented throughout the Project. The potential for recycling or reuse should be explored and opportunities taken if waste generation is unavoidable The EMP should provide recommendations for appropriate disposal routes if waste cannot be recycled. The EMP should include the method statement for demolition and transportation of the excavated materials and other construction wastes. The EMP should be approved before the commencement of construction. All mitigation measures arising from the approved EMP should be fully implemented. The project proponent will ensure that the day-to-day operations comply with the approved EMP. According to the EMP, the project proponent shall control the disposal of public fill, C&D materials and C&D waste to public fill reception facilities, sorting facilities and landfills respectively through a trip-ticket system. The project proponent shall require the contractor to separate public fill from C&D waste for disposal at appropriate facilities. In addition, the project proponent shall record the disposal, reuse and recycling of C&D materials for monitoring purposes.	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	EIA, Contractual requirements
7.4.5	8.3	In formulating the EMP in respect to waste management, the following hierarchy should be considered: • Avoidance and minimization to reduce the potential quantity of C&D materials generated; • Reuse of materials as practical as possible; • Recovery and Recycling as practical as possible; • Proper treatment and disposal in respect to relevant laws, guidelines and good practice; and • Landfill disposal shall only be considered as the last resort.	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	DEVB TC(W) No. 6/2010 “Trip Ticket System for Disposal of Construction and Demolition Material

7.4.5	8.3	A good management and control plan would be formulated. Good management and control can prevent the generation of significant amount of waste. On-site sorting of construction wastes will be recommended. Secondary on-site sorting can be achieved by avoiding the generation of "mixed waste" through good site control. Construction wastes shall be sorted to remove contaminants, with the inert materials broken up into small pieces before being transported to landfill sites.	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	EIA, Contractual requirements
7.4.5	8.3	In addition, the contractor(s) shall be required to reuse inert C&D materials (e.g. excavated soil) or in other suitable construction sites as far as possible, in order to minimize the disposal of C&D materials to public fill reception facilities. The project proponent shall encourage the contractor to maximize the use of recycled or recyclable C&D materials, as well as the use of non-timber formwork to further minimize the generation of construction waste.	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	EIA, Contractual requirements

7.4.5	8.3	The following additional control/ mitigation measures are recommended to be followed by the Contractor: • Storage of different waste types – different types of waste should be segregated and stored in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal. An on-site temporary storage area equipped with required control measures (e.g. dust control) should be provided; • Trip-ticket system – in order to monitor the proper disposal of non-inert C&D waste to landfills and to control fly-tipping, a trip-ticket system should be included as one of the contractual requirements and audited by the Environmental Team; • Records of Wastes – a recording system should be proposed to record the amount of wastes generated, recycled and disposed of (including the location of disposal sites); • Training – The contractor should provide his workers with proper training of appropriate waste management procedure to achieve waste reduction as far as practicable and cost-effective through recovery, reuse and recycling and avoid contamination of reusable C&D materials; • Incorporate good practice in "Recommended Pollution Control Clauses for Construction Contracts" published by EPD in respect to removal of waste material from the construction site into the contract of the contractor. No excavation of pond sediment is expected due to the Project works, however, in case such pond sediment is encountered during construction, testing and disposal of excavated sediment shall follow the requirements in PNAP ADV-21[21], where appropriate. The stockpiled malodorous materials should be covered entirely by plastic tarpaulin sheets and removed from Project Area as soon as possible within 24 hours. Disposal of excavated sediment shall follow the requirements stated in Buildings Department's PNAP ADV-21 for "Management Framework for Disposal of Dredged/ Excavated Sediment"	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	DEVB TC(W) No. 6/2010 "Trip Ticket System for Disposal of Construction and Demolition Material

21 PNAP ADV-21, Management framework for disposal of dredged/ excavated sediment, April 2007 version, published by Buildings Departments.

7.4.5.1	8.3	• The Contractor shall submit to the Engineer for approval a waste management plan with appropriate mitigation measures including the allocation of an area for waste segregation and shall ensure that the day-to-day site operations comply with the approved waste management plan. • The Contractor shall minimize the generation of waste from his work. Avoidance and minimisation of waste generation can be achieved through changing or improving design and practices, careful planning and good site management. • The Contractor shall ensure that different types of wastes are segregated on-site and stored in different containers, skips or stockpiles to facilitate reuse/recycling of waste and, as the last resort, disposal at different outlets as appropriate. • Excavated top soil materials due to retaining wall construction shall be reused on-site for the site formation of developable area, formation of landscape area within the developable area or the construction of the wetland area. Therefore, it is expected that there will not be any disposal of the excavated material. In case there is any surplus excavated material or the concerned material is found not suitable for re-use on-site, this will be disposed of at public fill facility. Landfilling will only be the last resort in any case. • The reuse and recycling of waste shall be practised as far as possible. The recycled materials shall include paper/cardboard, timber and metal etc. • The Contractor shall ensure that Construction and Demolition (C&D) materials are sorted into public fill (inert portion) and C&D waste (non-inert portion). The public fill which comprises soil, rock, concrete, brick, cement plaster/mortar, inert building debris, aggregates and asphalt shall be reused in earth filling, reclamation or site formation works. The C&D waste which comprises metal, timber, paper, glass, junk and general garbage shall be reused or recycled and, as the last resort, disposal of at landfills. • The Contractor shall record the amount of wastes generated, recycled and disposed of (including the disposal sites).	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	DEVB TC(W) No. 6/2010 “Trip Ticket System for Disposal of Construction and Demolition Material

7.4.5.1	8.3	• The Contractor shall use a trip ticket system for the disposal of C&D materials to any designated public filling facility and/or landfill. • Training shall be provided for workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling. • Spent bentonite slurries, if any, will be handled and disposed of properly in accordance with the requirements set out in the Practice Note for Professional Persons (PN1/94) Construction Site Drainage.	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	DEVB TC(W) No. 6/2010 "Trip Ticket System for Disposal of Construction and Demolition Material
7.4.5.2	8.3	The Contractor shall not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the Project Area onto any adjoining land or allow any waste matter [or refuse] which is not part of the final product from waste processing plants to be deposited anywhere within the Project Area [or onto any adjoining land]. He shall arrange removal of such matter from the Project Area [or any building erected or to be erected thereon] in a proper manner to the satisfaction of the Engineer in consultation with the Director of Environmental Protection.	Waste management during construction	Project Engineer, Contractor	Throughout the entire construction period	DEVB TC(W) No. 6/2010 "Trip Ticket System for Disposal of Construction and Demolition Material
7.4.5.3	8.3	The Contractor shall apply for registration as chemical waste producer under the Waste Disposal (Chemical Waste) (General) Regulation when chemical waste is produced. All chemical waste shall be properly stored, labelled, packaged and collected in accordance with the Regulation.	Waste management during construction	Contractors	At all construction areas of the site during the entire construction period	Waste Disposal (Chemical Waste) (General) Regulation
During Operation Phase:						
7.5	8.4	Refuse collection points (RCP) will be provided for the residential development. In order to comply with Building Regulation, mechanical ventilation will be provided. The odour nuisance to the public can be minimized by incorporating the odour absorption system. With proper management and maintenance of the waste facilities, possible leachate impact from the RCP is not anticipated.	Waste management during operation	Project Proponent/ Property Management Company, Incorporated Owners	During operation	EIA, Waste Disposal Ordinance

7.5	8.4	It is also recommended that collection bins for used aluminium cans, waste paper and glass bottles should be provided at strategic locations of the residential development area to promote and encourage recycling by residents during the operational phase.	Waste management during operation	Project Proponent/ Property Management Company, Incorporated Owners	During operation	EIA, Waste Disposal Ordinance
Ecology						
During Detailed Design:						
8.10.3.3	10.4	Design of the temporary noise barriers should include elements which would reduce potential bird collision impact, such as the use of opaque, non-reflective materials and colour that blend in with the environment.	Minimize the ecological impact	Project architect and Project Proponent	During detailed design stage	EIA
8.11.1.2	10.2	The habitats in the north of the Project Area (including ponds, marsh, seasonally wet grassland and agricultural land) will be retained and enhanced under the Recommended Option. Wetland compensation will be provided for the residual loss of wetland habitats within the Project Area	Minimize the ecological impact	Project architect and Project Proponent	During detailed design stage	EIA
8.11.1.2 , & 2.9	10.2	A total of 3.8 ha of wetland habitat will be enhanced / restored within the Wetland Restoration Area (WRA) including 0.2 ha of Area 40. The design of wetland within the WRA is such that the overall wetland function of the Project Area will be increased in comparison to existing conditions. Details of the design rationale and management and monitoring methodologies for these wetland habitats within the WRA are given in the Wetland Restoration Plan in Appendix 8-10 of the EIA. Table 8-42 to Table 8-44 of the EIA describe the functions of each proposed wetland habitat within the WRA. In addition, herpetofauna corridors will be provided along the eastern side of the Project Area (about 9m to 19m wide) to provide an ecological corridor between Area 40 and the restored wetland at A1, permitting the dispersal of amphibians between these sites (see Section 2 and Figure 2-9 of the EIA).	Minimize the ecological impact	Project architect and Project Proponent	During detailed design stage	EIA

8.11.1.2	10.2	The main WRA is situated on the northern side of the Project Area, comprising three deep water ponds separated by grassy bunds and bordered by areas of shallow water (except the pond located in Pond 18). Several gravel islands are situated in the shallow water zones, with two bamboo clumps planted in the middle of the south-westernmost gravel island. Several clumps of bamboo will also be planted in the northern and south western boundaries of the Area. Marsh cells are proposed in the southeast of the WRA and separated by grassy bunds. To minimize disturbance, the main WRA will be buffered from the proposed development by wooded bund and/or reed, and from the existing development in the north by grassy bund/reed bed. A total of 3.8 ha of wetland habitat will be enhanced / restored within the Wetland Restoration Area (WRA), including 0.2 ha of Area 40. The design of wetland within the WRA is such that the overall wetland function of the Project Area will be increased in comparison to existing conditions. Details of the design rationale and management and monitoring methodologies for these wetland habitats within the WRA are given in the Wetland Restoration Plan in Appendix 8-10 of the EIA. Table 8-42 – Table 8-44 of the EIA describe the functions of each proposed wetland habitat within the WRA.	Minimize the ecological impact	Project architect and Project Proponent	During detailed design stage	EIA
8.11.2.1	10.2	Clear demarcation of the Project Area limits is required in order to minimize and contain any disturbance during the construction period. Special attention will be paid to the northern and north-western limits of the Project Area, which are adjacent to the inactive/abandoned ponds connected with the Deep Bay wetland system. These pond areas and the associated wildlife are regarded as ecologically sensitive receivers from the proposed development.	Minimize the ecological impact	Project architect and Project Proponent	During detailed design stage	EIA
8.11.2.1	10.2	Reed bed and wooded bund habitats, fenced by a perimeter wall of 1.8 m high on the landward side, will be formed along the interface between the WRA and the proposed residential area. Together with landscape planting and (any) retention of existing trees along the interface, mature reed bed and moderate-sized shrubs and trees will minimize disturbance to waterbirds in the open water zones and marshy habitats. No unsupervised public access into the WRA and the adjacent ponds will be allowed, to ensure that direct human disturbance to waterbirds in the adjacent wetlands will be avoided as far as possible. On the boundary between the WRA and the adjacent ponds outside the Project Area a 1.8m high fence will be formed to prevent unsupervised public access from surrounding footpaths without reducing ecological continuity and connectivity with the adjacent wetland habitats	Minimize the ecological impact	Project architect and Project Proponent	During detailed design stage	EIA

8.11.2.4	10.2	To ensure the continuity of habitats for wetland-dependent taxa, in particular herpetofauna, and to fulfil the 'No-Net-Loss' of wetland habitats criterion, the following measures safeguarding the continuity of wetland habitats will be implemented: • Provision of wetland habitats in a unit contiguous and continuous with the existing ponds in the east including measures to restore linkages between (currently isolated) Area 40 and the wider wetland system; • Avoidance of anthropogenic structures in the boundaries adjacent to the existing wetland habitats, and employment of natural barriers such as grassy bund, reed bed and (wet) wooded planting, which will serve as potential roosting and foraging sites for many species; and • Concentration of the proposed development in the south and west of the Project Area, adjacent to existing anthropogenic habitats (Yau Pok Road and Fairview Park) to reduce additional anthropogenic impacts to a minimum.	Minimize the ecological impact	Project architect and Project Proponent	During detailed design stage	EIA
8.13.1	10.2	The detailed rationale of formulating the target species for the WRA is given in Section 4.2 of Appendix 8-10 and a summary of the target species is shown in Table 8-52 of the EIA.	Minimize the ecological impact	Project architect and Project Proponent	During detailed design stage	EIA
App 8.10, S 3.1.2	App. III	Detailed design of the WRA should be conducted upon approval of the planning application and the relevant details to be submitted to relevant government authorities for approval prior to commencement of construction of the WRA.	Minimize the ecological impact	Contractor and Project Proponent	Prior to the Construction Phase	EIA
App 8.10, S 4.3.13	App. III	Target levels of the WRA are to be derived from the baseline ecological monitoring.	Minimize the ecological impact	Contractor and Project Proponent	After the baseline ecological monitoring	EIA
During Construction Phase:						

8.11.1.4	10.3.2, 10.4.8	Loss of habitats for bird species of conservation importance including the four species mentioned above (Little Egret, Chinese Pond Heron, Red-throated Pipit and Greater Painted-snipe) will be compensated by the provision of suitable habitats in the WRA, including marsh, grassy bund, bamboo clumps and shallow water zone. Temporary impacts and disturbance to these bird species through loss of foraging habitat during wetland construction are minimized by providing a temporary enhancement area (Figure 8-6), in the form of shallow water pond and marsh, on existing agricultural land at the south western part of the Project Area. The temporary wetland enhancement area will be operated by maintaining traditional wetland agricultural farming practices. The direct impact and disturbance to wetland birds will be limited to the start of the construction period, as the WRA will be constructed during the wet season of the first year of construction and prior to main construction of the proposed residential development to minimize impacts during the period of greatest abundance of waterbirds. Accordingly, operation of the temporary wetland enhancement area will be stopped after the completion of the construction and planting/ replacement planting works of the WRA.	Minimize the ecological impact	Contractor and Project Proponent	During Construction Phase	EIA
8.11.2.1	10.4.8 10.4.5	Construction of the WRA will be undertaken at the start of the proposed project (prior to the main residential construction), with earthworks restricted to minimal pond re-profiling work for excavating the existing ponds to a depth of 1 – 2.5m, re-contouring the pond bund and excavating some existing pond bunds to provide larger ponds. The proposed earthworks are similar to usual fish pond maintenance practice, and earthwork machinery will be restricted to a small dredger as is commonly utilised in fish pond maintenance. Furthermore, a temporary hoarding around the WRA and a movable noise barrier around the machinery will be maintained during the construction of WRA. Once the temporary barrier is formed, the site formation for the WRA will be completed in the wet season of the first construction year, so as to minimize disturbance impacts during the period of greatest abundance of disturbance-sensitive waterbirds. In addition to the above measures, impacts on waterbirds during the construction of the WRA will be minimized by the utilization of an area of existing agricultural land in the west of the Project Area for the temporary provision of shallow water pond (0.75ha) and marsh (0.35ha) during WRA construction..	Minimize the ecological impact	Contractor and Project Proponent	During Construction Phase	EIA

8.11.2.1	10.3.4	During the construction period, no dogs will be allowed on the construction site to ensure that these do not provide a source of disturbance to waterbirds. Good site practice and selection of quiet equipment are expected to minimize noise impacts to waterbirds. Night-time light disturbance will be minimized by limiting the amount of lighting on the Project Area and by locating light sources far away from the adjacent ponds. Planting and initial vegetation maintenance will commence in the subsequent wet season.	Minimize the ecological impact	Contractor and Project Proponent	During Construction Phase	EIA
8.11.2.1	10.4.4	During the following 1.5 years of establishment and stabilization, the temporary barrier around the northern, eastern and north western boundary of the WRA will be replaced with a 1.8m high dog-proof chain-link fence so that the wetlands in WRA will be able to integrate with the adjacent ponds and will provide a buffer from ongoing construction work in the residential development and to prevent disturbance to the WRA resulting from access by human and dogs.	Minimize the ecological impact	Contractor and Project Proponent	During Construction Phase	EIA
8.11.2.1	10.4.6	During the main construction phase for the residential development, a temporary 3m high visual barrier will be erected along the interface between the WRA and the residential area. The only major sensitive receivers to the disturbance impacts arising during the Construction Phase are large waterbirds, a considerable number of which utilize the wetland system to the northwest of the Project Area (approximately 400 – 500m away from the proposed residential area). In addition to the presence of the 100m wide WRA which will perform as a buffer zone between these areas of high wildlife utilization and the proposed residential area, the construction of temporary 3-m visual barrier will further reduce anthropogenic disturbance and impact from the proposed residential area, to the adjacent ponds. Good site practices will be followed to minimize noise, visual and light disturbance to the waterbirds.	Minimize the ecological impact	Contractor and Project Proponent	During Construction Phase	EIA
8.11.2.3	10.4.7	Good site practice during the construction phase, appropriate design of the surface water collection system and efficient sewerage management is required in order to eliminate on-site run-off to the Channel and Deep Bay system	Minimize the ecological impact	Contractor and Project Proponent	During Construction Phase	EIA
8.11.2.5	10.4.5	A temporary hoarding and a movable noise barrier around the WRA will be maintained during the construction of WRA to minimize the noise impact. The site formation of the WRA will be carried out during the wet season to avoid the period of greatest abundance of disturbance–sensitive waterbirds. The proposed temporary wetland enhancement area will mitigate the temporary loss of wetland habitat within the Project Area and during the construction of WRA	Minimize the ecological impact	Contractor and Project Proponent	During Construction Phase	EIA
App 8.10, S 4.3.13	App. III	The performance of the WRA and its management and monitoring requirements will be reviewed and agreed with relevant government authorities after the establishment period.	Minimize the ecological impact	Contractor and Project Proponent	After establishment period of WRA	EIA

During Operational Phase:						
8.11.2.3	10.5.8	During the operational phase, no sewage or water from the residential areas will be discharged into the WRA, which will be fully self-contained, with rainwater as its major water source. Pond water will only be transferred between ponds, thus no pond water discharge is expected (layout of WRA is shown in Figure 8-5 of EIA report). All sewage from the site would be treated by the interim sewerage treatment plant (or the public sewer system upon completion) prior to discharge. Surface water runoff from the residential area will be collected and discharge into NTMDC after passing through sand traps and/or oil interceptors, especially for car parks and similar facilities. In addition, a system of containment bunding will be implemented (where appropriate) in the event of emergency (such as car accident which involved major spillage of oil, chemical or fuel, dispersants or fire fighting foam etc.).	Minimize the ecological impact	Project Proponent	During Operation	EIA
8.11	10.5.8	No fertilizers and herbicides will be routinely used for vegetation management in the WRA, hence reducing any potential source of contamination into the adjacent watercourses that feed into Deep Bay.	Minimize the ecological impact	Project Proponent	During Operation	EIA
8.11.2.1	10.2.8, 10.2.9	• Reed bed and wooded bund habitats, fenced by a permanent perimeter wall of 1.8 m high on the landward side, will be formed along the interface between the WRA and the proposed residential area. Together with landscape planting and retention of existing trees along the interface, mature reed bed and moderate-sized shrubs and trees will minimize disturbance to waterbirds in the open water zones and marshy habitats. No unsupervised public access into the WRA and the adjacent ponds will be allowed to ensure that direct human disturbance to waterbirds in the adjacent wetlands will be avoided as far as possible. • On the boundary between the WRA and the adjacent ponds outside the Project Area a 1.8m high fence will be formed to prevent unsupervised public access from surrounding footpaths without reducing ecological continuity and connectivity with the adjacent wetland habitats	Minimize the ecological impact	Project Proponent	During Operation	EIA
8.13.2.3	10.6.3	Ecological monitoring during the operational phase is essential to assess the effectiveness of the restored/enhanced wetland in attracting wildlife and implementing proper wetland management approach in any unexpected events. Abundance and diversity of fauna groups (birds, dragonflies, butterflies and herpetofauna) and their prey (aquatic invertebrates, benthic invertebrates and freshwater fish) are required for the monitoring. The frequency of the monitoring is summarized in Table 8-53 of the EIA and the methodology is detailed in Section 7 of Appendix 8-10. The management strategy and requirements of the WRA during the operational phase, are provided in the Wetland Restoration Plan in Appendix 8-10 of the EIA.	Minimize the ecological impact	Project Proponent	During Operation	EIA

Fisheries						
During Construction Phase:						
9.5.2	10.8	Good site practices will be implemented during the construction phase of the Project. Excavated material and other inert construction wastes produced will be transferred to proper recipients (i.e. landfill). An emergency response plan for any water pollution in the fish ponds surrounding the Project Area will be implemented.	To prevent runoff and other water quality impacts affecting surrounding watercourses and ponds downstream.	The Contractor	During the construction phase.	EIA
During Operation Phase:						
Nil	Nil	Nil	Nil	Nil	Nil	Nil
Cultural Heritage						
During Construction Phase:						
Nil	Nil	Nil	Nil	Nil	Nil	Nil
During Operation Phase:						
Nil	Nil	Nil	Nil	Nil	Nil	Nil
Landscape and Visual						
During Detailed Design						
11.10.2 to 11.10.4	9.2	The landscape and visual mitigation measures detailed in **Tables 11-5A; 11-5B; 11-8A and 11-8B** of the EIA report shall be adopted during the detailed design, and be built as part of the construction works so that they are in place at the date of commissioning of the Project.	Avoid impacts on adjacent landscape.	Project architect and Project Proponent	During detailed design stage	EIA
11.10.4	9.2	A list of species appropriate for mitigation planting is provided in **Table 11-6** in the EIA report. The planting list is subject to specialist design and investigation at the detailed design stage to maintain a suitable ecological enhancement plant community. The planting will comprise principally of native trees and shrubs selected for their ecological value to the area.	Avoid impacts on adjacent landscape	Project architect and Project Proponent	During detailed design stage	EIA
During Construction Phase:						

11.10.2	9.2	Other mitigation measures including strategies for reducing, offsetting and compensating for impacts have been designed into the Project and to be implemented during construction. These are identified in **Table 11-5A, 11-8A** as following:	Minimum impacts on adjacent landscape.	Project Proponent (via Contractor)	During Construction Phase	EIA
11.10.2	9.2	**CM1** - **Proper protection of existing trees designated to be retained in-situ** Existing trees designated to be retained in-situ will be properly protected. This may include the clear demarcation and fencing-off of tree protection zones, tight site supervision and monitoring to prevent tree damage by construction activities, and periodic arboricultural inspection and maintenance to uphold tree health. A total of 6 nos. of trees will be retained in-situ. Other trees mostly are growing in raised ridges or slopes between ponds and vegetable fields, which result in difficulties for tree to be retained or transplanted.	Minimum impacts on adjacent landscape.	Project Proponent (via Contractor)	During Construction Phase	EIA
11.10.2	9.2	**CM2** - **Enhancement of Wetland/Pond Area Expansion** Existing abandoned wetland/ pond area will be expanded and enhanced into a larger and comprehensive wetland restoration area. The enhancement works of wetland/pond will be commenced in early stage to establish the migration of some ecological habitats. Along the interfaces between the proposed residential areas and the WRA, it is proposed to erect a 3m high perimeter temporary fence/ hoarding to define the site and prevent unauthorized access. This perimeter temporary fence/hoarding will be buffered by planting of moderate to tall sized trees and shrub. Enhancement of the wetland/pond will result in the increase of the wetland/pond area from its current 3.0 ha to around 3.8 ha.	Minimum impacts on adjacent landscape.	Project Proponent (via Contractor)	During Construction Phase	EIA
11.11.3	9.2	**CM3** - Height of temporary noise barrier along the development boundary is kept to minimum required. Temporary Noise Barrier finishes and materials will be re-used from the approved existing temporary noise barrier from Wo Shang Wai project which have an opaque and non-reflective material with colour blending in with the environment to minimize visual impact and to avoid bird strike.	Minimum impacts on adjacent landscape.	Project Proponent (via Contractor)	During Construction Phase	EIA
11.11.3	9.2	**CM4** - Advance screen planting of fast growing large shrub and ground cover species to noise barriers and hoardings.	Minimum visual impacts	Project Proponent (via Contractor)	During Construction Phase	EIA
11.11.3	9.2	**CM5** – Control of night-time lighting by hooding all lights	Minimum visual impacts.	Project Proponent (via Contractor)	During Construction Phase	EIA

11.11.3	9.2	**CM6** - Reduction of construction period to practical minimum.	Minimum visual impacts.	Project Proponent (via Contractor)	During Construction Phase	EIA
During Operational Phase:						
11.10.2	9.2	Mitigation measures including strategies for reducing, offsetting and compensating for impacts have been designed into the Project and to be implemented during operation phases. These are identified in **Table 11- 5B, 11-8B** as followings	Minimum impacts on adjacent landscape and visual	Project Proponent	During Operational Phase	EIA
11.10.2	9.2	**OM1 - Maximizing Tree Preservation Effort** Healthy existing trees that are not affected by the proposed development will be retained in-situ. Affected existing trees that are of high to medium amenity value and high to medium survival rate after transplanting will be transplanted	Minimum impacts on adjacent landscape and visual	Project Proponent	During Operational Phase	EIA
11.10.2	9.2	**OM2 – Provision of New Trees** Compensatory tree planting shall be provided for soft landscape in the proposed development. The tree compensation to tree loss ratio shall be at least 1:1 in term of quantity and quality within the Project Site. Required numbers and locations of compensatory trees shall be determined and agreed separately with Government during the Tree Felling Application process under ETWBTC 3/2006.	Minimum impacts on adjacent landscape and visual	Competent Conservation Agent identified by Project Proponent	During Operational Phase	EIA
11.10.2	9.2	**OM3** - **Suitable Design for WRA and Residential Development** The landscape design for the wetland restoration area in the north and western portion of the Project Site will be maximised for wetland habitat restoration consistent with achieving other parameters and the design on the residential development on the center to south western portion of the Project Site will adopt a rural, naturalistic approach with open space to compliment the original landscape character. Emphasis will be placed on a balanced approach between trees and grass/herbs. Use native species will be proposed for the planting design theme. No access is allowed for unauthorised person. Along the interfaces between the proposed residential area and the WRA, it is proposed to erect a 1.8m high fence wall. Natural materials, such as timbers, will be mostly used for landscape hardworks. Management and maintenance of the WRA shall be carried out by a separate unit from the residential estate and follow the specifications in Section 5.5 of Appendix 8-10.	Minimum impacts on adjacent landscape and visual	Incorporated Owners/ Management Company	During Operational Phase	EIA
11.10.2	9.2	**OM4** - **Provision of Buffer Planting along WRA** Tree and shrub planting will be provided at strategic locations along the WRA to ensure connectivity with the adjacent habitats while minimising potential disturbance impact to the wetland.	Minimum impacts on adjacent landscape and visual	Incorporated Owners/ Management Company	During Operational Phase	EIA

11.11.3	9.2	**OM5** - **Continuous belt of screen planting within the Project Site** Continuous buffer planting along the south-western and southern boundary of the Project Site and along the edge of residential area adjacent to WRA will be provided and planted outside the fence/ boundary wall by by featuring trees capable of reaching a height >10m within 10 years.	Minimum impacts on adjacent landscape and visual	Competent Conservation Agent identified by Project Proponent	During Operational Phase	EIA
11.11.3	9.2	**OM6** - Use appropriate (visually unobtrusive and non-reflective) building materials and colours in built structures.	Minimum impacts on adjacent landscape and visual	Private Owners	During Operational Phase	EIA
11.11.3	9.2	**OM7** - Streetscape elements (e.g. paving, signage, street furniture, lighting etc.) sensitively designed in a manner that responds to the local context, and minimizes potential negative landscape and visual impacts. Lighting units to be directional and minimising unnecessary light spill.	Minimum impacts on adjacent landscape and visual	Incorporated Owners/ Management Company	During Operational Phase	EIA
11.10.2	9.2	A list of species appropriate for mitigation planting is provided in **Table 11-6** in the EIA report. The planting list is subject to specialist design and investigation at the detailed design stage to achieve two fundamental aims: to maintain a suitable ecological enhancement plant community and to prevent colonisation of terrestrial plants and / or unwanted exotics. The planting will comprise principally of native trees and shrubs selected for their ecological value to the area.	Avoid impacts on adjacent landscape	Incorporated Owners/ Management Company	During detailed design stage	EIA

15. CONCLUSIONS

15.1 Air Quality

Through proper implementation of dust control measures required under the Air Pollution Control (Construction Dust) Regulation and good site practice, construction dust can be controlled at source to acceptable levels and hence no unacceptable impact is anticipated.

Practical mitigation measures have already been proposed for this Project to alleviate potential impacts during construction. The concerned site formation works will only be short-term and potential air quality impacts have been reduced to a minimal through recommended mitigation measures and can comply with the relevant air quality criteria/ AQOs. Thus, no adverse construction dust impact is anticipated.

The Project can satisfy the buffer distance requirements as given in the HKPSG, thus no unacceptable air quality impacts due to vehicular emissions is envisaged during operational phase of the Project. There is also no chimney identified within 500m from the Project site boundary and hence no unacceptable air quality impact due to industrial emissions impacts is expected.

During the operational stage, no adverse odour impact is anticipated, especially the interim sewage treatment plant comprising a combination of membrane bioreactor system and reverse osmosis system will be located underground within a totally enclosed building, and that the exhaust of the totally enclosed interim sewage treatment plant will be equipped with odour removal system. The exhaust will be directed away from the nearby ASRs. In a long run, the interim STP will be decommissioned once connection to public sewerage is available.

Given the scale of the Project (for small house development), there are no major planned dust generating or air pollutant emission sources from the proposed development that would contribute to any adverse impact on air quality. Thus, the Project Site itself is unlikely to generate any air pollution nuisance. Vehicular emissions due to additional traffic generated/ attracted by this Project is found to be insignificant and negligible, thus this Project will not attribute to any deterioration on air quality. A licensed waste collector will be employed to collect domestic waste on daily basis during operational phase and Refuse collection points (RCP) will be provided for the residential development. Thus, no adverse odour impact is anticipated.

15.2 Noise

Construction noise impact is not envisaged a key issue. With the implementation of noise mitigation measures such as careful design of layout and construction methodology for proposed WRA as well as erection of sufficient noise barrier for residential portion, construction noise levels at the NSRs will comply with the noise standard. No residual noise impact is expected.

As there will be predicted full compliance with the noise criteria for road traffic noise and fixed plant during the operational phase, no noise mitigation measures are therefore recommended.

15.3 Water Quality

The major impacts during construction of the Project will be construction site surface runoff and soil erosion associated with exposed surfaces. Standard best practices as well as site specific measures have been recommended in order to avoid and minimise potential impacts. Peripheral site drainage system comprising precast concrete u-channels,

sedimentation basins, sand traps and similar facilities together with those good site practices stipulated in ProPECC Note PN 1/94, have been recommended. Construction site runoff will be collected, and pretreated effluent will be discharged into the NTMDC following the existing flow regime. By adopting good site management practices and proposed mitigation measures, adverse water quality impact is not expected. The Contractor will be required to apply for a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence.

During the operation of the Project, sewage generated will be discharge to the planned public sewerage system under the permanent sewage disposal scheme, thus there will be no adverse water quality impact. An interim STP will be provided for treatment of sewage generated from the proposed development site until the public sewerage system becomes available. The STP has been designed in such a way to comply with the no net increase in pollution loading requirement in Deep Bay. The effluent discharge issue has been addressed in Chapter 6 of the EIA report. The discharge from the STP is also subject to a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence as well as the conditions specified in the Environmental Permit of this Project.

Surface runoff from the development site will be discharged to the NTMDC. Pollutants, if any, will be pre-treated and settled before discharge. It was estimated that the increase in surface runoff due to this Project is negligible when compared with the design capacity of the NTMDC. Best Management Practices have been proposed in order to abate first flush pollution in stormwater runoff such as design measures to minimise soil erosion; minimizing paved area; proper managed landscape area; proper site drainage design/control; provision of devices/ facilities to control pollution and to remove pollution source; minimizing the use of fertilizers; and administrative measures for maintenance issues. Screening facilities such as gully grating, trash frille, and road gullies with silt traps and oil interceptor will be incorporated into the drainage design to control pollution. In addition, manhole with sand trap will be incorporated before final discharge.

Specific measures have also been recommended for the design, operation, and management of the WRA such as the operation is self-contained; overflow to be discharged into proper drainage system; and the discharge from residential area is to be diverted away from the WRA. With the recommended measures, there will be no unacceptable impacts to the water quality in the Deep Bay.

15.4 Sewerage and Sewage Treatment

The future public sewerage and pumping stations have been checked to have adequate spare capacity for conveying the overall sewage generated (including the additional sewage from the Project). All domestic sewage generated at the Project will be discharged to the planned public sewerage under the permanent sewage disposal scheme.

Considering that all the existing village houses and associated septic tanks within the site area will be vacated and demolished for the purpose of the proposed development, the residual pollution loads of the on-site STP will be reduced by offsetting the current pollution loads from the existing village houses after the completion of the proposed development.

The interim STP will therefore generate effluent contributing to no net increase of pollution loading to the Deep Bay required under the Town Planning Board (TPB) Guidelines, i.e. TPB PG-No.12C. Before the proposed future public sewerage is available for connection, it has been demonstrated that no adverse sewerage impact due to the development is anticipated.

Adverse short-term and long-term environmental impacts in respect of water quality, ecological, public health and safety arising from both the long term and interim sewerage scheme are not anticipated.

No adverse sewerage impact will result from the Project.

15.5 Waste Management

Waste that can be generated during the construction of the Project include inert and non-inert C&D materials associated with site clearance, excavation, and a small amount of chemical waste from the maintenance of construction plant and equipment, and general refuse from the workforce. Opportunities for reduction in waste generation through recovery, reuse or recycling are identified in the assessment.

With the implementation of recommended measures, no waste related regulatory non-compliance and unacceptable environmental impacts are expected to arise during the construction phase. No biogas hazard has been identified that could pose a risk to the Project as no pond filling activities would be involved. In addition, Project Area has been used for farming (proposed residential portion) and as a pond (proposed wetland restoration area). No potential contaminative activities/ operations have been identified in the past that will cause any land contamination issue for the Project Site.

During the operational phase, refuse collection points will be provided for the residential development with mechanical ventilation and odour absorption system. With proper management and maintenance of the waste facilities, possible leachate impact from the refuse collection point is not anticipated. Collection bins are also recommended to be provided at strategic locations of the residential development area to encourage recycling by residents.

15.6 Ecology

Ecological survey indicates that the habitats on-site support low numbers of fauna of conservation importance. All significant impacts to these fauna of conservation importance, both on and off-site, will be mitigated by appropriate measures during both the construction and operation of the Project. Furthermore, with the implementation of the Wetland Restoration Area and a long-term commitment to manage the area, it is likely that the Project will bring about moderate but significant ecological benefit to a site on the landward fringe of the Deep Bay wetland system.

15.7 Fisheries

Since the ponds inside the Project Area are not actively managed for commercial purpose, losing these ponds is unlikely to cause any significant impact on local culture fisheries. Indirect impacts during construction and operation phases would also be insignificant given that appropriate mitigation measures (e.g. measures for water quality impact) are implemented.

15.8 Cultural Heritage

From the surveys and review of relevant records, no sites of cultural heritage were identified in the 500m Assessment Area. The only potential cultural resource identified in the 500m Assessment Area is the Wo Shang Wai ancestral hall which has already been modified with modern structures and is located beyond the Project Area and an existing major residential development. It is therefore concluded that no cultural heritage resources will be affected by the Project.

15.9 Landscape and Visual

A net gain of trees and the restoration of wetland area that is expected to result from this Project will produce some Slight Positive landscape impacts. The residents of Fairview

Park, Palm Springs, and Yau Mei San Tsuen as well as motorists, cyclists and pedestrians along the Ngau Tam Mei channel are the most affected visually sensitive receivers but the residual visual impact will be Slight after mitigation planting matures.

It is considered that the landscape and visual impacts are acceptable with mitigation. There will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific mitigation measures.