Proposed Comprehensive Development at Wo Shang Wai, Yuen Long

Environmental Impact Assessment

(Volume 1 of 3)

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Mott Connell Ltd
7th Floor, West Wing Office Building
New World Centre
20 Salisbury Road
Tsim Sha Tsui, Kowloon
Hong Kong

Tel: 2828 5757

Fax: 2827 1823

Anne.Kerr@mottconnell.com.hk

in association with

Urbis Limited
Master Plan Limited
Asia Ecological Consultants Limited
Allied Environmental Consultant Limited

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1 INTRODUCTION

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

1.1 Background

1.1.1. In March 2005 the Project Proponent, **Profit Point Enterprises Limited (Ltd)**, acquired a development site in Yuen Long at Wo Shang Wai, as shown on **Figure 1.1**. The site has evolved from tidal flats for fishponds to infilled fishponds during the 1980's until 1991 almost 15 years before the Project Proponent obtained the site.

1.1.2. The statutory planning intent of the site at Wo Shang Wai is to provide an incentive for the restoration of degraded land through comprehensive residential and/or recreational development to include a wetland restoration area. It is also the intention of the zoning plan to encourage the removal of existing sporadic open storage uses on degraded land in the New Territories. The overarching objective of this Project is thus to formulate a land use system with creative layout design which will simultaneously benefit both the planned residential community and the created wetland and be sustainable in the long term. The Project will allow wetland restoration to be realised in harmony with residential development. It allows an opportunity for innovative ideas to be showcased to demonstrate that it is possible to achieve the planned intent to upgrade degraded areas in the New Territories in a sustainable manner with ecological enhancement to the Wetland Buffer Area within which the development site lies.

1.1.3. The Project, and thus the EIA has also sought ways to minimise impacts to acceptable levels and to harmonise the apparently conflicting concepts of providing residential developments and the adjacent sensitive ecology in the Deep Bay Buffer Zone. In order to put the proposed development into context it is important to note that the site is bounded on three sides by existing residential development and is in an area which has already been disturbed by development as illustrated in **Plate 1.1**.

1.1.4. In April 2005 **Mott Connell Ltd (MCL)** was commissioned to undertake an EIA for this project. A Project Profile was prepared and submitted to the Director of Environmental Protection (EPD), and in September 2005 a Study Brief No. ESB – 131/2005 for the "Proposed Comprehensive Development at Wo Shang Wai, Yuen Long" was issued. The EIA has been conducted by **MCL** with **Urbis** providing the urban planning and design, landscape and visual impact assessments. **Masterplan** and **Allied Environmental Consultant Limited** were also engaged to provide statutory planning inputs and noise impact assessment respectively to the EIA. In addition to the foregoing the Project has also benefited from ecological inputs from **Asia Ecological Consultants** (AEC) and **Ecology and Environment, Inc. (E&E)**. AEC has principally been responsible for input to the Ecological Assessments and developed the wetland restoration plans as well as providing suggestions on the management and maintenance aspects. In addition to which, the Wetland Management arrangement have been reviewed by one of Hong Kong's most experienced wetland lawyers, **John Davison**. The Project has also benefited from the adoption of the Continuous Public Involvement (CPI) process in which members of the public and interested bodies have been consulted at various stages of the Project development. The feedback received has been considered and used as appropriate in the development and refinement of the planned layout for this development project.

1.2 The Project

History and Existing Condition of the Site

1.2.1 As revealed in the Study on the Ecological Value of Fishponds prepared for Government in 1997, the Project Area was filled by 1991. Since then, the northeastern side of the Project Area has been used as open storage while the remaining area has remained vacant.

1.2.2 The existing habitat types within the proposed comprehensive development include developed area in active use (open storage for containers and lorry parking), bare ground (site access), grassland, seasonal marsh, freshwater marsh/reedbed and drainage ditches. The Project Area is surrounded by residential developments, Wo Shang Wai village, fishponds and an open storage area. The site context is shown on **Figure 1.1** whilst **Figure 1.2** illustrates the Project Area in relation to the Deep Bay Conservation Area and Wetland Buffer Area boundaries.

1.2.3 As the proposed project includes wetland restoration it is important to define the site using accepted terminology.

Definition of Wetland under the "Ramsar Convention" is:

1.2.4 "Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres."

1.2.5 *The Working Definition of Wetland as per the "Corps of Engineers, Wetlands Delineation Manual"* Wetlands Research Program Technical Report Y-87-1, 1987, which is more specific in terms of characterisation of a particular site, is as follows:

1.2.6 Wetland is defined as a site containing the following features:

- presence of wetland hydrology;
- presence of hydric soil; and/or
- presence of predominantly wetland vegetation.

1.2.7 At Wo Shang Wai the ecological surveys which were conducted between April 2005 and June 2006 recorded 66 plant species within the site itself. The vegetation observed on site is typically freshwater marsh/reedbed, seasonal marsh and grassland, with reed grass *Phragmites australis* and common grasses / herbs such as *Brachiaria mutica, Panicum* spp., *Paspalum* spp. respectively. Riparian vegetation along the drainage ditches within the site boundary is typical of those found in the northwest New Territories fishpond areas including *Brachiaria mutica, Panicum* spp., *Paspalum* spp., *Eleusine indica* and *Bidens alba*. No rare or protected plant species of conservation importance were identified under the Study. More details on the ecology of the site are given in Chapter 8 of this EIA.

1.2.8 From on-site observations, there are patches of standing water on site during the dry season as illustrated on **Figure 1.3**. As described later in this EIA the soils have been tested to determine their characteristics from, inter alia, a hydric soil perspective. No evidence of hydric soils exists except in five locations on the former fish pond bunds there is some indication of gleyed soil; refer to **Figure 1.4**. This suggests some wetland function, which is not unexpected considering the historical land use of the Project Area as bunded fishponds. The extent of the patches of standing water and the distribution of freshwater marsh vegetation is around 23% of the total Project Area. In summary the Project Area displays some wetland characteristics which have been considered when developing the design of the Project and the restored wetland in terms of both extent and component features.

Rationale of a Wetland Restoration Scheme with Residential Development

1.2.9 The rationale for the wetland restoration scheme with residential development is to restore part of the previously filled fishpond area to wetland with proper management in the operation stage. The Study on Ecological Value of Fishponds in Deep Bay Area (Aspinwall, 1997) showed that the area of scattered open storage along the boundary of the Conservation Area (CA) caused significant decreases in ardeid numbers using the fishponds, while the residential areas at the southern boundary were identified as significantly less intrusive than the open storage. The proposed residential development with wetland creation will eradicate the open storage uses that impact on bird numbers and restore the function of the wetland, thereby enhancing the ecological value of the Deep Bay Wetland Ecosystem. The restored wetland will:

- compensate for the loss of habitat as a result of proposed development;
- provide flood protection to the surrounding developed area;
- provide life support by increasing habitat heterogeneity and thus increasing the biodiversity of the area;
- provide ecological linkages between the site and the CA; set a buffer between the residential development (set-back) and the existing fishponds area to the north of the Project Area; and
- increase the biodiversity of the site and encourage various forms of wildlife.

Statutory Planning Intention of the Site

1.2.10 According to the Approved Mai Po and Fairview Park OZP No. S/YL-MP/6, the Other Specified Uses (Comprehensive Development and Wetland Restoration Area) [OU(CDWRA)] zone is intended to provide an incentive for the restoration of degraded wetlands through comprehensive residential and/or recreational development to include a wetland restoration area. It is also intended to phase out existing sporadic open storage and port back-up uses on degraded wetlands. However, new buildings should be located as far as practical away from Deep Bay to minimise disturbance to the CA. The maximum plot ratio of 0.4 and maximum building height of 6 storeys including car park is allowed under the statutory plans, with ancillary facilities to the domestic development disregarded in the plot ratio calculation.

Purpose and Objectives of the Proposed Project

1.2.11 The purpose of the Project is to develop the site in accordance with the Planning Objectives and permitted conditions stated in the Outline Zoning Plan (OZP). This permits comprehensive residential development with wetland restoration. The Project Proponents' objective is to provide high quality residential development which is in harmony with nature and its surroundings, while complying with the planning intention of the site.

1.2.12 The findings of the Environmental Impact Assessment (EIA) and in particular the ecological surveys and assessments have provided the basis for the development assumptions. For example, the bird flight paths and use of the site by different species groups gives an indication of the functions of the site. This information was then used in the analysis of the type of restored wetland to be developed. This information was also used in the development of the layout of the whole site, as well as in the layout of the proposed residential developments and in the building form, disposition and height.

Significance of the Proposed Project

1.2.13 The Project Area is adjacent to existing developed areas, where the building form and landscaping provide few opportunities for biodiversity. The adjacent developments have also been created from infilled fishponds and thus have a similar basis for development. The difference between the adjacent developments and the proposed development relates to the fact that the planning intent for the Project Area combines the comprehensive development with wetland restoration. In essence, the intent is that the proposed development should be in harmony with its surroundings including the residential developments which are close to the boundaries of the Project Area. The wetland restoration proposals conform to the requirements of the Town Planning Board Guideline for Application for Developments within Deep Bay Area under Section 16 of the Town Planning Ordinance, TPB PG-No. 12B, (TPB 12B) and are in close proximity to the existing fishponds, thereby providing continuity and connectivity with the Conservation Area.

1.2.14 This development presumption is based on a series of guiding principles which were translated into development objectives and illustrated on the "bubble diagram" (see **Figure 2.1**). The "bubble diagram" was drawn up using sound wetland design and management principles and has been reviewed and developed as the information and data became available from the ecological and other baseline surveys, as well as the planning guidelines including those defined in TPB PG-No. 12B.

Scenario without the Proposed Project

1.2.15 The scenario without the project would essentially be further environmental degradation and more ecological harm. The existing temporary uses of the site may prevail, grassland and low shrubs would develop through natural succession, developing into tall grassland and low scrub. Active vegetation management would be required on a regular basis to maintain the grassland at a low height otherwise there is the potential for unwelcome users of the site (rats, mice, illegal immigrants etc. who might hide in tall grass). This is undesirable from a "good neighbour perspective", and on the basis that in order to reduce the risk of grass fires, clearing of the site would need to take place frequently, which would reduce the ecological value of the site. This scenario is described in more detail in Section 2 under consideration of the alternatives for development.

1.3 EIAO and Designated Projects

1.3.1 As the Project Area is 21.36 hectares (ha) including two zones (Other Specified Uses (OU) and Village Type Development (V)), the Project has the status of a Designated Project under Item 1 of Schedule 3 of the EIA Ordinance (EIAO) (engineering feasibility study of urban development projects within an Assessment Area covering more than 20 hectares).

1.3.2 In addition to the above, the proposed residential development lies within the Deep Bay Buffer Zone 2 and is not "New Territories exempted houses". Thus item P1 of Schedule 2 of the EIAO also applies to this Project.

1.3.3 In the early stages of the Project it was identified that as there is no public sewerage system in the area for the discharge of the domestic effluent, the "No Net Increase" (of pollution) to Deep Bay also applies. At the time of preparing the Project Profile the initial thinking was to provide a dedicated sewage treatment plant on-site with the possibility of reusing treated effluent within the development. Reuse of treated effluent from a treatment plant falls under item F4 of Part 1 of Schedule 2 of the EIAO and thus such an activity becomes a Designated Project in its own right. However during the planning and assessment stage of the Project the Government committed to the provision of a sewerage system which will include the catchment from this development site. Government has confirmed that the domestic effluent generated from this site can be discharged via the public sewer (on Castle Peak Road) and thus the timing of this development project has been phased to accord with the provision of the Government sewer. Hence item F4 is no longer a relevant component of this Project.

1.4 Continuous Public Involvement

1.4.1 From the outset, the Project Proponent has been committed to the Continuous Public Involvement (CPI) process in recognition of the fact that such an approach can assist in the smooth implementation of the Project. The CPI programme for this Project has included, but not been limited to, the involvement of community and conservation interest groups. The inputs and feedback on the development concepts and suggestions, particularly on the development and management issues associated with the wetland restoration, have been of particular value. Informal discussions with Government Departments such as the Environmental Protection Department (EPD), Agriculture, Fisheries and Conservation Department (AFCD), Drainage Services Department (DSD), Planning Department (PlanD), Transport Development (TD) and discussions with local interest groups, Nature and Conservation Groups including Conservancy Association, Hong Kong Bird Watching Society, World Wide Fund for Nature, Kadoorie Farm and Botanic Garden, Green Power, residents of Palm Springs and Royal Palms and international wetland experts have been fruitful and the feedback received has resulted in a more robust conservation component to the development plan.

1.5 Scope

1.5.1 The scope of this EIA study covers the potential impacts arising from this Project during the construction and operation phases. The EIA study has addressed the key issues identified in the aforementioned Study Brief as outline below:

- noise impacts arising from construction and operation of the Project to the nearby village and residential areas;
- dust impact arising from construction of the Project to the nearby air sensitive receivers (ASRs), as there is no on-site sewage treatment plant there is no sewage odour emanating from this development
- landscape and visual impacts during construction and operation of the Project;
- the potential water quality impacts caused by site formation, pond draining and filling, drainage diversion, and any other works activities during construction; the potential water quality impacts caused by the operation of the Project;
- potential impacts on historical buildings/architectures and monuments;
- terrestrial and aquatic ecological impacts, in particular the potential impacts disturbance and fragmentation to the adjacent recognized sites of conservation importance 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, Inner Deep Bay SSSI, Wetland Conservation Area and Wetland Buffer Area (both were defined under Town Planning Board Guideline TPB PG-No. 12B) and important habitats such as fishponds and egretries, due to the 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; and
- the short term and long term management of the proposed wetland restoration within the site including trust and financial arrangement.

1.6 Objectives of the EIA Study

1.6.1 Under the Study Brief (ESB-131/2005), the objectives of the Environmental Impact Assessment (EIA) Study are:

(i) to describe the Project and associated works together with the requirements for carrying out the Project;

(ii) 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;

(iii) to identify and quantify all environmental sensitive receivers, emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;

(iv) to identify and quantify any potential losses or damage to flora, fauna and wildlife habitats;

(v) to identify any negative impacts on sites of cultural heritage and to propose measures to mitigate these impacts;

(vi) to identify and quantify any potential landscape and visual impacts and to propose measures to mitigate these impacts;

(vii) to propose the provision of infrastructure or mitigation measures so as to minimise pollution, environmental disturbance and nuisance during construction and operation of the site;

(viii) 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;

(ix) 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;

(x) 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;

(xi) to identity, within the Assessment 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

(xii) 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.

1.6.2 The Technical Requirements of the EIA Study comply with those specified in the Study Brief No. ESB - 131/2005 (which is appended as **Appendix A** for ease of reference).

1.7 The Assessment Area

1.7.1 The Assessment Area encompasses all areas within 500m of the Project Area, comprising mostly residential uses (Palm Springs, Wo Shang Wai Village Houses, Royal Palms, Mai Po Lo Wai, Mai Po San Tsuen and Maple Gardens) and fishponds adjoining the Project Area. Ecological assessments also take into consideration sites of ecological importance identified during the CPI process, including the egretries at Mai Po Village ‘satellite’, Tam Kon Chau and Mai Po Lung, which are located outside the 500m Assessment Area boundary but are within the foraging distance of breeding egrets. The Assessment Area defined for this project is illustrated in **Figure 1.1**.

1.7.2 The development of the Project has considered the adjacent recognized sites of conservation importance, including but not limited to 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, Inner Deep Bay SSSI, Wetland Conservation Area and Wetland Buffer Area and important habitats such as fishponds and egretries. It has also recognised that the ecological sensitivity of the surrounding area is crucial to the successful implementation of the Project.

1.7.3 Particular consideration has been given to the adoption of workable solutions and methods of work within the Deep Bay area while upholding the principles of conservation and ecological protection. To this end the Deep Bay Guidelines have been followed and the construction programme has taken account of these guidelines which are fundamental to the assessment of noise impacts as detailed in Sections 4 and 8 of this EIA. Development of short term and long term management for the proposed wetland restoration within the Project Area including financial arrangements is documented in a standalone document in **Appendix H** in accordance with the requirements of the Study Brief (item 3.9.2.4 (xv)).

1.8 Programme

1.8.1 The overall programme for implementation of the Project is given in **Appendix B-2**. The construction works are anticipated to commence in 2008 and to be completed in 2012, with population intake timed to accord with the availability of new regional infrastructure such as public sewers on Castle Peak Road. As with any development project, the implementation of the works will be staged via a series of work packages. Essentially the advance works which are being undertaken at present include site and ground investigation contracts, investigation for potential land contamination contracts, a Section 16 planning application for the proposed comprehensive development at Wo Shang Wai (which is in progress) as well as this EIA.

1.9 Structure of the EIA Report

1.9.1 The EIA has been prepared to contain all the findings of the Study as follows:

- Section 2 presents the consideration of alternative layout options and building height profiles as required under the Study Brief, construction methods and sequence works and describes selection of preferred scenario for the Project;
- Section 3 describes the Air Quality Impact Assessment;
- Section 4 describes the issues associated with Noise during and following construction, quantifies the impacts and recommends mitigation measures;
- Section 5 presents the Water Quality Impact Assessment which include the potential problem of biogas on reclamation (pond filling);
- Section 6 describes the Sewerage and Sewage Treatment Implications
- Section 7 presents the Waste Management Implications;
- Section 8 describes the Ecological Impact Assessment which is a combined report using the findings of the baseline survey and describing the development of the mitigation measures for the protection of the ecological resources and habitats. The management package for the wetland restoration in the Project Area is appended to this EIA report;

- Section 9 presents the Fisheries Impact Assessment;
- Section 10 describes the Impact on Cultural Heritage;
- Section 11 presents the Landscape and Visual Impact Assessment (LVIA) which is one of the components of the EIA;
- Section 12 describes the Impact Summary;
- Section 13 provides a summary of the Environmental Outcomes;
- Section 14 presents the Environmental Monitoring and Audit (EM&A) Requirements;
- Section 15 presents an Implementation Schedule; and
- Section 16 presents a summary of the Conclusions of the EIA.

2 CONSIDERATION OF ALTERNATIVES

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

2.1 Summary

2.1.1 This section of the EIA Report provides a description on the need for the Project and narrative on the alternatives considered, both of the conceptual layout of the whole site and of the building forms, building heights and possible detailed layouts. The need for the Project is explained at the beginning of the Section and addresses the implications of the further degradation of the environment versus development. The Section describes the development concept building process and the process for the consideration of development alternatives of the Project Area. The Continuous Public Involvement (CPI) process is described herein and has been an important component of the process of developing and evaluating the alternatives. This section responds directly to Sections 3.3 through 3.6 inclusive of the Study Brief.

2.2 The Project Area

Background

2.2.1 The Project Area lies within an area designated for "Other Specified Uses" "Comprehensive Development to include Wetland Restoration Area" (OU(CDWRA)). The notes to the OZP make it clear that the planning intent for OU(CDWRA) is :

> *"this zone is intended to provide incentive for the restoration of degraded wetlands adjoining existing fishponds through comprehensive residential and/or recreational development to include wetland restoration area. It is also intended to phase out existing sporadic open storage and port back up uses on degraded wetlands. Any new buildings should be located farthest away from Deep Bay."*

2.2.2 The Project Area also falls within an area which is designated as Wetland Buffer Area (WBA) in the Town Planning Board Guidelines for Application for Developments within Deep Bay under Section 16 of the Town Planning Ordinance. While the Guidelines are provided for general reference and are not binding on the Town Planning Board, they do however imply the underlying philosophy which is to encourage the restoration of lost fishponds and to provide a desirable wetland habitat around Deep Bay and the Mai Po Area. Specifically :

> *"6.4 the intention of the WBA is to protect the ecological integrity of the fishponds and wetlands within the Wetland Conservation Area (WCA) and to prevent development that would have a negative off-site disturbance impact on the ecological value of fishponds……. As a substantial number of fishponds with 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 open storage use and/or to restore some of the fishponds lost.*
>
> *6.5 Within the WBA, for development or redevelopment which requires planning permission from the Board, an ecological impact assessment would also need to be submitted. Development/redevelopment which may have negative impacts on the ecological value of the WCA would not be supported by the Board, unless the ecological impact assessment can demonstrate that the negative impacts could be mitigated through positive measures. The assessment study should also demonstrate that the development will not cause net increase in pollution load to Deep Bay."*

2.2.3 With the foregoing as the guiding principles, the assessment of the implications of development at Wo Shang Wai commenced. In the first instance, prior to the issue of a Study Brief under the Environmental Impact Assessment Ordinance (EIAO), the following activities were undertaken:

- Visits to the Project Area and adjacent areas to characterize the site and the Assessment Area. This included the definition of the Project Area, its relationship with its nearest neighbours including the adjacent Royal Palms and Palm Springs and the WCA to the north. The land uses in the off-site areas were identified and categorized in terms of their sensitivity to development, such as the egretries at Mai Po San Tsuen.
- The history of the site was ascertained through examination of site records and aerial photographs.
- The planning status was confirmed.
- The constraints and opportunities for development were considered and compiled as a set of planning principles as illustrated in the "bubble diagram" (see **Figure 2.1**).
- Initial ecological baseline surveys were carried out.
- Initial environmental appraisals were conducted.

2.2.4 The next step in the assessment of the Project Area and its development potential was to undertake a preliminary environmental review such that an application for a Study Brief could be made. This was affected by the preparation of a Project Profile which contained the development parameters and constraints which were illustrated in a "bubble diagram" (see **Figure 2.1**).

2.2.5 Upon receipt of the Study Brief the ecological impact and other impact assessments were undertaken to determine the existing conditions of the Project Area, the potential impacts associated with permitted development and the associated mitigation measures needed to ensure acceptability in terms of the requirements of the EIAO, its Technical Memorandum and the Study Brief.

History

2.2.6 In the 1940's and 1950's the Project Area comprised brackish rice paddies, and it was during the 1960s when fresh water fish farming prospered in the New Territories that the rice paddies were converted into fishponds. With increased pressure for open storage activities in the North West New Territories (NWNT), the ponds were progressively filled from around 1987. From the aerial photo taken on 18th August, 1990, it is evident that about 90% of the ponds in the site were filled with the remainder filled by 1991. Part of the Project Area has been continuously used from that date as open storage and the parking of new vehicles.

2.2.7 The introduction of statutory planning control in the area to prevent infilling of ponds and proliferation of open storage uses commenced on 17 August 1990 with the gazettal of the Interim Development Permission Area (DPA) Plan. In August 1991, with the publishing of the Mai Po and Fairview Park Development Permission Area Plan, the Project Area was zoned "Unspecified Use Area". Under both plans the existing open storage uses on the Project Area were permitted to continue as they had "existing use" status.

2.2.8 In June 1994 the Town Planning Board gazetted the new Outline Zoning Plan to replace the DPA plan, and on that plan the Project Area was zoned as "Conservation Area". An objection was lodged to that zoning and the Board accepted the argument that the Project Area in its form at that time had limited conservation value because of the existing land use. On 27 October 2000 the Board gazetted an amendment to the Outline Zoning Plan under Section 6(7) of the Town Planning Ordinance to rezone the Project Area to the OU(CDWRA) zoning which exists at present (see **Figure 1.5**). In doing so, the Board recognized the "existing use" rights of the Project Area for open storage and provided an incentive for the redevelopment of the site to provide residential development in conjunction with the creation of a new wetland conservation area.

2.2.9 The existing use rights for the Project Area therefore go back to 1990 and also relate to the situation when the zoning was changed in 2000. These important dates must therefore be used when establishing the base case against which any wetland creation should be measured. The applicant purchased the land in 2005, well after the present zoning of the Project Area was introduced.

Statutory Planning Intention for the Project Area

2.2.10 The Project Area is zoned 'OU(CDWRA)' with a small portion at site entrance zoned as 'V'. Accordingly, the proposed residential development shall follow these parameters:

Plot Ratio	0.4
Maximum Building Height	6 storey including car park
Layout Arrangement	Building farthest away from Deep Bay
Maximum GFA	82,800m^2

2.2.11 According to the Approved Mai Po and Fairview Park OZP No. S/YL-MP/6, the OU(CDWRA) zone is intended to provide incentive for the restoration of degraded wetlands through comprehensive residential and/or recreational development to include wetland restoration area. It is also intended to phase out existing sporadic open storage and port back-up uses on degraded wetlands. However, new buildings should be located farthest away from Deep Bay. A maximum plot ratio of 0.4 and maximum building height of 6 storeys including car park is allowed. The 'V' zone does not include density calculation and is merely proposed as access and amenity in terms of the proposed development. Ancillary facilities to the domestic development may be disregarded in the plot ratio calculation.

The Need for the Project

2.2.12 The need for the project is derived directly from the statutory zoning of the Project Area by the Town Planning Board (TPB) as OU(CDWRA) with the expressed purpose of encouraging new residential development in degraded sites such as this. The implementation of the project provides a means to achieve the TPB's intention of safeguarding the ecological integrity of Wetland Conservation Area (WCA) to the North and providing new wetland areas with compatible residential development. Determining whether or not any proposed residential development with wetland restoration area will create ecological impacts to the Project Area or its surroundings needs to be considered in a rational manner with the ecological impact assessment being a key component of the assessment process.

2.2.13 The need for the Project has thus been considered taking full cognisance of the Town Planning Board Guidelines (TPB PG-No. 12B):

> *"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 fishponds lost."*

2.2.14 Reference has also been made to the Study on Ecological Value of Fishponds in Deep Bay Area (Aspinwall, 1997) which showed that the area of scattered open storage along the boundary of the Wetland Conservation Area (WCA) caused significant decreases in ardeid numbers using the fishponds, while the residential areas at the southern boundary were identified as significantly less intrusive than the open storage. The proposed residential development with wetland creation will eradicate the open storage uses that have potential negative impact on bird life.

Purpose and Objectives for the Proposed Project

2.2.15 The purpose of the project is to implement the Planning Intention for the site as stated in the planning notes of the OU(CDWRA) zone on the Outline Zoning Plan quoted above. Furthermore TPB PG-No.12B states that:

> "*Development proposals to restore lost fishponds or to replace existing undesirable uses by wetland habitats are encouraged."*

2.2.16 The objectives established for the project so as to achieve this purpose are:-

(a) To determine the function of the existing habitats, assess the ecological impact of development and provide a comprehensive proposal which will enhance the ecological function of the site and contribute to the overall value of the Wetland Buffer Area and the Wetland Conservation Area.

(b) To provide a viable high quality residential development in harmony with the conservation objectives of the zoning.

(c) To provide for an increase in the wetland function provided by the site over the existing degraded situation.

(d) To provide a comprehensive residential development with a plot ratio of 0.4 so as to provide support for the creation of a sustainable managed wetland.

(e) To ensure that the form and height of the residential development is compatible with the general character of the area within the flexibility provided by the 6 storey height limit.

(f) To establish clear conservation objectives which are compatible with the function that this wetland will provide in the Deep Bay context taking account of the locational constraints and the form of the development proposed on the site.

(g) To provide an effective wetland and visual buffer to separate the residential part of the development from the "CA" zone to the north.

2.3 Site Context

The Existing Site Conditions

2.3.1 The proposed Project is significant in that the Project Area is recognised by the TPB to be degraded and that action should be taken by the private sector to arrest further environmental degradation and ecological harm. The existing temporary uses are incompatible with the adjacent Conservation Area zoning and would benefit from being removed. The continued degraded nature of the site is difficult to manage and creates a fire risk and community safety concerns. An appropriate form of residential development with newly created wetland will add positively to the biological system of the Deep Bay Area and the broader regional ecological functions of Mai Po in a sustainable manner.

2.3.2 The adjacent developed areas have a building form and landscaping which provides few opportunities for diverse wildlife. The adjacent developments were also created from infilled fishponds and thus have a similar basis for development.

The Surrounding Conditions

2.3.3 The Project Area is located on the northern edge of the low-rise residential development at Palm Springs and Royal Palms. In this respect it forms a transition between a development area and the fishponds to the north which are zoned as "Conservation Area" on the Outline

Zoning Plan. A part of the existing Palm Springs, residential development area is also located outside the western-most edge of the site and is between the site and the Mai Po Nature Reserve located a further 700 metres to the west.

2.3.4 The adjacent existing development is predominantly three storeys in height in accordance with the planning restrictions for the R(C) zone. Along the north eastern boundary is the scattered village development of Mai Po San Tsuen and Mai Po Lo Wai villages interspersed with areas of open storage and other temporary uses. Other than the existing commercial fishponds to the north of the Project Area, there is no feature which is of particular ecological or environmental sensitivity immediately adjacent to the site.

2.3.5 The existing habitat types within the proposed comprehensive development include developed area in active use (open storage for containers and lorry parking), bare ground (site access), grassland, seasonal marsh, freshwater marsh/reedbed and water ditches. It is surrounded by a residential area, village development, fishponds and open storage.

2.3.6 The freshwater marsh/reedbed, seasonal marsh and grassland are secondary habitats developed on land filled over 15 years ago. Vegetation is typical to those similar habitats located in the surrounding NWNT areas. No rare or protected or species of conservation interest of flora were identified. Fauna species recorded within the Project Area are common and widespread throughout the Deep Bay Area.

2.4 Consideration of Alternatives

Introduction

2.4.1 The EIA Study Brief requires that consideration be given to alternative layout options and building profiles for the Project in arriving at the preferred option. A description of the environmental factors taken into consideration is required and a comparison between the options is to be provided. The preferred option should avoid or minimize adverse environmental effects to the maximum practicable extent. In particular, consideration must be given to avoiding disturbance to the adjacent recognized sites of conservation importance and important habitats during the construction and operation of the project. Where avoidance is not possible then minimisation and mitigation of potential impacts to acceptable levels is required. The process outlined in **Figure 2.1** and **Figure 2.2**, “Generation of Options”, illustrates how the principles of the “bubble diagram” were transposed into options or alternatives.

Working Up the Alternatives from Development Principles

2.4.2 At this juncture it is important to summarise the development principles which have been considered in the development of options or alternative development proposals. It is also important to note that some of the development principles apply to all options and do not provide differentiation between options/alternatives/layouts.

Wetland Restoration

2.4.3 Wetland restoration is one of the statutory requirements laid down in the OZP No. S/YL-MP/6. TPB PG-No. 12B “Application for Developments within Deep Bay Area under

Section 16 of the Town Planning Ordinance" (April, 1999) defines Wetland Restoration as:

> *"Development proposals to restore lost fishponds or to replace existing undesirable uses by wetland habitats…"*

and the definition of wetland habitat adopted by the TPB from Ramsar is :

> *"any area of marsh, fen, peatland or water whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including any area of marine water the depth of which at low tide does not exceed 6 metres, in which plants and/or animals live."*

2.4.4 Wetland Restoration is a term used to describe activities that return wetland from a disturbed or totally altered state to a previously natural condition. The converted wetland not only restore the physical state but also the functional values, by the re-establishment of flora and fauna to enhance life support, flood control, recreational, educational, or other functional uses (Hammer, 1996). From the analysis carried out as a result of the ecological assessments the wetland restoration area (WRA) will be 4.74 hectares (details provided in Section 8). The functions of the proposed WRA are given in detail in **Appendix H**.

Buffering from Existing Ponds in the North

2.4.5 The Project Area is located in the Wetland Buffer Area (WBA) and adjacent to the Wetland Conservation Area (WCA) as identified in TPB PG-No. 12B. According to the Guideline, development in the WBA should provide a wetland and visual buffer to separate the development from the WCA, to minimise its impact on the wetland and to restore some of the lost fishponds to an appropriate form of wetland adjoining the WCA.

Building Form and Location

2.4.6 The OZP permits buildings up to six storeys in height. However, consideration needs to be given to the form of other development in the area which is mainly of three storeys in height, such as at Royal Palms, Palm Springs, Fairview Park, Mai Po San Tsuen and Maple Garden. The form of development proposed on the site should therefore be compatible with the general character of the neighbourhood in terms of height and also in visual impact terms.

2.4.7 The OZP zoning also requires that any buildings be located as far as possible from the Mai Po Nature Reserve, and consideration should be given to the open nature of the general area between the Project Area and the Nature Reserve. Consideration also needs to be given to the relationship to the residential development on the adjacent site, with regard to building height variation; building height; spacing between units and distance between building and Visually Sensitive Receivers (VSRs).

2.4.8 Adequate open space provision must be provided in the development such that it fulfils HKSAR Government Planning Standards and Guidelines but also conforms to what are currently regarded as basic sustainable development principles including green space corridors, areas for groundwater recharge and opportunities for sustainable community interaction.

2.4.9 Building form and layout are key factors which have been examined when considering the different alternatives.

Access to the Project Area

2.4.10 The only vehicle access to the Project Area is via the Castle Peak Road – Mai Po section. The access passes through the Village zone before entering the OU(CDWRA) zone. This access shall also serve as the future access to the site after appropriate upgrading works. All options will use this access, therefore there are no differentiating factors for this consideration.

Parking Provision for Residential Development

2.4.11 As the Project Area is remote from mass transit and due to the large unit size, car usage is expected to be high. According to the HKPSG requirement, the minimum parking varies according to the flat size and the distance from a railway station. The development is likely to have mainly large units and the parking standard is stipulated as a minimum with possible greater provision being subject to Transport Department's approval. The parking standard calculation results in a minimum requirement of approximately 1.5 car parking spaces for each dwelling unit. However, it is considered that a higher parking provision than 1.5 spaces per unit may be appropriate and this will be subject to further discussion with Transport Department. This is not a factor which will differentiate between the options.

No Community Facility Needed

2.4.12 Given the small anticipated population of the development, no particular community facilities are required. However, the normal provision of a Club House will be provided for the residents' use for all options.

Site Formation Level Relative to Water Level

2.4.13 The minimal site formation level for buildings in Hong Kong in general is +5.5m to prevent flooding. The difference between building level, water level and level of existing channels and ponds shall be taken into account when designing the area for building works and when forming the waterscape design. This is not a factor which will differentiate between the options considered.

Adjacent Site within the same OU(CDWRA)

2.4.14 Part of the OU(CDWRA) zone falls outside the proposed site boundary and is in separate ownership. That portion of the OU(CDWRA) zone may therefore be developed independent of the current proposal. The existing vehicular access to that Project Area will be suitable for future up-grading to serve permanent development of the site. It also fronts onto an adjacent area of fishponds zoned as 'Conservation Area' and there is scope for a wetland area to be created adjacent to the existing ponds. The implementation of the current proposal will therefore not adversely affect the long-term achievement of the desired form of development within the whole zone. Paragraph 9.9.4 of the Explanatory Statement recognises that the zoning may be implemented in parts. The Project Area has incorporated a buffer between this area and the residential and wetland area in the form of the Clubhouse and open areas.

No Net Increase in Pollution Load to Deep Bay

2.4.15 To protect water quality and ecosystems in and around Deep Bay, this Project within the WBA should not cause a net increase in the pollution load to Deep Bay (i.e. no net increase requirement) as specified in the Town Planning Board Guidelines No. 12B. The government has a confirmed program for the construction of public sewers along Castle Peak Road. It is therefore intended that the development should not be completed and occupied before the availability of the public sewer. It is understood that the current program is for the public sewer to be completed in 2012 and that is compatible with the development program for this Project. A sewer will therefore be laid from the site to connect to the new public sewer, thus there is no difference between any of the alternatives considered for this element.

Avoidance of Key Ecological Impact

2.4.16 The existing conditions within the Project Area are such that any development would have unavoidable negative impacts to existing wetland habitats, especially through fragmentation of this habitat from nearby existing wetlands. Thus it is considered that retention of existing wetlands within the Project Area is not feasible. The only feasible and desirable option is to compensate for the loss of these wetlands by creation of a Wetland Restoration Area which would be located to the immediate south of the existing offsite fishpond habitats. This will permit enhancement of the wetland habitats within the Project Area, through habitat management and through integration with contiguous wetland habitats in the Deep Bay ecosystem. This will have the additional benefit of creating a buffer area between the residential development of the Project Area and fishpond habitats to the north of the Project Area, minimizing potential disturbance impacts to wetland-dependent birds using these fishponds. The type, nature, size, dimension, functions and other design parameters of the habitats to be created will be carefully considered to achieve a robust eco-system. To minimize impacts on the ecology, existing ecological resources including the reeds and some native vegetation within and surrounding the Project Area will be reused as far as possible. Suitable areas of topsoil on the site will also be retained for the use in landscape planting as far as possible. To minimize the disturbances to both on-site habitats and to provide maximum linkage to surrounding fishponds, the wetland restoration area will be constructed at the earliest stage, to form a buffer between the construction site and the Conservation Area. This is a key element in considering the alternatives.

Adjacent Ponds Wo Shang Wai Village

2.4.17 There is an existing pond located to the south of the Project Area in Wo Shang Wai Village. There are also ponds within the Palm Springs development. The latter ponds are zoned 'CA' while the one in the village is zoned for residential development in the long term. While there may be relatively little ecological value in these two adjacent water bodies, it is considered that their existence should be taken into account when preparing the layout for the site. While there is no intention of establishing a physical link with them, it may be advantageous to consider ways of trying to improve the visual corridor of these water bodies to the fishponds located to the north of the Project Area.

Water Supply to Wetland Features

2.4.18 Wetland features need water to perform ecological and landscaping functions. Rain water will be the source of water and historic data indicates that the normal rainfall expected in the area should provide adequate water in all but exceptionally dry years. In the dry months of the year there will be some natural draw-down of water by evaporation. This is a natural process of the wetland which facilitates feeding by some species. The design of the wetland will include four compartments separated by bunds. Short periods of flooding or drain down of water in these compartments could be controlled by the uPVC pipes located within each internal bund and sluice gates at the discharge point. This will permit the rapid discharge of water when the compartments are full or following heavy rainfall events for water level control. The area will be designed such that water can be pumped between each compartment for maintenance using pumps.

Flight Path of Birds

2.4.19 Wetland birds fly over the northern part of the Project Area (**Figure 8.4** summarises the bird flight path survey analyses), but there appear to be no regularly used flight paths which would be significantly impacted, provided careful consideration is given to the building heights, the building profile and the effects of lighting/glare effect at night of the proposed developments.

2.4.20 Six storey buildings could affect the use of any existing fishponds, or those wetland habitats created on site, by foraging egrets from nearby egretries and by other species of conservation concern, particularly during winter migratory bird season. Parts of the Project Area adjacent to off-site wetlands to the north would be unsuitable for any 6 storey buildings.

Existing and Proposed Hydrology

2.4.21 The development will not extinguish any existing flow path (including streams and channels) and the existing ditch on the perimeter of the site will be filled in order to facilitate the construction of the site formation for the proposed Development. However, an internal drainage network underneath the future road system within the proposed development will be provided to collect the surface runoff generated within the site area. Careful consideration will be given to ensuring the overall drainage provisions and systems on site will not reduce the drainage performance of the area.

Nuisance from Existing Open Storage in the Northeast

2.4.22 The development has also taken into account the potential industrial/residential interface problem arising from the existing open storage use within the OU(CDWRA) zone which is located immediately next to the Project Area. Industrial noise arising from the nearby open storage operations may impose noise nuisance and other impacts.

Sustainable Development

2.4.23 The design and construction of a development of this nature provides an ideal opportunity for the introduction of sustainable development measures. These will be incorporated, where appropriate, into the design of the site formation works, construction process, building materials and also in the design and management of the residential and wetland areas. The need to ensure the long term sustainability of the wetland restoration area will be a major influencing factor in this respect.

Continuous Public Involvement (CPI)

2.4.24 Wetland restoration in conjunction with development is a relatively new concept to Hong Kong. A CPI exercise has been carried out in parallel with the EIA preparation. This process has assisted in soliciting community and professional views, comments and suggestions at various stages in the design and data collection process. Green groups and residents of the developments surrounding the Project Area have been consulted during the preparation of the layout options and comments have been taken into account in arriving at the preferred option. The CPI process has been extremely useful in clarifying concerns and providing a sharing of experiences with others before selection of the preferred option. The CPI process undertaken for this Project is described in Section 1.

Consideration of 'No-development' Option

2.4.25 Various factors need to be considered when contemplating the 'No-development' option as described in the following paragraphs.

2.4.26 Agricultural use is permitted as of right under the OZP, and does not require government's approval for such use on the subject area. This implies that the whole site could in theory be used for agricultural purposes. This would neither be ecologically sustainable, nor is it compatible with the adjacent fishponds. Agricultural use would eventually reduce the ecological value of the site and damage the ecology in the wider context of the WBA and WCA.

2.4.27 According to information from the Town Planning Board (TPB) records, 64 applications have been submitted to the TPB since 2001 for permission for uses including open storage, parking area, workshop, etc. on various OU(CDWRA) zones within Yuen Long; of which 16 applications have been approved (up to June 2007). Most of the planning applications were approved on a temporary basis for up to 3 years (**Appendix B-1**). It should be noted that the existing open storage and lorry parking uses were on the Project Area before the gazettal of the OZP and are permitted to continue without a time limitation, as they have "existing use" status.

2.4.28 Under the statutory OZP, submission of a Wetland Restoration Area or Layout Plan is not necessarily 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.

2.4.29 According to the management offices of Palm Springs and Royal Palms, concerns on crime, grass fire and security of the subject site have been reported by residents of these neighbouring residential developments. The Project Area is covered with grassland and in some parts, high grass with potential fire risk and mosquito breeding issues. If the subject site remains in the current condition, worries about crime and trespassers through this undeveloped/vacant land to the adjacent low-rise residential buildings would continue. Active land stewardship and regular maintenance of the Project Area is possible to reduce the risks. However, it would and has at the same time unavoidably as a consequence, reduced the ecological value of the site by destabilising the ecological habitats.

2.4.30 The above paragraphs indicate that if the Project Area remains in its current condition not only would the planning intention not be achieved but the permitted uses and possible short-term uses on site might offer potential to further degrade its ecological value and continue to pose nuisance to neighbouring developments. The proposed residential development, with the provision of wetlands, is considered to be a desirable use of the Project Area. It would maintain the ecological value of the Project Area on a sustainable basis, as well as providing proper site management and security measures to avoid nuisance to the surrounding areas.

2.4.31 The ‘no action’ alternative could therefore result in long term degradation of the Project Area and is not therefore favoured.

Compatible Development

2.4.32 Another alternative considered was to develop the Project Area in a manner similar to the adjacent development at Palm Springs and Royal Springs to the south and west of the application site. These developments are of a form which could be described as typical for the North West New Territories. They are typically low-rise, characterised by predominantly 3 storey houses and a dense network of roads. There is little or no variation in height profile. The arrangement of units is typically low-rise with terraced units sitting alongside free-standing units.

2.4.33 This form of development has no design element which gives consideration to the ecology of the location, even though they are usually accompanied by areas of landscaping, trees planted along roads and vegetation within the private gardens. These features are usually for ornamental and decorative landscape purposes and generally are of little ecological value. The adjacent residential development at Palm Springs and Royal Palms was approved prior to the “Fish Pond Study” and the implementation of the Buffer Zone concept to protect and enhance the wetlands and the Mai Po Marshes.

2.4.34 This form of residential development therefore is not in line with the current requirements for development in the Buffer Zones and offers very little urban design/landscape and visual benefits in terms of variation of profile, permeability and landscape provision.

2.4.35 It has no mitigation measures to help restore or enhance the ecology of the area. During consultation with the Green Groups it became clear that this form of development was no longer considered acceptable within the Buffer Zone areas as there were no mitigation measures included.

2.4.36 The lack of any buffer areas between the residential development and the adjacent fishponds was considered unacceptable and allowed for intrusion of human activities onto the fishpond areas. Most fundamental was the lack of provision of any form of wetland within the Project Area. Without any attempt to restore wetland and to encourage the use of the area by suitably selected species of birds, the traditional form of residential development did not achieve any of the ecological objectives that have now been established for the Buffer Zone areas.

2.4.37 For these reasons a form of development similar to the adjacent Palm Springs and Royal Palms is considered unacceptable and this alternative was discarded.

2.5 Working Up the Initial Options

2.5.1 It is important to note that one objective relating to the permitted development on site is “an appropriate level of residential/recreational development”. The proposed development must also fulfil the requirements of TPB No. 12B and moreover provide ecological mitigation for the functions which will be lost as a result of the proposed development. Therefore the ecological survey data and analyses contained within the Ecological Impact Assessment (refer to Section 8) were drivers in the layout of the development.

Development Criteria for Option Consideration

2.5.2 The statutory zoning allows flexibility in the design and layout of the buildings on the site. The amount of development permitted is the same as the traditional form at a plot ratio of 0.4. However, the height limit is lifted to permit up to 6 storeys and this therefore allows some scope to provide taller buildings with smaller site coverage. This in turn allows for more of the Project Area to not be built on and scope for part of the un-built area to be used for ecological mitigation purposes.

2.5.3 By considering the statutory zoning a number of options or forms of development layouts were generated for consideration. Some of the initial forms of development included a generic ‘rectangular’ form illustrated on **Figure 2.3a** and a generic ‘horseshoe’ form illustrated on **Figure 2.4a** of residential development with associated areas of wetland. The ‘rectangular’ form provided little relief or edge effects and basically gave only a strip of wetland to separate the residential and CA zones (**Figure 2.3b**).

2.5.4 The concept of providing the buffer was acceptable in terms of the general concept set out in the TPB PG-No. 12B although it needed to be refined and developed to provide other component features of a well designed WRA.

2.5.5 The horseshoe style of development had advantages in that it gave a longer water/residential interface (**Figure 2.4b**), but the concept did present some challenges in terms of providing a buffer between residential developments and the CA. It was evident early on that the form of development needed to be refined and elaborated to accommodate the various “development criteria” which were used to develop alternatives and differentiate between options. The Development Criteria which allow differentiation between the options are summarized in **Table 2–1**.

Table 2-1 Development Criteria

Alternative Factors Considered	Reason for Consideration
Wetland Restoration Area (WRA)	The size, layout, form of the compensation differs between the options (refer to Section 8).
Buffering between Development and Existing	Minimum distance between residential

Alternative Factors Considered	Reason for Consideration
Ponds to the North	developments and CA vary (refer to Section 8)
Building Form and Location	Different building heights or mixes or layouts vary and affect performance of options (refer to Section 11)
Continuous Public Involvement (CPI)	CPI was used in the development of layouts, or in the modification of layouts following input from CPI (refer to Section 1and 11)
Avoidance of Key Ecological Impacts	Extent and variety of compensation is a key feature as is mitigation during construction (refer to Section 8)
Adjacent Ponds	Factors include the continuity of water features
Water Supply to Wetland Features	Source of water varies
Flight Path of Birds	Use of flight path data to ascertain impacts of development on avifauna (refer to Section 8 and Figure 8.4)
Nuisance from Existing Open Storage in the Northeast	Interface issues
Sustainable Development	Opportunities for sustainable development or green building designs

Integrated Wetland Concept Option

2.5.6 Developing the theme illustrated in the "bubble diagram" and taking cognisance of the buffer zone between residential and CA, the limitations and ecological impacts arising from retention of existing wetland habitats within the Project Area, and the opportunities of a simple, sustainable yet ecologically diverse WRA, various broad ecologically sensitive layout options were considered. Firstly, an integrated design (**Option A**) was derived which provided a series of residential development areas interspersed with water/wetland areas. This layout is illustrated in **Figure 2.5** and is a combination of water, roads and buildings providing for 276 houses. Each house is large having an average floor area of 300 square metres. This layout is relatively land intensive and shows that the areas of water are relatively narrow and that the areas of buffer between the residential development and the fishponds to the north are relatively small. There is limited height profile variation and interest, as well as relatively limited areas of landscape reprovisioning. The area of restored wetland is around 3.4ha for the core wetland and 1.0ha for the linear wetland areas between the development areas.

2.5.7 While the shoreline between water and land is relatively long, the close proximity of the residential uses to the water would likely have a negative impact on how the wetland would operate in relation to the target bird species and would not alleviate the issues of fragmentation of wetland highlighted in Section 2.4.16. The main disadvantage is the creation of a high site coverage and need for a large area for roads, limiting space for wetland restoration and landscaping, and the interface between residential developments, wetland restoration area and the existing fishponds adjoining the Project Area within the CA.

2.5.8 Furthermore, the layout does not accord with the TPB PG-No. 12B requirement to locate the residential developments as far as possible from the adjacent WCA and on that reason alone was considered to be not acceptable for further consideration.

Transitional Wetland Concept Options

2.5.9 A layout based on the conceptual design framework as established in the statutory OZP was considered as this is more likely to meet the ecological objectives. This approach can be seen in **Figure 2.2** where the concept was developed from a bubble diagram to a conceptual zoning of the Project Area and then refined to a number of options.

2.5.10 **Figure 2.6** illustrates the concept (**Option B**) of introducing wetland areas into the residential zone. The intention was to provide compensatory habitats for species using the site such as dragonflies and butterflies and amphibians. The concept was to provide a large area of core wetland area located to the north of the Project Area with linear wetland areas between "fingers of housing land" flowing south and protruding into the residential development. While a priority was given to achieving a high quality of wetland mitigation, consideration was also given to achieving a high quality residential environment based upon a respectful relationship between the residential development and the wetland area.

2.5.11 **Option B** represents the medium rise form of development and has **all 6 storey blocks**. 36 blocks 6 storeys high are proposed. This form of development provides the largest population with smaller units with average size of 95.8 square metres although it could also reduce population intake by having 3x duplex or 2x triplex blocks. However, the analysis of flight paths of birds indicates that there was likely to be an adverse impact because of the height of the buildings. These would be the only buildings of this height in the whole of the Mai Po area and in this respect visually significant. The development has around 28% of the Project Area for wetland areas with 3.4 ha for core wetland and 2.5 ha for linear wetland areas. Although the option offers relatively high areas of landscape reprovisioning and visual permeability, it also offers no variation in height profile and results in visual effects from relatively tall 6-storey structures on visual receivers (especially on residents in Royal Palms and Palm Springs, and on the landscape character of the Tsing Lung Tsuen Plain.

2.5.12 **Figure 2.7** has a similar medium rise layout with streams of wetland extending within the residential area (**Option C**). The width of wetland between the fingers is narrower and this may result in greater negative impact from human activities on the use of the wetland by the target species. There is 21% of the Project Area as core wetland (around 4.3 ha), around 2.1 ha of linear wetland areas and around 44% as landscape area. The layout has **2.5/3 storey** houses along the fingers which would reduce the light glare and have less impact on the bird flight paths. There are **4 storey** buildings introduced along the boundary and some **6 storey** blocks are retained in the central area away from the wetland. This results in a gentle built-form profile consisting of 44 detached houses, 116 semi-detached houses, 164 units as four storey duplex blocks and 144 flats in 6 storey apartment bocks. There is concern however that the location of 4 storey buildings along the boundary will have a negative impact in relation to the adjoining residential developments.

2.5.13 The medium rise options which included 6 storey buildings were not selected due to their visual impact on the regional landscape and the potential effect on ecology.

2.5.14 **Figure 2.8** shows an alternative low rise option which removes all of the 6 storey buildings and has 28 **2.5/3 storey** detached houses, 132 semi-detached houses and 188 duplex units in

4 storey buildings (**Option D**). About 19% of the Project Area is core wetland area of approximately 4.0 ha and around 10% or 2 ha are linear wetland areas. The longer waters edge also means that more of the wetland will likely be subject to intrusion by human activities. This option achieves some limited variation in profile and its relatively less dense layout may offer slightly reduced effects on landscape character whilst offering greater area for landscape mitigation. The possible negative impact of 4-storey development along the boundary of the adjacent residential developments also remains.

2.5.15 Another low rise option (**Option E**) shown on **Figure 2.9** has the same area of wetland as Option D. Some buildings are now only **2.5/3 storeys** high along the boundaries of the Project Area adjacent to the existing residential properties with backyards directly fronting onto the proposed development in Wo Shang Wai. The low-rise structures conform closely to the existing scale of structures in the landscape, but provide limited height profile variation and interest. The same relationship exists between the residential buildings proposed on the Project Area to the wetland area as for Option D. However, there is less communal open space than in Option D.

2.5.16 From an ecological perspective, the low rise options (**Option D** and **E**) with 2.5/3 storey houses at the centre of the Project Area are likely to have similar environmental/ecological performance. In both options, the proposed residential areas are located away from the ecological sensitive receivers i.e. fishponds in the WCA and kept close to the existing residential estates of Palm Springs and Royal Palms, leaving the proposed wetland restoration area (WRA) to encourage direct ecological linkage with the fishponds in the WCA. The reduction in building height and the reduction in number of residential units by approximately 60% and 25% respectively from the medium rise options would reduce the population of the whole development and thus reduce human activities in vicinity to the WRA. This minimization measure aims to prevent future human disturbance from the proposed residential area on the sensitive habitats offsite and also enhance the performance of the proposed wetland onsite as far as possible.

2.5.17 The proposed wetland of both **Option D** and **E** would contain a core area and several stream features. As a result of the discussion between different interest groups (Nature Conservation Groups, relevant Government Departments and Wetland Specialists) during Continuous Public Involvement (CPI), a further refined scheme was generated.

Refined Preferred Option

2.5.18 This option was developed after a thorough assessment of the ecological impacts and evaluation of the findings of the ecological baseline undertaken for this Project. In addition to which several rounds of consultation with Green Groups, residents of Palm Springs and Royal Palms and discussions with Government Departments. The modified option presented here as **Option F**, is the **Preferred Option**, and is included in **Figure 2.10.**

2.5.19 This option has discarded the “streams of water” (wetland area in between the residential houses protruding in the form of fingers) as being wetland habitat and turns them into landscaped areas. As the interface between the residential area and wetland area has been designed out, the negative edge effect from human activities should also be minimized. The further enlargement of the WRA, the distance between the proposed residential area and the fishponds in WCA, is increased. The potential off-site impacts could be further reduced by this design, and provide opportunity for ecological enhancement of the fishpond area.

2.5.20 As a result of further CPI, the length of the fingers of land has been shortened and the form of the design has been amended to create a loop in the road network and to pull the land back from the northern edge of the Project Area. This also improves traffic circulation so that visitors who lose their way will be able to use the loop rather than having to turn in a cul-de-sac. The effect of pulling the land back has been to increase the area of wetland to the north to **22%** of the Project Area (around **4.74ha**). The landscaped area provide a visual softening and greening effect to the Project as a whole and physically link with the WRA proposed at the northern portion of the Project Area and fishponds at the north to provide aesthetical view. The 4.74ha of WRA under Option F will be in the form of freshwater marshes with reeds, freshwater ponds, trees and shrubs that provide habitats for the target species and provide a visual buffer to separate the residential development from the WCA to meet the planning intention of OU(CDWRA). A buffer planting area with trees, shrubs and groundcovers and garden fence will be included along the edge of the wetland restoration area to functionally and visually separate the residential areas and amenity areas from the wetland restoration area.

2.5.21 It was considered to be equally important to address the concerns of the residents in the neighbouring developments. Other than providing a landscape buffer, greater setback of buildings and the staggered arrangement of building facades, the 4 storey blocks which are directly facing the backyard space of the adjoining 3 storey structures in Palm Springs and Royal Palms have been changed into 2.5/3 storeys buildings to minimize the "over-looking" effect. The evolution of the various layout options were ecologically driven and environmentally oriented for improvement. It is anticipated that the "over-looking" concerns from both the Palm Springs will be further investigated in the detailed design for the planning application submission.

2.5.22 The preferred option (**Option F**) has 127 nos. of **2.5/3 storey** detached houses, 44 semi-detached houses and 180 duplex units in **4 storey** buildings. It offers a balanced alternative with regard to ecology/landscape/visual criteria as well as a number of advantages over other options, namely: its reduced visual effects on adjoining residents in Palm Springs and Royal Palms as well as some variation in building profile. The 4-storey development previously located along the southern boundary has been moved to the centre of the Project Area in this option. The fingers of water (wetland streams) between the areas of housing have been removed and are replaced by landscape areas, resulting in an overall increase in the available area for landscape mitigation.

Summary of Alternatives Considered

2.5.23 The CPI process has therefore resulted in achieving a design and layout which maximizes the effectiveness and functionality of the wetland habitat area that is to be created on the site, by limiting adverse human interference. It also allows for minimal impact on existing bird flight paths and results in a compatible form of residential development along the boundaries with the neighbouring sites.

2.5.24 The consequences of implementing the Preferred Option would therefore be the creation of an area of enhanced managed wetland in excess of the compensation required for the ecological value of the existing wetland on the site, and with a much improved carrying capacity for wildlife, and particularly for birds. The design clearly demarcates the landscape water elements from the wetland habitat that is created. It also creates an effective system of buffers between the residential development and the wetland habitat, and between the residential developments and the fishponds to the north.

2.5.25 The approach taken in reaching this design option has been to avoid any impact on the surrounding areas if at all possible and if this could not be achieved, then the impact has been minimized. An example of this is illustrated by the location of the different house types along the boundary of the Project Area. Any residual impact that may remain will be further offset by mitigation, such as by detailed design of the buffer space and earth bunds between the waters edge and the residential development.

2.5.26 The Preferred Option has therefore provided a residential development created in the context of an ecological design. This has included a strategy for the long term management of a newly created wetland system which will enhance the overall integrity of the Mai Po Marshes.

Summary of Alternative Options Considered

2.5.27 To summarise the discussions in the foregoing Sections **Table 2–2** has included salient points which illustrate the consideration of alternatives.

Table 2-2 Summary of Alternative Options Considered

Development Criteria	**Integrated Option**	**Medium Rise Option**		**Low Rise Option**		
	A	**B**	**C**	**D**	**E**	**F**
Wetland Restoration Area (WRA) (ha)	3.4	3.4	4.3	4.0	4.0	4.7
Buffering between Development and Existing Ponds to the North (m)	little buffer distance between residential developments and the CA.	provided by discrete WRA				increased buffer zone especially in the northwest of the Site
Building Form and Location	all 2.5/3 storeys	all 6 storeys	hybrid up to 6 storeys	hybrid 2 and 4 storeys	all 2.5/3 storeys	hybrid 2.5/3 and 4 storeys
Continuous Public Involvement (CPI)	discussed as part of CPI, not forward option	discussed as part of CPI	discussed as part of CPI	discussed as part of CPI used to develop option F	discussed as part of CPI	discussed as part of CPI process and subsequently further refined following further CPI process

Development Criteria	Integrated Option	Medium Rise Option		Low Rise Option		
	A	B	C	D	E	F
Avoidance of Key Ecological Impact	extensive mitigation required during formation of wetland restoration area	minimisation and mitigation measures adopted				avoidance, minimisation and mitigation principles adopted
Adjacent Pond	fragmented development	continuity provided especially with the adjacent fishponds				
Water Supply to Waterscape	initially rainwater plus supplies of "top up" water such as tap water using fixed pumps and a network of pipes					rainwater only with no fixed pumps
Flight Path of Birds	consideration of birds with medium flight height but no buffer provided at the northern portion	some of the frequent flight paths may be affected by the building heights and increase disturbance	buffer zone provided but limited width at the northwest of the Site where there are records of frequent flight paths			consideration of frequent birds flight path at low height with appropriate buffer width especially increased at northwest part of the Site
Nuisance from Existing Open Storage in the Northeast	reduced, but interface with low-rise residential units	impacts further minimized by locating non-noisy private facilities in this area.				
Sustainable Development	All have opportunities to incorporate sustainable development and green building design. However F has most sustainable solution as the WRA is wholly sustained by rainwater and not fed by alternative sources and requires no energy to maintain its functions.					

2.6 Construction Methods and Sequences of Works

Forms of construction

2.6.1 There are fundamentally 3 forms of construction under the development project, namely site formation, building construction and wetland restoration. In this case, it is important to consider the types of building structures that would be suitable in the context of the statutory planning requirement and from a geotechnical perspective.

Site Characteristics

2.6.2 The Project Area is located immediately west of the Scheduled Area No.2 as delineated by Environmental, Transport and Works Bureau (ETWB) Technical Circular (Works) No. 4/2004.

2.6.3 Based on available ground investigation findings, marble has been found in the western portion of the Project Area. About 2m thick fill layer is underlain by layers of marine and alluvial deposit which are mainly clay in nature. Deep weathered metasiltstone or meta-sandstone has been envisaged in the eastern portion of the Project Area.

Site Formation Work

2.6.4 Owing to the compressible nature of the top marine and alluvial clay, the Project Area is subject to settlement which requires some engineering works to resolve the problem.

2.6.5 In order to accelerate the settlement process preloading in collaboration with vertical band drains may be adopted at the Project Area. The extent of the excavation or surcharging for the sites to be selected for residential building will be subject to further engineering appraisals.

2.6.6 Excavated material will be utilized on site where possible for wetland restoration preloading and eventually for landscaping or disposal to a suitable facility. Contamination testing of existing fill will be conducted to confirm, or otherwise, that the fill is inert and can be reused. Similarly, sedimentation testing will be carried out in accordance with ETWB Technical Circular (Works) No. 34/2002. This will identify an appropriate disposal strategy for any excavated sediment.

Building Construction Work

2.6.7 Ground investigation work has been carried out to confirm the classification of existing marble quality. Non-percussive piling, if any is to be carried out, will need to take heed of the additional loading imposed on the marble.

2.6.8 On the other hand, due to the long term settlement anticipated, because of the existence of superficial marine and alluvial clay, conventional raft footing alone, resting on top of these compressible layers may impose excessive settlement to the building structures, which is not desirable.

2.6.9 In order to control effect on underlying marble as well as settlement consideration, box footing or pile raft supported by short piles could be the foundation schemes for some 2.5 to 3 stories houses. For the non-marble zone, conventional Continuous Flight Augar (CFA) piles could be another foundation option for houses up to 4 stories high which include the clubhouse situated in eastern corner of the site.

2.6.10 The statutory zoning plan permits 6 storey dwelling. However, it is envisaged there will be a range of 2.5/3 to 4 storey residential properties of maximum GFA 82,800m^2 and plot ratio 0.4. These will be constructed in conventional cast in-situ method. The feasibility of using pre-cast construction will be subject to further engineering appraisals.

Wetland Restoration

2.6.11 In terms of creating the wetland, it is envisaged that the wetland restoration could be formed using a clay perimeter and existing marine mud. This would avoid exporting this material from site. A liner is expected to be required to prevent water loss; this could be natural or artificial, the final decision will be made at the detailed design stage. In any case a layer of soil will be laid on the bottom and sides of the wetland in order to provide suitable conditions for the establishment of the wetland. The edges of the wetland restoration works will be formed at suitably shallow gradients to ensure they remain stable.

Sequence of Works

2.6.12 The Project Area covers approximately 21.36ha and construction is planned to be undertaken in phases as shown in **Figure 2.11**.

2.6.13 In order to protect the nearby residents and the ecological resources utilizing the adjacent fishponds as well as the Project Area per se from the disturbance of construction works (noise, movement, visual nuisance) noise barriers are proposed as shown in **Figure 4.6**. The establishment of barriers/hoardings is the initial task on site and is scheduled to take place sequentially over a 6 month period.

2.6.14 The Wetland Restoration Area will be constructed and established under Phases A and B, shown on **Appendix B-2**, taking around 8 months for the excavation of the Wetland Restoration Area and profiling of the ground (refer to **Appendix H** for details of the shape and form of this area), with an establishment period of at least 12 months. This establishment period will permit the wetland to be rain fed and filled, and vegetation to be planted. The hoarding between the WCA fishponds and the Wetland Restoration Area will be removed only upon completion of the site works. However the hoarding between the Wetland Restoration Area and the construction site will remain until construction works has been completed. This is to protect the newly created ecological resource from the effects of construction of the residential area, as described in Section 8. The noise barriers around the perimeter of the site (for the protection of the noise sensitive human resources) will be of varying height (as described in Section 4). This barrier may be removed in stages once the first layer of houses and protection is provided to the Project Area.

2.6.15 Site formation and preloading will start in Phases C and D in advance of the excavation for the wetland. Site formation works will include excavation, filling, installation of vertical band drains and preloading works. Once preloading works have been completed the materials will be moved from phase to phase around the site to minimize off site export or import of materials, thereby minimizing truck movements and waste of onsite resources.

2.6.16 Around eight months after Phases C and D commence site formation works, Phases E and F will start and follow the same construction sequencing.

2.6.17 Construction of substructure and superstructure work will be carried out immediately after the preloading activity for each Phase. Overlapping of different forms of construction is expected during the whole construction period.

2.6.18 Raft footing supported by short piles (Pile Raft System) or box foundation is preferred for supporting the 2.5 to 3-storey houses for both marble and non-marble zone, while Continuous Flight Augar (CFA) piles will be an option to be considered for duplex-on-duplex properties.

2.6.19 Superstructure construction will be carried out using conventional cast-in-situ method instead of using pre-cast construction. The feasibility of using pre-cast construction will be subject to further engineering appraisals.

3 AIR QUALITY

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

3.1 Summary

3.1.1 An air quality impact assessment has been undertaken in accordance with Section 3.9.1 of the EIA Study Brief to define the nature and scale of potential air quality impacts associated with the Project. For this Project, major air sensitive receivers are essentially residents in nearby developments including the Mai Po San Tsuen, Royal Palms, Palm Springs and the Wo Shang Wai village.

3.1.2 Potential impacts associated with the construction phase have been assessed. Major sources of air quality impact include fugitive dust emissions during the excavation of pond deposits and infill materials during the foundation works, and construction of the Project and the associated infrastructure works. (i.e. roads, drains, pavements etc.). Other minor sources include emissions from vehicles using the Project Area.

3.1.3 However, the Study Brief states that quantitative assessments are only required if construction dust is likely to cause exceedance. As fugitive dust impacts are expected to be minor and could be controlled by standard mitigation measures, no quantitative modelling has been undertaken to predict the fugitive dust impacts. Details of the mitigation measures and audit requirements are contained in this section.

3.1.4 During the operational phase, air quality impacts associated with vehicular emissions on- and off-site are considered insignificant. Major roads like the San Tin Highway and the Castle Peak Road are some 230m away from the nearest air sensitive receivers of the Project Area, and the traffic flow on-site along access roads is also expected to be low and mainly dominated by private cars.

3.1.5 As a result, vehicular emission impacts on air sensitive receivers within the proposed development should be insignificant. There is no on-site sewage treatment plant proposed or any other sources that will contribute to odour emissions and hence no odour modelling has been undertaken.

3.1.6 The conclusion is that there should be no unacceptable air quality impacts associated with the implementation of this project, both during the construction and operational phases.

3.2 Legislation, Standards, Guidelines and Criteria

3.2.1 Legislation, Standards, Guidelines and Criteria relevant to the consideration of air quality impacts under this study include the following:

- Hong Kong Air Pollution Control Ordinance;
- Air Pollution Control (Construction Dust) Regulation; and
- Environmental Impact Assessment Ordinance and Technical Memorandum on Environmental Impact Assessment Process.

Hong Kong Air Pollution Control Ordinance

3.2.2 Hong Kong's air quality is regulated through the Air Pollution Control Ordinance (Cap. 311) ("APCO"). The APCO specifies Air Quality Objectives ("AQOs"), which are the statutory limits for a number of pollutants and the maximum allowable number of times that these may be exceeded over specified periods – these pollutants are defined as Criteria Pollutants ("CP"). The Air Quality Objectives (AQOs) that have been defined for these pollutants (CP) are given in the following table

Table 3-1 Hong Kong Air Quality Objectives ($\mu g/m^3$)(i)

Pollutant	1 Hour (ii)	8 Hours (iii)	24 Hours (iii)	3 Months (iv)	1 Year (iv)
Sulphur Dioxide	800		350		80
Total Suspended Particulates	500(vii)		260		80
Respirable Suspended Particulates (v)			180		55
Carbon Monoxide	30,000	10,000			
Nitrogen Dioxide	300		150		80
Photochemical Oxidants (as ozone) (vi)	240				
Lead				1.5	

Notes:
(i) Measured at 298K(25 °C) and 101.325 kPa (one atmosphere).
(ii) Not to be exceeded more than three times per year.
(iii) Not to be exceeded more than once per year.
(iv) Yearly and three monthly figures calculated as arithmetic means.
(v) Respirable suspended particulates means suspended particles in air with nominal aerodynamic diameter of 10 micrometres and smaller.
(vi) Photochemical oxidants are determined by measurement of ozone only.
(vii) This is not an AQO but a criterion for construction dust impact assessment under Annex 4 of the Technical Memorandum on Environmental Impact Assessment Process.

Air Pollution Control (Construction Dust) Regulation

3.2.3 *Air Pollution Control (Construction Dust) Regulation* stipulates the construction dust control requirements for both notifiable (e.g. site formation) and regulatory (e.g. road opening) works to be carried out by the Contractor. The requirements for various notifiable and regulatory works are given in Parts 1 and 2 of the Regulation respectively. Part 3 of the Regulation stipulates the general control requirements (e.g. site boundary and entrance) for construction dust. The control requirements for individual activities (e.g. stockpiling of dusty material) are given in Part 4 of the Regulation.

Environmental Impact Assessment Ordinance and Technical Memorandum on Environmental Impact Assessment Process

3.2.4 The criteria for evaluating air quality impacts are stated in Annexes 4 and 12 of the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM). The EIAO-TM states that the hourly Total Suspended Particulate (TSP) level should not exceed 500$\mu g/m^3$ (measured at 25^oC and one atmosphere) for construction dust impact assessment There is also a criterion for odour to meet 5 odour units based on an averaging time of 5 seconds for odour prediction assessment.

3.3 Assessment Methodology

Construction Phase

3.3.1 Activities anticipated during the construction phase that could potentially give rise to fugitive dust emissions include site formation and construction of on-site infrastructure (roads/drains) and residential units. Other potential sources of air quality impacts may include exhaust emissions from construction vehicles and odour generated from the excavation of pond deposits. Para 3.9.1.4 (iii) of the EIA Study Brief states that a quantitative assessment is needed if the potential construction dust impact is likely to cause exceedance of the criteria despite incorporation of dust construction measures.

Operational Phase

3.3.2 Potential air quality impacts could attribute to vehicular emissions from both on-site and off-site sources as well as odour sources in the vicinity. However, there will be no need for on-site sewage treatment plant as public sewer will be available shortly after completion of the development.

3.3.3 During the operational phase, sources of air quality impact include vehicular emissions from road traffic and on-site vehicular movements. Para 3.9.1.4 (iv) of the EIA Study Brief states that if the assessment indicates likely exceedance of the recommended limits in the TM at the development and the nearby ASRs, a quantitative impact evaluation following the methodology in para. 3.9.1.4 (v) shall be carried out.

3.3.4 As the minimum separation distance between the major roads, San Tin Highway and Castle Peak Road, and the nearest air sensitive receivers within the proposed development is more than 230m, vehicular emissions from the major roads should unlikely to affect the residential development and hence a qualitative assessment has been adopted in this Study.

Traffic Forecast

3.3.5 The traffic forecast for the year 2027 (15 years after the originally planned occupation year of 2012) (both AM and PM peak hour flow) has been summarised in **Table 3–2** below. Although the occupation of the proposed residential development is now been postponed to 2013, the effect on air quality due to a further 1.95% annual increase in the flow is considered insignificant.

Table 3-2 Traffic Forecast in Year 2027

Peak Hour Vehicle flows (veh/hr)	San Tin Highway		Castle Peak Road		Project Access Road		San Tam Road	
	AM	PM	AM	PM	AM	PM	AM	PM
Motor cycles	51	82	6	8	2	3	4	6
Private Car	2533	2631	226	240	88	89	162	213
Taxi	243	212	20	18	8	7	15	16
Private light buses	30	35	16	21	0	0	19	29
Public light buses	148	114	81	68	0	0	95	96
LGV	846	984	68	46	18	20	59	38
HGV	1454	1482	105	88	2	1	121	122
Non-franchised buses	203	271	11	8	3	3	9	8
Single Deck Franchised Buses	13	15	0	0	0	0	0	0
Double Deck Franchised Buses	81	105	3	2	0	0	3	3
Total	5602	5931	535	499	121	122	487	530

3.4 Baseline Conditions/ Sensitive Receivers

Baseline Conditions

3.4.1 Existing air quality in the Assessment Area is mainly affected by the traffic flow along major roads near the Project Area such as Castle Peak Road and San Tin Highway to the east of the site. In accordance with the wind data obtained from the nearest wind monitoring station at Lau Fau Shan, the prevailing wind direction is easterly (080 degrees) in year 2005.

3.4.2 In respect of background air quality, Air Quality in Hong Kong 2002-2006 and Annual Air Quality Statistics 2006 have been referred to. Air Services Group of the Environmental Protection Department (EPD) operates a network of 14 Air Quality Monitoring Stations in Hong Kong. The nearest EPD's monitoring station is located at Yuen Long. The monitoring data recorded at this station have been used as background concentration in this assessment as shown in **Table 3-3.**

Table 3-3 Air Quality at Yuen Long Monitoring Station in Past Five Years

Pollutant	**5-year Annual Average, μg/m^3**
Nitrogen Dioxide	60
Total Suspended Particulates	100
Respirable Suspended Particulates	62

Source: Adapted from EPD's Air Quality in Hong Kong 2002 – 2005, Annual Air Quality Statistics 2006.

Sensitive Receivers

3.4.3 Representative Air Sensitive Receivers (ASRs) within 500m of the site boundary have been identified according to the criteria set out in the EIAO-TM through site inspections and a review of land use plans. ASRs and their horizontal distance to the nearest emission source have been identified and are summarized in **Table 3-4**. Locations of the ASRs are shown in **Figure 3.1**.

Table 3-4 Locations of Representative Air Sensitive Receiver

ID	**Receiver Description**	**Usage**	**Construction Phase**	**Operational Phase**	**Distance to the nearest Emission Sources* (in metres)**
ASR1	Royal Palms	Residential	✓	✓	approx 10m
ASR2A & ASR 2B	Palm Springs	Residential	✓	✓	approx 10m
ASR3	Wo Shang Wai	Residential	✓	✓	approx 50m
ASR4	Village House of Mai Po San Tsuen	Residential	✓	✓	approx 15m
ASR5	Proposed Comprehensive Development at Wo Shang Wai (Project Area)	Residential	×	✓	approx 5m (local road) more than 230m (major road)

* Emission sources include construction activities in the construction phase and vehicular emissions from road traffic during operation

3.5 Air Quality Impact Assessment

Construction Phase

Identification of Potential Impacts

3.5.1 Fugitive dust could be generated during the construction of the Project as a result of construction activities like material handling, excavation, vehicles movement and erosion of unpaved area and stockpiles. The potential air quality impact is however anticipated to be short-term and can be controlled through appropriate design and good site practice stipulated in the Air Pollution Control (Construction Dust) Regulation.

3.5.2 Vehicles and plants powered by diesel emit SO_2 and NO_2 but the extent of these emissions should be limited and will unlikely breach the AQO. Other potential impact may include malodour arising from excavation of pond deposit.

3.5.3 No concrete batching plants will be used on-site. Concrete will be brought into site in "ready-mixed" state or in pre-cast sections. Given a relatively flat site, no rock crushing will be necessary.

Evaluation of Impacts

3.5.4 Commencement of Project construction has been tentatively scheduled in 2008 with the residential development ready for occupation in 2013. The entire site will be divided into 6 portions i.e. 2 restored wetland and 4 residential development phases. Construction works will be carried out in phases from the east portion near the ingress towards the west portion. An indicative construction programme and a layout plan are shown in **Appendix B-2** and **Figure 2.11** respectively.

3.5.5 Dust may be generated from materials handling (loading and unloading) activities, excavation, vehicle movement on unpaved roads and wind erosion of unpaved areas and stockpiles. It is anticipated that the dustiest periods include filling work, preloading and removing top fill. The construction works will be carried out in 6 Phases. In order to minimize dust impact during the construction phase, the overlapping of each phase will be minimized (**Appendix B-2** refers). The total volume of topsoil materials to be excavated is around $10,000m^3$, which includes a thin layer of vegetation with moisture content of about 20-25%.

3.5.6 Dust generation could be effectively minimized by providing covers to dusty materials in order to prevent erosion, and dust could be suppressed by regular site watering. In general practice, site watering twice a day can reduce dust contribution from exposed areas by 50%. More frequent wetting/ watering is advisable during dry conditions determined by on-site specific parameters (e.g. temperature, humidity, soil moisture content etc.). The number of dump trucks is expected to be around 25-30 per hour, in which assumed 15 dump trucks shall be travelling on the haul road and 15 stationary at various work phases for load/ unloading works. The speed of the trucks within site will be controlled to 10 kph in order to reduce dust impact and for safe movement around the site. In addition, there are noise barriers proposed surrounding the site. With appropriate dust control measures, adverse dust impact is not anticipated.

3.5.7 Based on the information provided by the Drainage Services Department (DSD) and Environmental Protection Department (EPD), a gravity trunk sewer will be provided along Castle Peak Road between Ngau Tam Mei and San Tin under PWP Item 235DS by 2012.

3.5.8 This 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 tentative construction period is to be from 2009 to 2012, in which a section of the alignment will be constructed at the same time as the proposed development at Wo Shang Wai. The EIA report just mentioned 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.

3.5.9 To minimise cumulative impact from this concurrent project, the EIA recommended to carry out the construction works 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 areas of these sites should be small. In addition, this concurrent project is far away (about 200m) from the Project Area and proper mitigation measures had been proposed in their EIA study. As such, the cumulative impact that can be caused by this concurrent project should be insignificant.

3.5.10 Respective project specific EM&A manual and monitoring requirements had been stipulated for this concurrent project. The respective Contractor will be responsible for the ultimate construction method, selection of plants, proper mitigation measures and event/action plan for effective control of dust emissions. With the continual monitoring and review of dust impact in the area, cumulative impact would not be anticipated.

3.5.11 Apart from the implementation of dust control measures, an Environmental Monitoring and Audit (EM&A) programme will be undertaken to monitor the dust impacts associated with construction to ensure no adverse impacts on the adjacent ASRs and to verify the effectiveness of the control measures. In conclusion, compliance with the AQOs is considered achievable during construction given the proper control measures recommended and the EM&A programme.

3.5.12 Since the proposed Project Area was derived from fishponds, pond deposits underlay a majority of the Project Area. Pond deposits are a mixture of organic material and may release odour for a short duration if excavated. In order to minimise the odour nuisance to surrounding environment, the following control measures are recommended:

- all malodorous excavated material should be placed as far as possible from any ASRs;
- the stockpiled malodorous materials should be removed from site as soon as possible; and
- the stockpiled malodorous materials should be covered entirely by plastic tarpaulin sheets.

3.5.13 With proper measures, potential odour impact is considered to be short-term and controllable.

Operational Phase

Identification of Potential Impacts

3.5.14 Impacts arising from operation of this Project could primarily attribute to on-site vehicular emissions that may affect the proposed development itself and identified ASRs off-site. The potential impacts are however anticipated to be insignificant.

3.5.15 In addition, odour impacts from the nearby sewage treatment plants are another potential concern. Given the vastness of the site, the potential impacts are considered insignificant. Unacceptable impacts are unlikely as no malodours have been reported on site during the past 15 months of on-site surveys. It is re-emphasised that there will be no sewage treatment plant provided for this development and thus no direct odour source will present on-site.

3.5.16 The layout of the facilities for the development has been carefully planned and the refuse collection point (a potential odour generator) has been deliberately situated away from the residential development and will be close to the main access area connecting the main road. During the detailed design phase the minimisation of odours at the refuse collection point will be considered in more detail to reduce any potential for localised nuisance.

Evaluation of Impacts

3.5.17 Vehicular emission impact from the major roads, San Tin Highway and Castle Peak Road, and project access road are considered insignificant as the nearest sensitive receivers are more than 230m from these major roads.

3.5.18 Within the Assessment Area (a distance of 500m from the Project Area), there are two existing private sewage treatment plants which serve the Palm Springs and Royal Palms residential developments as shown in **Figure 3.1**. The population size of Palm Springs and Royal Palms are about 3300 and 1700, respectively. No sewage odour has been detected when conducting site surveys at the Project Area over a 15 month period from April 2005 to June 2006. In addition, site walks near the sewage treatment plants at Palm Springs and Royal Palms have been conducted. It was found that even near the sewage treatment plants, no sewage odour has been detected.

3.5.19 It is noted that the nearest air sensitive receiver of Royal Palms and its sewage treatment plant, and the nearest air sensitive receiver of Palm Springs and its sewage treatment plant are separated by a distance less than 20m and no complaints were recorded for these two sewage treatment plants. It should be reasonable to expect that no sewage odour impact should be likely at the Wo Shang Wai Project Area as the minimum separation distance of air sensitive receivers from the Royal Palms Sewage Treatment and Palm Springs Sewage Treatment Plant will be at least 200m and 250m respectively.

3.6 Mitigation of Impacts

During Construction

3.6.1 To ensure compliance with the AQOs at the ASRs at all times, it is recommended to include 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. All the relevant dust control measures stipulated in the Air Pollution Control (Construction Dust) Regulation would be fully implemented. Details of the monitoring and audit requirements are provided in a separate EM&A Manual. Mitigation measures include:

- 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;
- dump trucks for material transport 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 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;
- the portion of road leading only to a construction site that is within 30m of a designated vehicle entrance or exit should be kept clear of dusty materials;
- stockpile of dusty materials to 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;
- 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;
- all malodorous excavated material should be placed as far as possible from any ASRs;
- the stockpiled malodorous materials should be removed from site as soon as possible; and
- the stockpiled malodorous materials should be covered entirely by plastic tarpaulin sheets.

During Operation

3.6.2 As the potential impacts in terms of air quality during the operational phase will be insignificant, no specific mitigation measures are required. Nevertheless, the air quality aspect has been taken into account during the Project planning.

3.7 Residual Impacts

3.7.1 No adverse residual impacts are envisaged for the construction and operational phase of the Project.

3.8 Environmental Monitoring and Audit

3.8.1 Although the proposed Project is not expected to generate excessive dust levels, an environmental monitoring and audit program is recommended to ensure compliance with air quality criteria and the proper implementation of mitigation measures. Details are discussed in the EM&A Manual.

3.9 Conclusions and Recommendations

3.9.1 Through proper implementation of dust control measures required under the Air Pollution Control (Construction Dust) Regulation by the works contractor, construction dust can be controlled at source to acceptable levels and hence no unacceptable impacts are anticipated.

3.9.2 During the operational stage, no adverse impact is anticipated, especially as there will be no on-site sewage treatment plant and therefore no sources of odour.

4 NOISE IMPACT

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

4.1 Introduction

4.1.1 This section presents an assessment of the potential noise impacts arising from the construction and operation of the proposed comprehensive development at Wo Shang Wai in Yuen Long. This noise impact assessment was conducted in full compliance with the criteria and guidelines for evaluating and assessing noise impact as stated in Annexes 5 and 13 of the Technical Memorandum on the Environmental Impact Assessment Process (hereafter referred to as the EIAO–TM), respectively and the requirements under section 3.9.2 of the Study Brief.

4.2 Government Legislation and Standards

Environmental Impact Assessment Ordinances, Cap. 499 S. 16

4.2.1 The Technical Memorandum (TM) published under Section 16(5) of the Environmental Impact Assessment Ordinance (EIAO) gazetted in 1997, is the fundamental legislation of noise criteria for evaluating noise impact of designated projects. The Summary of Noise Criteria is given in **Table 4-1**, Noise Standards for Planning Purposes and, **Table 4-2**, Noise Standards for Daytime Construction Activities.

Table 4-1 Relevant Noise Standards for Planning Purposes

Noise Sources / Noise Standards / Common Uses	Road Traffic Noise Peak Hour Traffic $L_{10\ (1hour)}$ dB(A)	Fixed Noise Sources
All domestic premises including temporary housing accommodation	70	(a) 5 dB(A) below the appropriate Acceptable Noise Levels (ANL) shown in Table 3 of the Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction Sites, or (b) the prevailing background noise levels (For quiet areas with level 5 dB(A) below the ANL)
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	65	

Notes: (i) The above standards apply to uses which rely on opened windows for ventilation
(ii) The above standards should be viewed as the maximum permissible noise levels assessed at 1m from the external façade

Table 4-2 Noise Standards for Daytime Construction Activities

Noise Sources / Noise Standards / Uses	0700 to 1900 hours on any day not being a Sunday or general holiday $L_{eq\ (30\ mins)}$ dB(A)	1900 to 0700 hours or any time on Sundays or general holiday
• All domestic premises including temporary housing accommodation	75	(See Note iii)
• Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	70 65 (During examinations)	

Notes: (i) The above 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 criteria laid down in the relevant technical memoranda under the Noise Control Ordinance for designated areas and construction works other than percussive piling may be used for planning purpose. A Construction Noise Permit (CNP) shall be required for the carrying out of the construction work during the period.

Noise Control Ordinance, Cap. 400

4.2.2 The Noise Control Ordinance (NCO) gazetted in 1988, is the fundamental legislation controlling noise levels in industrial and commercial premises, as well as for construction works. The NCO is enacted through the Technical Memoranda (TM) and Regulations. The TM relevant to this assessment study is the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM). IND-TM details the procedures that should be adopted by the Authority for the measurement and assessment of noise emanating from places other than domestic premises, public places or construction sites. The Acceptable Noise Levels (ANLs) depend on the ASR of the assessment area. **Table 4-3** illustrates the ASRs of different types of area containing the NSR. The ANLs are shown in **Table 4-4**.

Table 4-3 Area Sensitivity Ratings (ASRs)

Type of area containing the NSR	Not Affected [1]	Indirectly Affected [2]	Directly Affected [3]
(i) Rural area, including country parks or village type developments	A	B	B
(ii) Low density residential area consisting of low-rise or isolated high-rise developments	A	B	C
(iii) Urban area	B	C	C
(iv) Area other than those above	B	B	C

[1] Not Affected - NSR is located such that the noise generated by the influencing factors (IF) [4] is not noticeable.

[2] Indirectly Affected - NSR is located such that the noise generated by the influencing factors while noticeable, is not a dominant feature of the noise environment.

[3] Directly Affected - NSR is located such that the noise generated by the IF is readily noticeable and is a dominant feature of the noise environment.

[4] IFs are defined as industrial areas, major roads, or the area within the boundary of Hong Kong International Airport.

Table 4-4 Acceptable Noise Levels (ANLs)

Time Period	Area Sensitivity Rating A	Area Sensitivity Rating B	Area Sensitivity Rating C
Day (0700 to 1900 hours)	60	65	70
Evening (1900 to 2300 hours)			
Night (2300 to 0700 hours)	50	55	60

4.2.3 As the subject site is located in rural area with village type developments and is not affected by any influencing factors (IF), the Area Sensitivity Rating (ASR) is “A” and the planning noise standards (ANL -5dB(A)) should be 55dB(A) for day and Evening periods and 45dB(A) for night time. Nevertheless according to the site noise surveys, the prevailing background noise level within in the area is 46dB(A) during daytime, which is more than 5dB(A) lower than the relevant ANL of 55dB(A) in EIAO-TM. Details of the noise surveys are provided in Section 4.3. Therefore the prevailing background noise level of 46dB(A) is adopted as the noise criterion for day and evening time (i.e. 0700 – 2300). On the other hand, the noise criterion remains as 45 dB(A) for night time according to EIAO-TM.

4.3 Background Noise Climate

4.3.1 The “Assessment Area” for the noise impact assessment has included all areas within 300m from the boundary of the Project Area, which is shown in **Figure 4.1**. Major land use within the assessment area includes residential developments such as Royal Palms, Palm Springs, Mai Po San Tsuen and Wo Shang Wai village, open storage sites and roads such as Castle Peak Road, San Tin Highway and San Tam Road. As observed during site visits in February 2006, and March, April and September 2007, the noise climate of the area is predominately affected by nearby traffic including heavy vehicles travelling along the access road to the open storage site at the northeast corner of the Project Area.

4.3.2 Noise surveys were carried out on 15 February 2006, 19 March 2007, 19-20 April 2007 and 19-20 September 2007 to investigate the background noise condition of the surrounding environment and the Project Area. **Figure 4.5** shows the baseline noise measurement locations.

4.3.3 Noise measurements were carried out at the Project Area and surrounding area. The noise measurements were undertaken using Type 1 sound level meters, namely Rion NL31 and Rion NA27. During each measurement, the sound level meter was checked using an acoustic calibrator generating a sound pressure level of 94dB(A) at 1kHz immediately before and after the noise measurement. The measurements are accepted as valid only if the calibration levels before and after the noise measurement were agreed to within 1.0dB. Moreover, the sound level meters and acoustic calibrators were calibrated in accredited laboratories yearly to ensure reliable performance. The measurement results are shown in **Table 4-5** below.

Table 4-5 Measured Noise Levels

ID	Location Description	Date	Time Period	Measured Noise Level, $L_{eq(15mins)}$ dB(A)	Corrected Façade Noise Level at planned NSRs, $L_{eq(15mins)}$ dB(A)
A	Northern side of the subject site – dominant noise source is activities at fishpond and natural environment[1]	15 Feb 2006	1035 - 1050	44	47
B	Western side of the subject site – dominant noise source is from the domestic premises (which located approx. 30m from the subject site)[1]	15 Feb 2006	1135 - 1150	46	49
C	Southern side of the subject site – dominant noise source is natural environment[1]	15 Feb 2006	1205 - 1220	43	46
D	Near entrance of the subject site – dominant noise sources are domestic premises, open storage area and vehicles[1]	15 Feb 2006	1250 - 1305	50	53
E	Sewage Treatment Plant within Royal Palms[1]	19 Mar 2007	1030 - 1045	56	N/A
F	Entrance of the existing open storage site[1]	19 – 20 Apr 2007	24 hours	46 – 63	N/A
G	Outside southern boundary of the site – dominant noise source was insect[2]	19 – 20 Sep 2007	2345 - 0015	49	N/A

[1] Noise measurement undertaken by Mott Connell Ltd.

[2] Noise measurement undertaken by Allied Environmental Consultants Ltd.

4.4 Identification of Potential Noise Impacts

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

Construction Phase

4.4.2 Noise impacts arising from construction of the proposed development are mainly due to the use of powered mechanical equipment (PME) for various construction activities. The construction work for the proposed development is generally divided into six development phases:

- Phases A and B – Wetland restoration
- Phases C, D, E and F – House construction

4.4.3 Phases A and B mainly involve site formation works. Phases C, D, E and F involve foundation and superstructure construction works. Non-percussive piling shall be used for the foundation works at the subject development site. The construction activities that are likely to cause noise impacts include excavation, piling and concreting. No noisy operations are predicted during the 'finishing' activity of each phase as shown in **Appendix B-2** as it is predicted that such activities are mostly confined to the inside of the already constructed houses. The potential noise impact during the construction phase of the development was assessed quantitatively as detailed in Section 4.6.

Operational Phase

4.4.4 There is no major fixed plant such as on-site pump house and sewage treatment plant in the proposed development. Operational phase noise impact from the proposed development is not anticipated.

4.4.5 There are an existing open storage site and a sewage treatment plant in Royal Palms within the assessment area. No planned fixed plant operation is found. According to the letter from Planning Department (**Appendix D-1A**) and the Notes of the approved Mai Po & Fairview Park Outline Zoning Plan (OZP) No. S/YL-MP/6, the planning intention of the "OU(CDWRA)" zone is to provide incentive for the restoration of degraded wetlands adjoining the exiting fish ponds through comprehensive residential and/or recreational development to include wetland restoration area. It is also intended to phase out existing sporadic open storage and port back-up uses on degraded wetlands. In this connection, it is anticipated that future planned fixed plant operation in the area is unlikely.

4.4.6 In due regards to the planning policy to phase out industrial uses and encourage wetland restoration in the area, the potential noise impact of these two existing fixed noise sources is considered as the worst case scenario during operation stage of the proposed residential development.

4.4.7 Road traffic on nearby road network is the dominant noise source within the assessment area. There is potential road traffic noise impact on the proposed development. The noise impact assessment was detailed in Section 4.6.

4.5 Determination of Noise Sensitive Receivers

4.5.1 With reference to Annex 13 of the TM, noise sensitive receivers (NSRs) have been identified within the assessment area. These NSRs included all existing NSRs as well as planned/committed noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans and development layout plans.

4.5.2 According to Planning Department's record, no planning application or rezoning application for residential development or other noise sensitive uses in the nearby OU and V zones. With reference to the Planning Application Cases (**Appendix D-1B**) for the site nearby (namely Site B and Site C as shown in **Appendix D-1B**), applications for industrial or open storage uses were rejected by the Rural and New Territories Planning Committee / Town Planning Board. These cases are listed below:

- A/YL-MP/061 – Application for "Temporary Car, Lorry and Container Trailer/Tractor Park for a Period of 12 Months"
- A/YL-MP/021 – Application for "Temporary Container Storage, Container Repair Workshop with Ancillary Office and Canteen for a Period of 12 Months"

4.5.3 Any future planned residential uses of these sites require the approval from Town Planning Board and application for such uses likely have to go through the EIA process. Therefore there are currently no known planned sensitive uses in the OU. As New Territories Exempted Houses in V zone are always permitted, representative noise sensitive receiver at the V zone in the vicinity of the proposed development is included in this assessment.

4.5.4 The uses and designation of the noise sensitive receivers within the assessment area are shown in **Table 4-6**. The assessment points for construction noise impact evaluation are shown in **Figure 4.2** and **Table 4-7** and for operation phase assessment are shown in **Figure 4.3** and **Table 4-8**.

Table 4-6 Identified Noise Sensitive Receivers within 300m from the Boundary of Project Area

Use	Designation
Residential	Palm Springs
Residential	Royal Palms
Residential	Wo Shang Wai Village
Educational Institute	St Lorraine English Kindergarten
Residential	Mai Po San Tsuen
Residential	Scenic Heights

Table 4-7 Horizontal Distances between the Assessment Points of Representative NSRs and the Notional Centre of Each Phase for Construction Stage

NSR ID	Use	Building Name	No. of storeys	Horizontal distance between NSRs and the notional centre of each phase, m					
				A	B	C	D	E	F
1	Residential	House No. 5, Camelia Path, Palm Springs	3	104	364	220	442	66	338
1a	Residential	House No. 5, Cherry Path, Palm Springs	3	76	338	214	424	96	358

NSR ID	Use	Building Name	No. of storeys	Horizontal distance between NSRs and the notional centre of each phase, m					
				A	B	C	D	E	F
2	Residential	House No. 1, Pinaceae Drive	3	272	488	254	484	88	256
3	Residential	House No. 17, Wo Shang Wai Village	3	296	406	176	336	150	120
4	Residential	House No. 25, Narcissus Path, Royal Palms	3	330	364	180	282	234	58
4a	Residential	House No. 61, Narcissus Path, Royal Palms	3	418	396	256	280	344	84
4b	Residential	House No. 1, Narcissus Path, Royal Palms	3	278	366	148	294	156	76
5	Residential	House No. 1, Ventura Avenue, Royal Palms	3	370	208	224	84	408	110
6	Residential	House No. 1, Mann Avenue, Royal Palms	3	400	288	226	180	398	94
7	Residential	Mai Po San Tsuen	3	652	394	548	268	740	452
8	Residential	House A1, Scenic Heights	3	800	608	644	414	816	514
9	Educational Institute	St Lorraine English Kindergarten	1	412	466	272	376	280	156
10	Residential (Planned)	Mai Po San Tsuen	3	578	360	448	168	636	340

Table 4-8 Assessment Points of the Representative NSRs for Operational Stage

NSR ID	Location	No. of storeys	Height, mPD
A	2.5/3 Storey house (near Project entrance, façade facing San Tin Highway)	3	1/F – 7.2mPD 2/F – 10.2mPD 3/F – 13.2mPD
A	2.5/3 Storey house (near Project entrance, façade facing Project access road)	3	
B	2.5/3 Storey house (façade facing Project access road)	3	
C	4 Storey duplex-on-duplex (façade facing San Tin Highway)	4	1/F – 7.2mPD 2/F – 10.2mPD 3/F – 13.2mPD 4/F – 16.6mPD

4.6 Assessment Methodology

Construction Phase

4.6.1 Construction noise levels are predicted at the identified noise sensitive receivers for both the foundation and superstructure work stages in order to assess the project feasibility during the planning stage and to identify if there are any potential constraints on the works programme or the use of construction equipment.

4.6.2 The tentative construction programme for the proposed development will start from January 2009 to January 2012 as shown in **Appendix B-2**. It is anticipated that evening or night time (7pm to 7am the next day) construction work is not required. Therefore, the potential noise impacts of construction works during restricted hours were not assessed in this EIA study. Notwithstanding the above, for any construction works to be carried out during the restricted hours, the Contractor will be required to submit CNP applications to the Noise Control Authority and has the responsibility to ensure compliance with the conditions of CNP, if issued.

4.6.3 Despite any description or assessment made in this EIA Report on construction noise aspects, there is no guarantee that a Construction Noise Permit (CNP) will be issued for the project construction. The Noise Control Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant Technical Memoranda issued under the Noise Control Ordinance. The Noise Control Authority will take into account of contemporary conditions / situations of adjoining land uses and any previous complaints against construction activities at the site before making his decision in granting a CNP. Nothing in this EIA Report shall bind the Noise Control Authority in making his decision. If a CNP is to be issued, the Noise Control Authority shall include in it any condition he thinks fit. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution action under the NCO.

4.6.4 The potential noise impacts on the nearby sensitive receivers arising from the construction of the proposed development during non-restricted hours (7am to 7pm) were assessed. The construction noise impact assessment was carried out based on standard acoustic principles and practices, following the methodology given in the Section 2 of the Technical Memorandum on Noise from Construction Works other than Percussive Piling of the Noise Control Ordinance and the British Standards (BS) 5228: Part 1, where appropriate.

4.6.5 **Table 4-9** shows the details of plant inventory for each phase. As confirmed by the project proponent, the plant inventory and the number of vehicles travelling along the site access road and haul road adopted in this assessment are technically feasible for undertaking the construction works. The maximum number of dump trucks to be deployed on site shall be 30, amongst which it is assumed that 15 dump trucks shall be travelling on the haul road and 15 stationary at various work phases for loading/unloading works. The alignment of site access road and haul road is shown in **Figure 4.4**. The total number of plants for different works throughout the construction stage is presented in **Appendix D-2A**.

Table 4-9 Inventory of Noise Sources at Each Phase – During Construction

Construction Stage	Powered Mechanical Equipment	TM Ref.	Quantity	SWL/unit, dB(A)
Wetland Restoration (only at Phases A and B)	Breaker, excavator mounted (pneumatic)	CNP027	1	122
	Excavator	CNP081	2	112
	Roller, vibratory	CNP186	2	108
	Bulldozer	CNP030	2	115
	Generator, standard	CNP101	1	108
	Dump Truck	CNP067	1	117
	Lorry, with crane, gross vehicle weight > 38 ton	[1]	1	112
	Breaker, hand-held, mass > 35 kg	CNP026	1	114
Site Formation and Excavation	Breaker, excavator mounted (pneumatic)	CNP027	1	122
	Excavator	CNP081	2	112
	Roller, vibratory	CNP186	3	108
	Bulldozer	CNP030	3	115
	Generator, standard	CNP101	2	108
	Dump Truck	CNP067	3 [2]	117
Installation of Band Drains	Band drains installation machine (Compactor, vibratory)	CNP050	6	105
Piling	Continuous flight auger (CFA) piles (Piling, earth auger)	CNP167	4	114
	Generator, standard	CNP101	2	108
	Bar bender and cutter (electric)	CNP021	2	90
	Concrete pump	CNP047	2	109
	Concrete lorry mixer	CNP044	3	109
Pile Cap	Bar bender and cutter (electric)	CNP021	2	90
	Generator, standard	CNP101	2	108
	Lorry	CNP141	3	112
Concreting	Crane, Mobile	CNP048	1	112
	Concrete lorry mixer	CNP044	3	109
	Compactor, vibratory	CNP050	3	105
Superstructure	Air Compressor, air flow Air flow >10 m^3/min and < = 30 m^3/min	CNP002	4	102
	Bar bender and cutter (electric)	CNP021	3	90
	Concrete lorry mixer	CNP044	5	109
	Concrete pump	CNP047	5	109
	Crane, tower (electric)	CNP049	2	95
	Drill/ grinder, hand-held (electric)	CNP065	5	98
	Excavator	CNP081	3	112
	Generator, standard	CNP101	4	108
	Lorry	CNP141	4	112
	Poker, vibratory, hand-held	CNP170	6	113
	Saw, circular, wood	CNP201	6	108
	Water pump (electric)	CNP281	6	88
	Water pump, submersible (electric)	CNP283	6	85
Haul Road	Dump Truck (Moving along Haul Road)	CNP067	15	117

Note:
[1] Details extracted from EPD website:
http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf
[2] The number of dump trucks stationary at Phase F is 4 during site formation stage.

4.6.6 Noise due to the travelling of dump trucks along the site access road and haul road within the site was evaluated according to the procedures given in British Standard, *Noise Control on Construction and Open Sites, BS5228: Part 1: 1997* according to the equation below:

$L_{Aeq} = SWL - 33 + 10Log_{10}Q - 10Log_{10}V - 10Log_{10}d$

Where,

SWL is the sound power level of dump truck (117dB(A))

Q is the number of vehicles per hour (15 veh/hr)

V is the average speed (10km/hr)

d is the distance of receiver position from the centre of the site access road / haul road (m)

Operational Phase

(a) Fixed Noise Sources

4.6.7 As there shall be no major fixed plant within the proposed residential development, operational phase noise impact arising from this project is not anticipated. Within the assessment area, there is an existing sewage treatment plant at the entrance of Royal Palms and an existing open storage site at the northeast corner of the Project Area.

4.6.8 The sewage treatment plant at Royal Palms is located at 230m from the nearest NSR (i.e. NSR C) of the proposed residential development. The location of the sewage treatment plant is shown in **Figure 4.5**. On site noise measurement was carried out at the sewage treatment plant on 19 March 2007 to determine the operation noise level of the plant. The measured noise level at 3m from the plant is $L_{eq(15mins)}$ 56dB(A). The plant operates 24 hours a day and it is assumed that the operational noise is steady throughout the day. The worst-case fixed plant noise level at the NSR C was predicted using standard acoustics principles and practices.

4.6.9 There is an existing open storage site located at the northeast corner of the proposed residential development. The location of the storage site is shown in **Figure 4.5**. The identified NSR A within the proposed residential development is 60m away from the storage site. It shall be the nearest NSR which has direct line of sight to the open storage site. Several site inspections were carried out at different time periods of a day in February 2006 and March, April and September 2007. There were no noisy industrial operations observed within the storage site. According to the nearby resident and on-site observations, the predominant noise source during the operation of the open storage site is the heavy goods vehicles travelling to and from the open storage site.

4.6.10 Site visits to the subject site were carried out in February 2006 and March, April and September 2007 as detailed in Section 4.3. The operation mode of the open storage site was investigated. As observed during the site visits, there was no mechanical plant operation within the site and the predominant noise is due to the movement of vehicles. In order to obtain the noise profile of the daily operation of the operating open storage site, a 24-hour continuous noise measurement was conducted during normal weekdays from 19 to 20 April 2007 (Thursday to Friday). To assess the worst-case noise contribution from the site, noise measurement was conducted near the entrance of the open storage site, which has direct line of sight to the noise source without any obstruction. Location and height of noise measurement have been selected to be as close to the noise source as practicable to ensure the measured noise levels are primarily due to the noisy operation within the open storage site. The microphone of the sound level meter was positioned at 1.2m above ground and located at 3m from the entrance of the open storage site and noise measurement was taken under a free field condition. The noise profile of the worst case scenario of its operation was recorded. The 24-hours continuous noise measurement profile is shown in **Appendix D-3**. The measurement location is identified as Point F shown in **Figure 4.5**.

4.6.11 The noise profile shows that the measured maximum noise level at Point F is $L_{eq(30mins)}$ 63dB(A) during 1400-1430. **Table 4-10** summarized the noise measurement results. The sound power level was determined according to standard acoustic principles in order to evaluate the noise impact on the nearest NSR within the proposed residential development.

Table 4-10 Summary of Open Storage Site Noise Measurement Results at Point F

Date	Measurement Duration	Maximum Measured Noise Level, $L_{eq(30mins)}$	Calculated Sound Power Level, dB(A)
19-20 April 2007	24 hours	Day and Evening (0700-2300) : 63	81
		Night (2300 – 0700) : 54*	71

* Maximum measured noise level for night time period was recorded at 2300 – 2330

(b) Noise from Road Traffic

4.6.12 As identified in the above section, there is potential road traffic noise impact from the roads within the assessment area, i.e. San Tin Highway, San Tam Road, Castle Peak Road and Project Access Road. Potential road traffic noise impact on the proposed residential development has been assessed. **Figure 4.8** shows the cross-sectional diagrams of four types of houses in the proposed residential development.

4.6.13 The noise prediction was carried out based on the maximum projection of road traffic flow within 15 years upon occupation of the proposed residential development which is 2028. The traffic flow projection at year 2027 as shown in **Table 4-11** is adopted and this set of traffic flow data have been agreed with Transport Department as appropriate for the noise assessment in this EIA study. **Appendix D-4** shows the relevant correspondences with Transport Department.

Table 4-11 Traffic Flow Forecast of Existing and Future Road Networks (Year 2027)

Road Name	Peak Traffic Flow (Veh/hr)		% of Heavy vehicles		Road Speed (km/hr)	Road Surface Type
	AM	PM	AM	PM		
San Tin Highway	5602	5931	49.5	50.7	100	Pervious
San Tam Road	487	530	62.8	55.8	50	Bitumen
Castle Peak Road	535	499	53.1	46.7	50	Bitumen
Project Access Road	121	122	19.0	19.7	50	Bitumen

Note: The traffic flow of Project Access Road is for the planned site only.

4.6.14 The road traffic noise calculation procedures prescribed in the "Calculation of Road Traffic Noise (1988)"[1] (CRTN) published by the Department of Transport, UK have been adopted in this assessment. The traffic noise modelling was carried out using a proprietary traffic noise model software "roadNoise", which implements the CRTN procedures. A sensitivity test was carried out and indicated that PM peak is the worst case scenario for the road traffic noise assessment. Input files of the 'roadNoise' model used in the traffic noise prediction are given in **Appendix D-5**. **Figure 4.9** shows the computer plot of the input features in the noise model.

4.7 Prediction and Evaluation of Noise Impacts

Construction Phase

4.7.1 Without mitigation, the predicted construction noise levels at the representative NSRs range from $L_{eq(30\ mins)}$ 67 dB(A) to 88 dB(A). The maximum predicted unmitigated construction noise levels are given in **Table 4-12**, which indicates that the noise criteria of $L_{eq(30\ mins)}$75dB(A) for domestic premises and 70 dB(A) for educational institution (NSR 9) set out in the EIAO–TM will be exceeded at all the representative NSRs except NSR 8. The overall noise levels predicted at the NSRs over the construction period (noise from vehicles using site access road included) are summarized in **Appendix D-2B**. Details of construction noise level from each phase to each NSR are provided in **Appendix D-2B**.

Table 4-12 Maximum Predicted Unmitigated Construction Noise Levels at Representative NSRs

NSR	Maximum Predicted Unmitigated Construction Noise Level, $L_{eq\ (30mins)}$, dB(A)
1	**87**
1a	**86**
2	**85**
3	**85**
4	**88**
4a	**85**
4b	**87**
5	**87**
6	**85**
7	**77**
8	75
9	**81**
10	**82**

Note: **Bold** figures denote exceedance of relevant noise criteria.

4.7.2 The assessment results indicate that the construction work for the proposed residential development may give rise to excessive noise impact on most of the nearby NSRs if no noise mitigation measures are implemented.

[1] Department of Transport, UK, Calculation of Road Traffic Noise (1998)

Operational Phase

(a) Fixed Noise Sources

4.7.3 The noise impact of sewage treatment plant at Royal Palm was assessed. The predicted noise level at the nearest NSR (i.e. NSR C) is 21dB(A) without background noise level superimposed which complies with the noise criteria for day and evening time (i.e. 46dB(A)) and night time (i.e. 45dB(A)). The noise calculation is given in **Appendix D-6**.

4.7.4 Based on the calculated sound power level (SWL) of the existing open storage site, the predicted maximum noise levels at the nearest NSR (i.e. NSR A) are 40dB(A) without background noise level superimposed for day and evening time and 31dB(A) for night time which comply with the respective noise criteria.

4.7.5 As the predicted noise level at the potentially worst-affected dwelling at the proposed development is $L_{eq(30mins)}$ 21dB(A) for sewage treatment plant operation and $L_{eq(30mins)}$ 40dB(A) for open storage site operation, the cumulative fixed noise level is $L_{eq(30mins)}$ 40dB(A) which complies with the day and evening time noise criteria of $L_{eq(30mins)}$ 46dB(A). The night time noise level for open storage site operation is 31dB(A). The cumulative fixed noise level is 31dB(A) which complies with the night time noise criterion of 45dB(A) for Area Sensitivity Rating of "A".

(b) Noise from Road Traffic

4.7.6 The road traffic noise assessment indicates that the predicted noise levels at the representative NSRs within the proposed residential development in 2027 comply with the noise criterion of $L_{10(1hour)}$ 70dB(A). **Table 4-13** summarised the predicted noise levels. As mentioned in Section 4.6.13, the noise prediction should be carried out based on the maximum projection of road traffic flow within 15 years after occupation of the proposed residential development in 2013, i.e. 2028. However, it is believed that the increased noise levels due to an estimated 1.95% annual growth of traffic flow is minimal and insignificant and will not contribute to more than 1.0dB(A). Therefore the 100% compliance of noise criterion of $L_{10(1hour)}$ 70 dB(A) are still considered valid in 2028.

Table 4-13 Predicted Noise Levels at Representative NSRs

NSR ID	Description	Floor	Height, mPD	Predicted Noise Levels, $L_{10(1hour)}$ dB(A)
A	2.5/3 Storey house (near site entrance, façade facing San Tin Highway)	1/F	7.2	68
		2/F	10.2	68
		3/F	13.2	68
A	2.5/3 Storey house (near site entrance, façade facing Project Access Road)	1/F	7.2	69
		2/F	10.2	69
		3/F	13.2	69
B	2.5/3 Storey house (façade facing Project Access Road)	1/F	7.2	69
		2/F	10.2	69
		3/F	13.2	68
C	4 Storey duplex-on-duplex (façade facing San Tin Highway)	1/F	7.2	63
		2/F	10.2	63
		3/F	13.2	64
		4/F	16.6	65

4.8 Mitigation Measures

Construction Phase

4.8.1 As the predicted unmitigated construction noise levels exceed the noise criteria of $L_{eq(30\ mins)}$75dB(A) for domestic premises and 70 dB(A) for educational institution set out in the EIAO–TM will be exceeded at all the representative NSRs except NSR 8, appropriate mitigation measures have been proposed to reduce the potential construction impact to acceptable levels. These include use of the following quiet powered mechanical equipment (QPME) tabulated in **Table 4-14** and detailed in **Appendix D-7A**.

Table 4-14 QPME to be used at the Construction Site

QPME	Reference	SWL (dB(A))
Excavator	Kato HD-512E	104
Crane, Mobile	Hitachi Sumitomo SCX700, 132kW	101
Lorry	BS 5228: C3/59	105
Pneumatic Breaker	BS 5228: C3/101	113
Dump Truck (5.5 tonne < Gross vehicle weight ≦ 38 tonne)	Note [1]	105
Roller, vibratory	Komatsu SW750, 77kW	104
Bulldozer	Komatsu modelled D21A-8	102
Generator, standard	Atlas Copco QAS 300	99
Continuous flight auger (CFA) piles (Piling, earth auger)	BS 5228: C4/41	112
Concrete pump	BS 5228: C6/36	106
Concrete lorry mixer	BS 5228: C6/35	100
Air Compressor, air flow Air flow ≦ 10 m^3/min	CNP001	100
Poker, vibratory, hand-held	BS 5228: C6/40	98
Saw, circular, wood	BS 5228: C7/78	106

Note [1] – Details extracted from EPD website:
http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf

4.8.2 With the use of QPME as shown in **Table 4-14**, the mitigated construction noise levels at the representative NSRs range from $L_{eq(30\ mins)}$ 60 dB(A) to 83 dB(A). The maximum predicted mitigated construction noise levels are given in **Table 4-15**, which indicates that the noise criteria of $L_{eq(30\ mins)}$75dB(A) for domestic premises and 70 dB(A) for educational institution (NSR 9) set out in the EIAO–TM will be are exceeded at all the representative NSRs except NSRs 7, 8 and 10. The overall noise levels predicted at the NSRs over the construction period are summarized in **Appendix D-7B**. Details of construction noise level arising from each phase predicted at the NSRs are provided in **Appendix D-7B**.

Table 4-15 Maximum Predicted Mitigated Construction Noise Levels at Representative NSRs with the use of QPME

NSR	Maximum Predicted Mitigated Construction Noise Level, $L_{eq\ (30mins)}$, dB(A)
1	**81**
1a	**78**
2	**79**
3	**78**
4	**83**
4a	**80**
4b	**81**
5	**81**
6	**79**
7	70
8	68
9	**75**
10	74

Note: **Bold** figures denote exceedance of relevant noise criteria.

4.8.3 The assessment results indicate that use of QPME alone is not sufficient to reduce the noise impact on nearby NSRs to acceptable levels. Noise barriers and site hoardings are proposed along the site boundary to block the direct line of sight from the most affected NSRs to the major noise contribution construction phases as shown in **Figures 4.6** and **4.7**. The noise barriers and site hoardings shall be built before the commencement of construction works in order to ensure protection to nearby NSRs. The height of the noise barriers are ranged from 9–10m, while the height of site hoardings are ranged from 2.4-3m. The noise barriers and site hoardings should have a surface density of at least 10kg/m^2 or material providing equivalent transmission loss. Moreover, the noise barriers and site hoardings should have no gaps and openings to avoid noise leakage.

4.8.4 The 10m high noise barrier section located at the eastern site boundary near the site entrance as shown in **Figure 4.6** is proposed for mitigating potential noise impact associated with the site access road on the adjacent V zone. Currently, there is no planned developments in that V zone. Should there be any future sensitive use developed in the concerned V zone, this section of noise barrier shall be erected before the occupancy of such use.

4.8.5 With the uses of QPME and noise barriers/ site hoardings, the mitigated construction noise levels at the representative NSRs range from $L_{eq(30\ mins)}$ 60dB(A) to 75 dB(A). The maximum predicted mitigated construction noise levels are given in **Table 4-16**. The overall noise levels predicted at the NSRs over the construction period are summarized in **Appendix D-7C**. Details of construction noise levels contributed from each phase predicted at the NSR are provided in **Appendix D-7C**.

Table 4-16 Maximum Predicted Mitigated Construction Noise Levels at Representative NSRs with the uses of QPME, Noise Barriers and Site Hoardings

NSR	Maximum Predicted Mitigated Construction Noise Level, $L_{eq\ (30mins)}$, dB(A)
1	74
1a	73
2	73
3	74
4	75
4a	73
4b	75
5	73
6	73
7	70
8	68
9	70
10	74

4.8.6 Construction noise assessment results show that, with the uses of QPME, noise barriers and site hoardings, the maximum predicted construction noise levels at all of the representative NSRs will comply with the construction noise criterion of $L_{eq(30mins)}$75dB(A) for domestic premises and 70 dB(A) for educational institution as stipulated in the EIAO–TM.

4.8.7 The kindergarten, namely NSR9 is shielded by three rows of 3-storey houses, by which the direct line of sight to the subject site is obstructed. Further noise reduction of 10dB(A) is provided to NSR9. The predicted noise level at NSR9 is 60dB(A). The construction noise level of NSR9 will comply with the noise criterion of 65dB(A) for examination period.

4.8.8 Notwithstanding that the construction works will involve typical construction activities and without massive excavation, practical noise mitigation measures, good practices and site management as described in Sections 4.8.9 & 4.8.10 shall be implemented as far as practicable to further minimize the construction noise emission and ensure that there is no unacceptable residual construction noise impact on the nearby NSRs.

4.8.9 In addition, practical mitigation measures should be implemented to minimise and further alleviate the potential noise impact. It is expected that with suitable on-site supervision in limiting the number of powered mechanical equipment and good site practices, the construction noise impact can be further reduced. The following mitigation measures are recommended to further alleviate the construction noise impact:-

- Scheduling of work - The Contractor will be required to determine the number and type of construction equipment taking into account the use of quiet plant while devising a feasible work programme.
- Sitting of facilities - This includes avoiding simultaneous operation of noisy equipment; retaining existing features that can act as a noise barrier until the last phase; and erecting, as early as possible, any new structures which will have the effect of screening noise sources. Such screens can reduce noise levels by 15dB(A) or more.

Noisy equipment should always be sited as far as possible from noise sensitive receivers. Consideration should also be given to the use of structures such as site offices and stores as noise barriers.

- Use of quiet Powered Mechanical Equipment (QPME) - The contractor should be requested, as far as possible, to use quiet PME, which has a lower SWL compared to one specified in GW–TM. This is one of the most effective measures to reduce noise emission at source and is increasingly practicable because of the availability of quiet equipment in the market.

4.8.10 Good site practices and noise management can further reduce the noise impact of the construction sites' activities on nearby NSRs. The following measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and the plant should be serviced regularly during the construction programme;
- machines and plant that may be intermittent in use should be shut down between work periods or should be throttled back to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be oriented so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction period;
- mobile plant should be sited as far away from NSRs as possible;
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities; and
- The Contractor shall at all times comply with all current statutory environmental legislation.

4.8.11 There will be works for the provision of gravity trunk sewer along Castle Peak Road between Ngau Tam Mei and San Tin under PWP Item 235DS in mid-2012, which may be overlapping the construction stage of the subject development. The EIA for "Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2" assessed the noise impact at an identified NSR at Mai Po San Tsuen, which is the same as NSR7 in this EIA study. The result indicated that there will be residual impact of 78.5dB(A) at this NSR. The cumulative noise impact at NSR7 is 79dB(A). There is a small increment of 0.5dB(A) in the overall noise level during construction of the subject development, which is considered insignificant contribution to the cumulative noise impact.

Operational Phase

4.8.12 As the predicted noise results indicate full compliance of noise criteria for both fixed noise sources and road traffic noise, no mitigation measures is required.

4.9 Conclusion

Construction Phase

4.9.1 With the implementation of noise mitigation measures during the construction phase, noise levels at the NSRs will comply with the noise criteria. Therefore no residual noise impact is anticipated.

Operational Phase

4.9.2 As there will be full compliance of noise criteria during the operation phase and no mitigation measures is required, there is no residual noise impact.

5 WATER QUALITY IMPACT

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

5.1 Summary

5.1.1 Aspects which have been considered during construction for the water quality assessment, include the construction of the dwellings and associated infrastructure (local roads and drains), site runoff, dewatering of excavated materials and provision of sanitary facilities for the workers. For the operational phase, water quality issues focus on the management of the water quality within the site (in water ditches as well as within the proposed created wetland restoration area) and potential off-site impacts. The assessments have been carried out in accordance with section 3.9.3 of the Study Brief.

5.1.2 It is important to note that no water will be discharged off-site once construction is complete. The only exception to this is the site drainage which will be discharged via standard drainage systems. The drainage for the residential development paved areas will be prevented from discharging into the restored wetland by the provision of internal drainage system and the soft landscaping which will absorb moisture or runoff. Water quality in the restored wetland has been assessed and proposals for control of the water within this facility is detailed in the Wetland Restoration Plan (refer to **Appendix H**). There will be no unacceptable water quality impacts associated with this development and indeed the Project offers significant environmental benefits.

5.2 Environmental Legislation, Standards, Guidelines and Criteria

5.2.1 Water quality impacts have been assessed with reference to the relevant environmental legislation and standards. The following relevant pieces of legislation and associated guidance are applicable to the evaluation of water quality impacts associated with the Project.

- Water Pollution Control Ordinance (WPCO) (Cap. 358);

- Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (WPCO, Cap. 358, S.21);
- Town Planning Board Guidelines No. 12B;
- Environmental Impact Assessment Ordinance (Cap. 499., S.16), Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM), Annexes 6 and 14;
- Technical Memorandum for Effluent Discharges;
- A Guide to Water Pollution Control Ordinance;
- River Water Quality in Hong Kong in 2002 to 2004; and
- Hong Kong Planning Standard and Guidelines (Chapter 9).

5.2.2 Apart from the above statutory requirements, the Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94), issued by ProPECC in 1994, also provides useful guidelines on the management of construction site drainage and prevention of water pollution associated with construction activities.

Water Pollution Control Ordinance

5.2.3 Under the *Water Pollution Control Ordinance* (WPCO) (Chapter 358), Hong Kong waters are divided into 10 Water Control Zones (WCZs) and 4 supplementary water control zones. Each of which has a designated set of statutory Water Quality Objectives (WQOs) designed to protect the inland and/or marine environment and its users. The proposed development is located in the Deep Bay Water Control Zone. The WQOs are applicable as evaluation criteria for assessing compliance of any effects from the construction and operation of the Project.

Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters

5.2.4 This technical memorandum (TM) was issued under section 21 of the WPCO. It sets the limits to control the physical, chemical and microbial quality of effluent discharges into foul sewers, storm water drains, inland and coastal waters. The proposed development is located within the Group C and Group D for Inland Water Grouping, where Group C includes waters are those running through areas where there are large numbers of fishponds and Group D waters are those draining urban and semi-urban areas. The standards for effluents discharged into Group C and Group D inland waters are provided in **Table 5–1** and **Table 5–2** respectively. The applicable WQOs associated with the WCZs are provided in **Table 5–3**.

Table 5-1 Standards for effluents 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)	1	1	1	1

Flow rate (m³/day) / Determinand	≤ 100	> 100 and ≤ 500	> 500 and ≤ 1000	> 1000 and ≤ 2000
(25mm cell length)				
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
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/100ml)	1000	1000	1000	1000

Note: Table abstract from Technical Memorandum on Effluent Standards (EPD, 1991).

Table 5-2 Standards for effluents discharged into Group D inland waters (All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated)

Flow rate (m³/day) / Determinand	≤ 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

Flow rate (m^3/day) **Determinand**	**≤ 200**	**> 200 and ≤ 400**	**> 400 and ≤ 600**	**> 600 and ≤ 800**	**> 800 and ≤ 1000**	**> 1000 and ≤ 1500**	**> 1500 and ≤ 2000**	**> 2000 and ≤ 3000**
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/100ml)	1000	1000	1000	1000	1000	1000	1000	1000

Note: Table abstract from Technical Memorandum on Effluent Standards (EPD, 1991).

Table 5-3 Key Water Quality Objectives for inland waters in Deep Bay Water Control Zones

***E. coli* (cfu) per 100ml ≤**	**Min. DO (mg/L) ≥**	**pH range ≥**	**and ≤**	**Max. BOD_5 (mg/L) ≤**	**Max. COD (mg/L) ≤**	**Max. Annual Median SS (mg/L) ≤**	**Ammoniacal nitrogen (mg/L) ≤**
1000	4	6.0	9.0	5	30	20	0.021

Note: WQO follows River Water Quality in Hong Kong in 2004 (EPD, 2005).

No Net Increase Requirement

5.2.5 Effluent treatment is required prior to discharge into the water courses in the Deep Bay Area, in order to meet the criteria of "no net gain" in pollution load as specified in the Town Planning Board Guidelines No. 12B. The underlying principle is to protect the important habitats and wildlife of the Deep Bay region.

Environmental Impact Assessment Ordinance (Cap. 499) Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)

5.2.6 Under Section 16 of the EIAO, EPD issued the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM) which specifies the assessment methods and criteria for environmental impact assessment. This Study follows Annex 6 – Criteria for Evaluating Water Pollution and Annex 14 – Guidelines for Assessment of Water Pollution under the EIAO-TM to assess the potential water quality impacts that may arise during construction and operational phases of the Project.

Technical Memorandum for Effluent Discharges

5.2.7 All discharges during construction and operational phases of the Project are required to comply with the statutory guidelines set in the *TM for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* issued under Section 21 of the WPCO. The TM defines discharge standards to different types of receiving waters and WCZ and prohibited certain kind of substances discharge to foul sewers, inland waters and coastal waters.

A Guide to Water Pollution Control Ordinance

5.2.8 This is a guide describing the development of WPCO and the different water control zones. Discharges from sewage treatment plants and septic tanks should obtain a licence granted under WPCO.

River Water Quality in Hong Kong

5.2.9 The EPD River Water Quality Report summarizes the results collected from monthly river water quality monitoring at 82 stations in 35 inland watercourses. A total of 48 parameters have been measured including physical and aggregate properties, flow, aggregate organics, nutrients, inorganic constituents, faecal bacteria, metals and pigments. The health of the rivers is rated by a Water Quality Index (WQI) based on the dissolved oxygen, 5-day Biochemical Oxygen Demand (BOD_5) and ammonia-nitrogen concentration. The river water quality at the Deep Bay WCZ has therefore been used as the reference for the baseline water for this Study.

Hong Kong Planning Standards and Guidelines (HKPSG)

5.2.10 Chapter 9 of these guidelines provide guidance for including environmental considerations in the planning of both public and private developments. The guidelines recommend that residential developments should locate away from stagnant waters, enclosed water bodies and existing water pollution black spots.

5.3 Existing Environment and Sensitive Receivers

Existing Conditions

5.3.1 Seasonal water ditches within the Project Area are the remnants of the historical fishpond drainage systems. A section of storm water drain, located along the south boundary of the east portion of site, drains from the adjacent local residential development throughout the year. During the dry season water in the ditches appeared turbid and grey. During the wet season, the whole water ditch appeared to be much clearer as a result of the increase in water exchange and flow rate. Permanent water was also observed in a short section in water ditch at the southwest corner of the site boundary. Water in this section also appeared turbid with sluggish flow during the dry season. Fishes with high tolerance to poor water quality conditions were observed in these two ditches. A seasonal ditch with intermittent flow at the northern boundary of the Project Area connects to the drainage channel at the northeast fishponds area. Water was only observed to flow from the Project Area into the drainage channel during the wet season and after heavy rainfall. The existing drainage pattern is shown in **Figure 5.1**.

5.3.2 The Project Area lies within two Drainage Basins (Basin 9 the North District & Basin 10 the Yuen Long Basin) under different Drainage Master Plan Studies (DMP) (**Figure 5.1**). The direction of water flow in the water ditches and drainage channels are basically from south to north diverting to the Shenzhen River in the Deep Bay Water Control Zone. The Water Quality Objectives for other inland waters were used for reference in planning of future activities.

5.3.3 The existing water pollution sources may include the runoff from adjacent agricultural activities, effluent from fish-cum-duck activities at the northern boundary of the Project Area, the disposal of domestic sewage from the adjacent developments and industrial discharge from the adjacent vehicles maintenance area.

5.3.4 The routine river water quality monitoring data collected by EPD between 2002 and 2005 have been reviewed for the nearest monitoring location to Wo Shang Wai at Fairview Park Nullah. This nullah is a short concrete channel within the Fairview Park residential development, which shares the same drainage basin as the southern part of the Project Area (see **Table 5–4** for the summary of findings).

Table 5-4 Summary of River Water Quality at Nearby Fairview Park Nullah in the Deep Bay Water Control Zones between 2002 and 2005 (Source: River Water Quality in Hong Kong in 2002 – 2005 (EPD))

Parameters	*WQO	2002	2003	2004	2005
pH	6.0 – 9.0	7.4 (6.8 – 8.7)	7.6 (6.9 – 8.6)	7.6 (7.3 – 9.1)	7.6 (7.0 – 8.8)
BOD_5 (mg/L)	≤ 5	**12** (6 – 40)	**11** (6 – 21)	**13** (7 – 26)	**11** (4 – 28)
COD (mg/L)	≤ 30	29 (20 – 46)	**42** (28 – 59)	**51** (35 – 75)	**39** (10 – 85)
SS (mg/L)	≤ 20	**49** (21 – 180)	**46** (18 – 110)	**46** (10 – 240)	**51** (10 – 170)
DO (mg/L)	≥ 4	5.3 (3.1 – 14.7)	6.4 (3.1 – 11.9)	7.2 (3.0 – 14.9)	6.6 (1.9 – 13.6)
E. coli **(cfu/100mL)**	≤1000	**29,000** (6,400 – 140,000)	**25,000** (5,600 – 90,000)	**31,000** (5,200 – 330,000)	**83,750** (14,000 – 150,000)
Ammonia-nitrogen (mg/L)	Annual average ≤0.021	**5.80** (2.50 – 14.00)	**5.65** (1.70 – 12.00)	**6.45** (1.70 – 11.00)	**5.39** (0.72 – 16.00)
Nitrate-nitrogen (mg/L)	--	0.98 (0.54 – 2.20)	0.89 (0.32 – 1.90)	1.65 (0.23 – 3.20)	0.73 (0.09 – 2.00)
Aluminium (µg/L)	(a) Waste discharges shall not cause the toxins in water to attain such levels as to produce significant toxic carcinogenic, mutagenic or	165 (50 – 350)	(60 – 580)	240 (160 – 700)	223 (90 – 460)
Cadmium (µg/L)		0.15 (0.10 – 0.50)	0	0.1 (0.1 – 0.3)	0.18 (<0.1 – 0.3)

Parameters	*WQO	2002	2003	2004	2005
Chromium (µg/L)	teratogenic effects in humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chains and to toxicant interactions with each other. (b) Waste discharges shall not cause a risk to any beneficial uses of the aquatic environment.	1.0 (1.0 – 4.0)	(<1 – 5)	2 (1 – 2)	1.5 (<1 – 2)
Copper (µg/L)		11.5 (5.0 – 69.0)	(2 – 21)	7 (4 – 16)	6.8 (2 – 25)
Lead (µg/L)		2.0 (1.0 – 6.0)	(<1 – 11)	4 (2 – 16)	4.2 (2 – 11)
Zinc (µg/L)		50 (30 – 200)	(10 – 80)	35 (20 – 110)	35 (10 – 80)

*Note: 1. WQO follows WPCO Cap.358R.
2. Data presented are in annual medians of monthly samples, except those for *E. coli* which are in annual geometric means.
3. Figures in brackets are annual ranges.
4. Figures in bold show non-compliance to WQO.

5.3.5 From **Table 5–4** it may be observed that compliance with river water quality objectives in the Fairview Park Nullah is very low (EPD, 2005). The recorded levels of biochemical oxygen demand, suspended solids and Ammonia-nitrogen all exceed the WQOs, and high chemical oxygen demand and *E. coli* counts further indicate poor water quality in the Fairview Park Nullah. This is considered to be due to a decrease in water flow from the Ngau Tam Mei Drainage to this nullah since 2002, the net result of which is to decrease the dilution and flushing of pollutants (EPD, 2005).

Water Quality Sensitive Receivers

5.3.6 The existing or potential beneficial uses that are sensitive to water pollution include the fishponds in active use in the Conservation Area (CA) adjacent to the Project Area and drainage channel connecting to the water ditch of the northern boundary of the Project Area. The Deep Bay Water Control Zone, the Ramsar Site and Mai Po Nature Reserve are the indirect sensitive receivers.

5.3.7 There are no public sewers within 5km of the Project Area, based on the information provided by the Drainage Services Department (DSD) and Environmental Protection Department (EPD), a gravity trunk sewer will be provided along Castle Peak Road between Ngau Tam Mei and San Tin under PWP Item 235DS and will be in place by 2012. This trunk sewer will eventually connect to the existing Yuen Long Sewage Treatment Works via a pumping station at Nam Sang Wai which is currently under construction. The population intake for the proposed development has thus been designed to be in line with the provision of the planned public sewer. It has been confirmed with Government that the domestic effluent from this project will be permitted to discharge to this public sewer.

Water Quality Monitoring at Sensitive Receivers

5.3.8 The Assessment Area for the water quality impact assessment covers all relevant sensitive receivers in Wo Shang Wai and the surrounding areas within 500m distance from the boundary of the Project. In particular the fishponds surrounding the Project Area and water courses connecting to the Deep Bay Catchment Area of the Deep Bay Water Control Zone (WCZ), the Ramsar Site and Mai Po Nature Reserve have also been considered (Study Brief Section 3.9.3.3). **Figure 5.2** shows the baseline water quality sampling locations.

5.3.9 The baseline water and sediment quality monitoring has been conducted at 13 water quality sampling locations (WM1 to WM13; see **Figure 5.2**) during the assessment period in March to June 2006. The sampling locations include water ditches within the Project Area (WM1 & WM2); the drainage channel along fishponds area which may receive water discharge from the future wetland (WM3 to WM5); the drainage channel along the northern boundary of Palm Springs which flow to the Mai Po Ramsar Site (WM6 & WM7); freshwater marsh on site (WM8 to WM10); and at 3 control stations (WM 11 to WM13) include drainage channel along fishponds area and fishpond at the north of the Project Area to estimate the water quality for the future restored wetland (Study Brief Section 3.9.3.4 (ii)).

5.3.10 Two monitoring events were carried out in the dry season and before the heavy rainfalls of March and April 2006 and 4 monitoring tests in the wet season after a period of rainfall (late April to June 2006). Water quality sampling was carried out at mid-depth for all locations as the water depth is less than 0.5m, except at WM13, in which samples were taken at 1m below surface water and 1m above the pond bed. The parameters which were tested included in-situ testing for water depth, dissolved oxygen (as % saturation), turbidity, temperature, salinity and pH. General observations (weather conditions, sampling time, date and location) were also recorded. (**Table 5-5**)

Table 5-5 In-situ Water Quality Testing Parameters

Reference	Parameters	Frequency	No. of Depths
WM1 to WM10	Dissolved Oxygen Saturation Water depth pH value Temperature Turbidity Salinity Dissolved Oxygen	2 in dry season & 4 in wet season	Mid-depth
*WM11 to WM13	Dissolved Oxygen Saturation Water depth pH value Temperature Turbidity Salinity Dissolved Oxygen	2 in wet season	Mid-depth for WM11 & 12; 1m below surface water and 1m above pond bed for WM13

*Note: WM11 to WM13 are control stations for estimation of the water quality of the future restored wetland.

5.3.11 Apart from in-situ measurement, samples from locations WM1 to WM7 and WM11 to WM13 also carried out using laboratory tests. The following parameters were analysed in a Hong Kong Accreditation Scheme (HOKLAS) laboratory within 24 hours of sampling (**Table 5-6**).

Table 5-6 Water Quality Testing Parameters in Laboratory

Reference	Sampling	Laboratory Testing Parameters
WM1-WM7	2 in dry season & 4 in wet season	Conductivity Copper (Cu) Chromium (Cr) Lead (Pb) Zinc (Zn) Aluminium Cadmium Suspended Solids Total Kjeldahl Nitrogen (SP) Ammonia-nitrogen Nitrate-nitrogen Ortho-phosphate Total Phosphorous (SP) Sulphide (SP) 5-day BOD COD Oil & grease *E. coli* Faecal coliforms
WM11-WM13	2 in wet season	

*Note: WM11 to WM13 are control stations for estimation of the water quality of the future restored wetland.

Baseline Water Quality

5.3.12 The baseline water quality of the Assessment Area at monitoring stations WM1 to WM13 are summarized in **Table 5–7** to **Table 5–11** below and the water quality sampling results for each sample are attached in **Appendix E**.

Table 5-7 Summary of Water and Sediment Quality Monitoring Results in Dry Season (For Monitoring Stations WM1 to WM7)

Parameters	WM1	WM2	WM3	WM4	WM5	WM6	WM7
pH value	6.6 (6.2-6.9)	5.3 (4.3-6.2)	6.6 (6.4-6.8)	6.4 (6.1-6.7)	6.3 (5.9-6.6)	6.2	6.2 (6.1-6.3)
Conductivity (μs/cm)	407.5 (290-525)	730.5 (592-869)	1042 (994-1090)	1011 (962-1060)	1155 (1030-1280)	2320	2470 (1330-3610)
Temp. (°C)	26.4 (22.6-30.1)	26.9 (23.4-30.3)	25.9 (23.0-28.7)	25.4 (21.4-29.4)	27.5 (26.6-28.3)	22.5	28.3 (26.9-29.6)
Salinity ‰	0.3 (0.2-0.4)	0.4	0.5	0.55 (0.5-0.6)	0.6 (0.5-0.7)	1.2	1.3 (0.7-1.9)
Suspended Solids (mg/L)	**24** (11-37)	**71** (16-126)	**44.5** (24-65)	**28.5** (22-35)	**22** (10-34)	**28**	**215.5** (75-356)
Turbidity (NTU)	29 (7-51)	52.5 (4-101)	34.5 (33-36)	14 (9-19)	24 (15-33)	10	85.5 (31-140)
Water Depth (m)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aluminium (μg/L)	23.5 (<10-37)	193.5 (18-369)	28 (<10-46)	<10	11.5 (<10-13)	25	11 (<10-12)
Cadmium (μg/L)	<0.2	0.3 (<0.2-0.4)	<0.2	<0.2	<0.2	0.2	<0.2
Chromium (μg/L)	<1	<1	<1	<1	<1	<1	1.5 (<1-2)
Copper (μg/L)	2 (1-3)	1 (<1-1)	1.5 (<1-2)	1.5 (<1-2)	1 (<1-1)	5	<1
Lead (μg/L)	<1	<1	<1	<1	<1	3	<1
Zinc (μg/L)	86.5 (32-141)	124.5 (<10-239)	<10	10 (<10-10)	<10	29	13 (<10-16)

Parameters	WM1	WM2	WM3	WM4	WM5	WM6	WM7
Ammonia as N (mg/L)	**0.65** (0.26-1.03)	**4.61** (3.91-5.30)	**4.46** (3.17-5.74)	**5.13** (4.74-5.51)	**7.24** (5.96-8.52)	**0.15**	**1.82** (1.81-1.83)
Nitrate as N (mg/L)	0.08	0.41 (0.14-0.67)	0.12 (0.02-0.22)	0.07 (0.05-0.08)	0.02 (0.01-0.02)	0.01	2.68 (2.35-3.01)
Total Kjeldahl Nitrogen as N (mg/L)	1.5 (0.9-2.0)	6.9 (5.2-8.6)	6.3 (4.9-7.6)	6.8 (6.3-7.2)	8.0 (6.9-9.0)	3.1	4.2 (4.1-4.2)
Total Phosphorus (mg/L)	0.15 (<0.1-0.2)	0.25 (<0.1-0.4)	1.1 (1.0-1.2)	2.8 (1.1-4.5)	2.2 (1.8-2.6)	0.2	1.3 (1.1-1.4)
Reactive Phosphorus as P (mg/L)	0.01 (<0.01-0.01)	0.015 (<0.01-0.02)	0.45 (0.43-0.46)	1.06 (0.50-1.61)	1.8 (1.20-2.40)	0.02	0.44 (0.38-0.50)
Sulphide (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.55 (<0.1-1.0)
Oil & Grease (mg/L)	<5	<5	<5	<5	<5	<5	<5
Dissolved Oxygen Saturation (%)	95.6 (93.8-97.4)	76.0 (34.9-117)	72.5 (69.7-75.3)	65.1 (54.0-76.1)	38.8 (23.1-54.4)	107	71.7 (60.9-82.5)
Chemical Oxygen Demand (mg/L)	24.5 (18-31)	**37.5** (19-56)	**44** (40-48)	**34** (28-40)	**43** (35-51)	**108**	24.5 (14-35)
Biochemical Oxygen Demand (mg/L)	2 (<2-2)	**9.5** (<2-17)	**9** (<2-16)	**8** (<2-14)	5 (<2-8)	4	**6** (<2-10)
DO (mg/L)	7.8 (7.1-8.4)	5.9 (3.0-8.8)	6.0 (5.9-6.0)	5.2 (4.6-5.8)	**3.3** (1.8-4.8)	8.5	5.8 (5.2-6.3)
E. coli (cfu/100mL)	230 (70-$1.6*10^{2}$)	$8.1*10^{2}$ (21-$1.6*10^{3}$)	99 (88-$1.1*10^{2}$)	96 (32-$1.6*10^{2}$)	**$1.5*10^{4}$** ($3.2*10^{3}$-$1.2*10^{4}$)	$1.0*10^{2}$	**$5.9*10^{3}$** ($3.7*10^{3}$-$8.0*10^{3}$)
Faecal Coliform (cfu/100mL)	125 (80-$1.7*10^{2}$)	$1.1*10^{3}$ (22-$2.2*10^{3}$)	104 (88-$1.2*10^{2}$)	$1.1*10^{2}$ (35-$1.8*10^{2}$)	$7.0*10^{3}$ ($3.9*10^{3}$-$1.0*10^{4}$)	$10*10^{2}$	$6.6*10^{3}$ ($4.4*10^{3}$-$8.8*10^{3}$)

Note: 1. Data presented are average values and the ranges are shown in brackets.
2. Values at or below laboratory reporting limits are presented as laboratory reporting limits (see Appendix E)
3. Figures in bold show non-compliance to WQO.
4. Water monitoring at WM6 was only performed on 29 Mar 06 due to no water could be obtained.

Table 5-8 Summary of Water Quality Monitoring Results in Wet Season (For Monitoring Stations WM1 to WM7 & WM11 to WM13)

Parameters	WM1	WM2	WM3	WM4	WM5	WM6	WM7	WM 11	WM 12	WM 13S	WM 13B
pH value	6.6 (6.2-6.9)	6.7 (6.1-7.2)	6.8 (6.2-7.3)	6.7 (6.1-7.1)	6.9 (6.3-7.5)	6.6 (6.5-6.8)	7.3 (7.1-7.4)	6.6 (6.3-6.9)	6.6 (6.3-6.8)	7.2	7.2 (7.1-7.2)
Conductivity (µs/cm)	530 (352-780)	561 (288-717)	681 (515-991)	674 (533-899)	605 (440-719)	564 (210-1180)	2308 (952-4600)	626 (561-691)	581 (483-679)	868 (716-1020)	881 (731-1030)
Temp. (°C)	27.5 (24.3-28.9)	27.6 (24.9-29.6)	26.3 (23.1-28.5)	26.3 (23.0-28.4)	26.2 (22.7-28.6)	28.1 (27.3-28.9)	27.0 (25.2-27.9)	27.6 (26.7-28.5)	27.6 (26.6-28.6)	28.0 (27.0-28.9)	28.0 (27.2-28.8)
Salinity %	0.3 (0.2-0.4)	0.3 (0.2-0.4)	0.4 (0.2-0.4)	0.4	0.3 (0.2-0.4)	0.3 (0.2-0.6)	1.3 (0.5-2.5)	0.4 (0.3-0.4)	0.3	0.5	0.5
Suspended Solids (mg/L)	**34.3** (8-87)	**24.0** (4-45)	**52.8** (20-104)	**53.3** (21-108)	**21.3** (12-32)	17.3 (5-42)	**92.5** (14-253)	**72.5** (19-126)	**44** (17-71)	**63.5** (60-67)	**90.5** (68-113)
Turbidity (NTU)	51.8 (17-92)	47.0 (9-83)	54.5 (18-85)	40.8 (15-70)	17.3 (11-22)	6.3 (4-8)	72.5 (7-200)	82.0 (24-140)	90.5 (29-152)	78.5 (77-80)	122.0 (116-128)
Water Depth (m)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0	1.5

Parameters	WM1	WM2	WM3	WM4	WM5	WM6	WM7	WM 11	WM 12	WM 13S	WM 13B
Aluminium (µg/L)	31 (<10-79)	41.8 (<10-84)	32.3 (<10-79)	24 (<10-40)	17.8 (<10-41)	66 (55-81)	15.3 (<10-21)	29 (19-38)	39 (29-152)	16 (14-17)	15 (14-16)
Cadmium (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium (µg/L)	1.3 (<1-2)	1.5 (<1-3)	1.5 (<1-2)	1.8 (<1-4)	1.5 (<1-3)	1 (<1-1)	1.5 (<1-3)	2 (<1-3)	1 (<1-1)	<1	1.5 (<1-2)
Copper (µg/L)	1.8 (<1-2)	1 (<1-1)	1.3 (<1-2)	1.3 (<1-2)	1.3 (<1-2)	1 (<1-1)	1.5 (<1-3)	1.5 (1.0-2.0)	1.5 (1.0-2.0)	<1	1 (<1-1)
Lead (µg/L)	1 (<1-1)	<1	<1	<1	<1	1 (<1-1)	<1	1 (<1-1)	1.5 (<1-2)	<1	<1
Zinc (µg/L)	10.5 (<10-12)	10.8 (<10-13)	<10	<10	<10	<10	11.3 (<10-15)	<10	<10	<10	<10
Ammonia as N (mg/L)	**0.69** (0.16-1.1)	**0.83** (0.04-2.2)	**4.11** (1.28-8.94)	**4.21** (1.92-8.67)	**5.17** (2.98-10.9)	**0.10** (0.09-0.1)	**2.35** (0.60-4.95)	**2.53** (1.85-3.2)	**2.29** (1.78-2.8)	**2.76** (2.6-2.91)	**2.75** (2.6-2.9)
Nitrate as N (mg/L)	0.08 (<0.01-0.16)	0.03 (<0.01-0.07)	0.06 (<0.01-0.19)	0.02 (<0.01-0.04)	0.02 (<0.01-0.03)	0.01 (<0.01-0.01)	1.68 (0.78-3.13)	0.03 (0.01-0.04)	0.03 (0.01-0.04)	0.39 (0.23-0.55)	0.39 (0.23-0.54)
Total Kjeldahl Nitrogen as N (mg/L)	2.0 (0.9-2.4)	2.7 (1.9-4.0)	5.2 (2.6-10.3)	6.9 (4.4-13.1)	7.2 (3.8-16.6)	2.4 (1.4-3.3)	4.4 (2.2-7.8)	4.1 (3.9-4.3)	3.8 (3.5-4.0)	3.1 (0.4-5.7)	3.3 (0.5-6.0)
Total Phosphorus (mg/L)	0.15 (<0.1-0.2)	0.68 (<0.1-1.1)	1.4 (0.5-2.1)	1.4 (0.7-2.2)	1.6 (0.6-2.8)	0.7 (0.4-1.0)	0.9 (0.7-1.3)	1.0 (0.8-1.1)	0.8 (0.6-1.0)	3.4 (0.2-6.6)	3.8 (0.3-7.3)
Reactive Phosphorus as P (mg/L)	0.01 (<0.01-0.01)	0.2 (0.03-0.55)	0.8 (0.12-1.94)	0.7 (0.09-1.68)	1.0 (0.2-2.7)	0.3 (0.21-0.37)	0.7 (0.50-1.23)	0.2 (0.09-0.4)	0.2 (0.09-0.21)	<0.01	<0.01
Sulphide (mg/L)	<0.1	<0.1	0.28 (<0.1-0.8)	0.45 (<0.1-1.1)	0.1 (<0.1-0.1)	<0.1	0.1 (<0.1-0.1)	<0.1	<0.1	<0.1	<0.1
Oil & Grease (mg/L)	<5	<5	<5	<5	<5	<5	<5	6.5 (<5-8)	<5	<5	<5
Dissolved Oxygen Saturation (%)	61.2 (47-72)	62.4 (43.6-108)	59.0 (45.2-67.3)	47.8 (25.2-68.2)	45.9 (24.9-54.6)	57.4 (55.3-58.4)	75.5 (56.8-84.1)	59.6 (54.4-64.7)	64.0 (60.8-67.2)	150.0 (143-157)	125.0 (112-138)
Chemical Oxygen Demand (mg/L)	**48.0** (27-67)	**71.8** (38-105)	**50.5** (27-76)	**63.5** (38-84)	29.0 (24-38)	**94.7** (76-112)	**37.0** (19-66)	**40.0** (34-46)	**44.5** (34-55)	**67.5** (63-72)	**81.5** (73-90)
Biochemical Oxygen Demand (mg/L)	**5.25** (<2-12)	**12.75** (<2-40)	**6.75** (<2-10)	**12.25** (<2-26)	**6.5** (<2-15)	**7.67** (<2-16)	**8.25** (<2-17)	**12.0** (6-18)	**10.0** (4-16)	**16.0** (7-25)	**17.5** (12-23)
DO (mg/L)	4.7 (3.6-5.4)	5.0 (3.3-8.9)	4.7 (3.9-5.4)	**3.8** (2.2-5.4)	**3.6** (2.1-4.2)	4.5 (4.3-4.6)	5.9 (4.6-6.6)	4.7 (4.2-5.2)	5.1 (4.7-5.4)	12.2 (11.8-12.5)	10.1 (9.2-10.9)
E. coli (cfu/100mL)	$2.9*10^{2}$ (46-$5.1*10^{2}$)	$2.4*10^{2}$ (39-$5.3*10^{2}$)	**$1.1*10^{3}$** ($2.1*10^{2}$-$2.4*10^{3}$)	$7.2*10^{2}$ ($2.4*10^{2}$-$1.2*10^{3}$)	**$4.1*10^{3}$** ($1.1*10^{2}$-$9.8*10^{3}$)	50 (2-$1.2*10^{2}$)	**$7.2*10^{3}$** ($3.2*10^{3}$-$1.4*10^{4}$)	**$1.9*10^{3}$** ($2.2*10^{2}$-$3.6*10^{3}$)	**$2.0*10^{3}$** ($1.4*10^{3}$-$2.7*10^{3}$)	28 (26-29)	40 (19-61)
Faecal Coliform (cfu/100mL)	$3.4*10^{2}$ (49-$5.6*10^{2}$)	$2.8*10^{2}$ (47-$5.7*10^{2}$)	$1.5*10^{3}$ ($2.4*10^{2}$-$3.1*10^{3}$)	$1.1*10^{3}$ ($2.7*10^{2}$-$1.9*10^{3}$)	$4.8*10^{3}$ ($1.9*10^{2}$-$1.0*10^{4}$)	55 (2-$1.3*10^{2}$)	$8.6*10^{3}$ ($4.3*10^{3}$-$1.7*10^{4}$)	$2.2*10^{3}$ ($4.0*10^{2}$-$4.0*10^{3}$)	$2.5*10^{3}$ ($1.9*10^{3}$-$3.0*10^{3}$)	31 (29-32)	49 (27-70)

Note: 1. Data presented are in average values and the ranges are shown in brackets.
2. Values at or below laboratory reporting limits are presented as laboratory reporting limits (see Appendix E)
3. Figures in bold show non-compliance to WQO.
4. Water monitoring at WM6 was not performed on 26 Apr 06 due to no water could be obtained.

Table 5-9 Summary of In-situ Water Quality Monitoring Results in Dry Season (For Monitoring Station WM8 to WM10)

Parameters	WM8	WM9	WM10
Dissolved Oxygen Saturation (%)	11.7	20.0	121 (110-132)
Dissolved Oxygen (mg/L)	**<0.1**	**1.6**	9.2 (8.2-10.1)
Water depth (m)	<0.5	<0.5	<0.5
Temperature (°C)	27	28.7	32.2
Turbidity (NTU)	37	37	5.5 (5-6)
Salinity ‰	1.7	1.7	1.9 (1.5-2.3)
pH value	**5.2**	**3.3**	**2.7** (2.5-2.9)

Note: 1. Data presented are average values and the ranges are shown in brackets.
2. Water monitoring at WM8 & 9 was only performed on 29 Mar 2006 due to no water sample could be obtained.
3. Figures in bold show non-compliance to WQO.

Table 5-10 Summary of In-situ Water Quality Monitoring Results in Wet Season (For Monitoring Station WM8 to WM10)

Parameters	WM8	WM9	WM10
Dissolved Oxygen Saturation (%)	79	68.7	75.4 (49.8-101)
Dissolved Oxygen (mg/L)	6.0	5.2	5.8 (3.7-7.9)
Water depth (m)	<0.5	<0.5	<0.5
Temperature (°C)	27.9	28.3	27.35 (26.3-28.4)
Turbidity (NTU)	26	71	78.5 (7-150)
Salinity ‰	0.2	0.2	0.8 (0.3-1.3)
pH value	6.4	6.5	**4.3** (2.4-6.2)

Note: 1. Data presented are average values and the ranges are shown in brackets.
2. Water monitoring at WM8 & 9 was only performed on 5 June 2006, monitoring at WM10 were performed on 26 April and 5 June 2006.
3. Figures in bold show non-compliance to WQO.

Table 5-11 Summary of Key Water Quality Objectives Compliance for the Water Quality Monitoring Station WM1 to WM7 and WM11 to WM13

Parameters	*WQO	WM1	WM2	WM3	WM4	WM5	WM6	WM7	WM11	WM12	WM13
pH	6.0 – 9.0	√	√	√	√	√	√	√	√	√	√
BOD_5 (mg/L)	≤ 5	√	×	×	×	×	√	×	×	×	×
COD (mg/L)	≤ 30	√	×	×	×	×	×	×	×	×	×
SS (mg/L)	≤ 20	×	×	×	×	×	×	×	×	×	×
DO (mg/L)	≥ 4	√	√	√	×	×	√	√	√	√	√
***E. coli* (cfu/100mL)**	≤1000	√	√	×	√	×	√	×	×	×	√
Ammonia-nitrogen (mg/L)	Annual average ≤0.021	×	×	×	×	×	×	×	×	×	×

*Note: WQO follows WPCO Cap.358R.

Water and Sediment Quality in the Drainage Channels and Water Ditches in the Mai Po Fishponds Area

5.3.13 According to **Table 5–11**, breaches in the WQO's for BOD_5, COD, SS and ammonia-nitrogen content are evident in the existing water quality for the drainage channels along the fishponds area at the north east boundary of the Project Area (WM3 to WM5) and north of Palm Springs (WM6 and WM7). This is not unexpected as previous EIA studies also report poor water quality in the water courses around San Tin River (Binnie, 2002; Ove Arup, 2004). The poor water quality with high ammonia-nitrogen with *E. coli* content is considered to be the result of the seepage of domestic sewage from septic tanks.

5.3.14 Water quality monitoring was undertaken at stations WM11 and WM12 on 15 June and 20 June 2006 as a control for WM3, WM4 and WM5. Some dilution effect was anticipated at WM12, which is downstream of WM3 (**Figure 5.2**). However, the results showed that the nutrient levels (ammonia-nitrogen and total phosphorus) were higher than in the upstream section. This suggests that the water ditch at WM11 was receiving pollutants and adding to the overall pollution load of the main tributary (i.e. drainage channel WM12).

5.3.15 Sediment testing parameters for the stations WM3 to WM5 include Copper (Cu), Chromium (Cr), Lead (Pb), Zinc (Zn), Aluminium (Al) and Cadmium (Cd) as illustrated in **Table 5–7** and **Table 5–8**. These parameters are either "not detected" or are "very low concentration". For the drainage channel close to Palm Springs (especially at WM6) higher concentrations of Al, Cu, Pb and Zn content were reported compared to WM3 to WM5 and WM7 for the dry season samples. During the wet season, the concentration of these metals are reduced to "not detectable" or "just detected" for all of the stations (WM3 to WM7) and parameters with the exception of Al at WM6. However, the average Al concentration is much lower at WM6 (240µg/L for Fairview Park Nullah, 58.5µg/L for WM6), which suggests insignificant toxic metals concentrations in the drainage systems around the Mai Po area.

Water Quality of Active Fishpond

5.3.16 Water quality monitoring took place in the fishpond closest to the Project Area (see WM13 in **Figure 5.2**). This pond is actively managed for rearing freshwater fish. The water quality samples shows non-compliance with the WQO for BOD_5, COD, SS and ammonia-nitrogen level which indicates a higher nutrient content and oxygen demand in the fishpond. However, the low *E. coli* and high dissolved oxygen content indicates better water quality than in some of the water ditches and drainage channels adjacent to the pond, the high DO content is due to the physical aeration of the pond.

Water Quality in the Ditches within the Project Area

5.3.17 Water quality in the water ditches at WM1, indicates compliance with WQOs for all parameters except SS and ammonia-nitrogen content. The minor exceedances may be due to the low water content during the dry season and the production of ammoniacal waste from fishes in the water ditch. The high suspended solids, BOD, COD and ammonia-nitrogen content at WM2 may also be a reflection of stagnant conditions during the dry season.

5.3.18 Sediment testing results showed that the Cd, Cr, Cu and Pb concentration are low for both WM1 and WM2 in both dry and wet season samples. On 10 April and 20 June 2006 samples, higher concentration of Al and Zn were recorded at WM1. On 29 March 2006, high concentration of Al (369μg/L) and Zn (239μg/L) were recorded at WM2, these high concentration were just recorded once and dropped to 18μg/L for Al and not detected for Zn on the following samples collected on 10 April 2006. The sudden rise in concentration of Al and Zn cannot be explained, but as catfish was detected in this stream section, the effect of these sediments concentration on aquatic fauna is not significant.

In-situ Water Quality Monitoring Results at the Marsh in the Project Area

5.3.19 Water quality monitoring in the marshland on-site (where water was taken from the shallow pools; **Figure 5.2** shows the locations while **Table 5–9** and **Table 5–10** summarise the results) confirm it is a freshwater habitat with salinity in the range of 0.2‰ to 2.3‰. The water in these pools was acidic, with WM10 having a pH value between 2.5 and 2.9 in the dry season. The dissolved oxygen content dropped to 1.6mg/L at WM9 in the dry season. This is not surprising for the type of habitat the marsh supports.

Summary of Water Quality within the Assessment Area

5.3.20 Water quality for the existing water ditches and drainage channel along the Mai Po fishpond area is poor, and BOD_5, COD, SS and ammonia-nitrogen content do not comply with the WQO's. The major source of pollution is organic matter produced by fish in the water ditches during the low flow season, and discharge from fishponds when these are drained and maintained. Domestic sewage and site run-off from the vehicle maintenance workshops contribute to the overall pollution load in this area.

5.4 Assessment Methodology

5.4.1 All activities which have the potential to alter sediment regime and water quality have been identified. During the construction phase impacts are likely to be confined to the release of sediments during excavation, site formation for residential development and the restoration of wetland and other waterscape areas. As there is no direct connection to external water bodies, the site can be considered 'self-contained' and thus no water quality modelling is deemed necessary. Pollution control measures have been developed for the construction phase to ensure the WQO's are maintained.

5.4.2 The Project implementation requires excavation of sediment for the construction of the wetland compensation. The potential water quality impacts that would result from the disposal of excavated sediment at sea are addressed in **Section 7** of this EIA, along with other waste management issues.

5.5 Identification of Impacts

Construction Phase

5.5.1 During construction of the future residential development and wetland restoration there may be wastewater generated which could potentially affect the existing water courses within the Project Area. Excavation of the existing fishponds will generate groundwater which may need to be treated prior to discharge to the drainage system (or stream courses), assuming the groundwater is uncontaminated. The water ditches within the Project Area will be diverted.

Diversion of Existing Water Ditches and Marsh

5.5.2 The existing water ditches and marsh within the Project Area mainly act as discharge points for the surface runoff generated within the site area to the Mai Po River at north. They will be filled in order to facilitate the construction of the site formation for the proposed Development, with the provision of temporary drainage channels to collect the runoff of the site area during the construction stage.

Draining of Existing Water Ditches

5.5.3 Draining water from the water ditches within the Project Area will be necessary for the site formation works.

Soil Excavation and Stockpiling

5.5.4 There are no existing ponds on site, however some excavation works for establishing the wetland restoration area (WRA) is required.

5.5.5 Excavation for WRA would have some impact on the adjacent environment. Excavation could release sediments into the existing water ditches in the vicinity of the Project Area, hence increasing suspended solids concentrations whilst any contaminants originally trapped in the sediments could also be released into the water column. However, all of these potential impacts are locally confined to the Project Area and will be managed under the construction environmental management plan which will be prepared by the Contractor.

Release of Contaminants during Excavation

5.5.6 During excavation for the WRA, fine sediment could potentially be suspended into the water column. However, the site is enclosed and the water column is not open to tidal influence. Any losses of fine sediment to suspension during excavation will be contained by the existing perimeter bunds. Thus no sediment plume will be formed and no sediment can be transported to sensitive areas. Therefore, no impacts to water quality will arise due to release of contaminants during excavation.

Chemical Waste from Plant and Equipment

5.5.7 Small quantities of wastewaters from mechanical equipment may be generated on-site. Oil or lubricant has the potential of accidental spillage and impact the water quality. This kind of waste water has to dispose of as chemical waste to avoid discharge to the existing water system.

Domestic Effluent

5.5.8 Domestic wastewater will be generated on-site and will be contained through the provision of chemical toilets.

Operational Phase

5.5.9 During operation, the drainage pattern will be affected, as the water ditches within the site are filled and storm drain at the eastern portion will be diverted underground to connect to the drainage channel along the fishponds area at the north. The changes in the drainage pattern and water flow are described below.

Waste Water Pollution

5.5.10 According to the design of the Wetland Restoration Area, a protective layer will be placed under the restored wetland habitats to prevent leakage and water loss. This may be made of natural materials such as clay or hydric soils or artificial material such as a polyethylene liner. It is recommended that this detail is confirmed at detailed design stage and may require on-site trials to confirm the suitability of specific materials/design. The wetland habitat has also been designed as a self maintained ecosystem without the need to apply fertilizers. From the experience of managing either constructed or natural wetlands such as the Lok Ma Chau reedbeds of the Boundary Crossing Project and the various types of wetland habitats in the Mai Po Nature Reserve, pesticide has not been applied and is considered unnecessary for the vegetation maintenance as no pathogen problem on the wetland plant species were observed. Therefore, no fertilizer, pesticides or herbicides are anticipated for the health and well being of the restored wetland.

5.5.11 Domestic sewage generated within the development (approximately 484m^3/day) will be collected through the internal sewerage system and discharged to the planned public trunk sewer along Castle Peak Road, which is scheduled to be completed by 2012. The construction for the proposed development is scheduled to commence in 2008 and will be completed by 2012. Therefore, the completion date of the planned trunk sewer will tie in with the occupation date of the proposed development in 2013.

Diversion of existing water ditches and marsh

5.5.12 The existing water ditches and marsh within the Project Area mainly act as discharge points for the surface runoff generated within the Project Area to the Mai Po River at north. They will be filled in order to facilitate the construction of the site formation for the proposed Development. Internal drainage network underneath future road system within the proposed development will be provided to collect the surface runoff generated within the Project Area.

Changes in hydrology

5.5.13 The proposed development will generate additional surface runoff due to the construction of additional paved area, roads and facilities associated with the residential development. The additional runoff will be discharged to Mai Po River on the north of the Project Area via the internal drainage system under the future internal road network. The estimated additional peak discharge generated is about 2.4m^3/s under a 200 year storm which is approximately 2.6% of the peak flow of the existing Mai Po River (90m^3/s) based on the flow data obtained in Drainage Master Plan in the Northern New Territories. Since the increase in the surface runoff is insignificant, no adverse effect on the existing aquatic organisms or water quality in the drainage system is anticipated. (Study Brief Section 3.9.3.4 (viii))

5.6 Mitigation Measures

Construction Phase

5.6.1 Potential water quality impacts primarily relate to the uncontrolled discharge of sediments/ silts during construction. Good site practices in addition to the implementation of mitigation measures would minimize the impact to the surrounding environment.

General Precautions

- The site should be confined to avoid silt runoff from the site;
- No discharge of silty water into the drainage channel within and in the vicinity of the site;
- Any soil contaminated with chemicals/oils shall be removed from site and the void created shall be filled with suitable materials;
- Stockpiles to be covered by tarpaulin to avoid spreading of materials during rainstorms;
- Suitable containers shall be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport;
- Chemical waste containers shall be labelled with appropriate warning signs in English and Chinese to avoid accidents. There shall also be clear instructions showing what action to take in the event of an accidental;
- Storage areas shall be selected at safe locations on site and adequate space shall be allocated to the storage area;
- Any construction plant which causes pollution to the water system due to leakage of oil or fuel shall be removed off-site immediately;
- Spillage or leakage of chemical waste to be controlled using suitable absorbent materials;
- Chemicals will always be stored on drip trays or in bunded areas where the volume is 110% of the stored volume;
- Regular clearance of domestic waste generated in the temporary sanitary facilities to avoid waste water spillage; and
- Temporary sanitary facilities to be provided for on-site workers during construction.

Diversion of Existing Water Ditches and Marsh

5.6.2 A temporary drainage channel and associated facilities should be provided to collect the surface runoff generated within the site during the construction phase.

Draining of Existing Water Ditches

5.6.3 Sandbags or silt traps should be placed to avoid silt runoff to the drainage channel draining the water in the northern ditch. Draining of the ditches should be avoided during rainy weather.

Soil Excavation and Stockpiling

5.6.4 Excavated soil which needs to be temporarily stockpiled should be stored in a specially designated area that should not obstruct existing overland flow. Tarpaulin sheet should also provide to cover and avoid runoff into the drainage channels.

Operation Phase

Provisional Measures to Emergency Sewage Discharges/Spillages

5.6.5 As described in Section 6, the sewage generated from the residents of this development will be discharged to the planned public sewer. For discharging the sewage to the public sewers in the permanent case, no special mitigation measures are required. In order to minimize the potential impacts arising from sewer bursts, it is proposed to provide concrete surrounds to the sewers within the proposed development as an additional protection measure for the pipelines. (Study Brief Section 3.9.3.4 (xxviii))

Diversion of Existing Water Ditches and Marsh

5.6.6 An internal drainage network will be provided to collect runoff from the residential development. Runoff from the developed areas will be diverted into the internal drainage system during storm and adverse weather conditions. The future internal drainage network will have sufficient capacity to cater for the runoff generated from the proposed development, to replace the existing water ditches and marsh. An indicative drainage scheme is shown on **Figure 5.3**. (Study Brief Section 3.9.3.4 (iv))

Provision of Soft-landscaping

5.6.7 Soft landscaping in between the boundary of the WRA and the residential area will be provided to act as a buffer zone to absorb any overflow or flood waters before enters into wetland restoration area.

Residual Impacts

5.6.8 No residual impact is anticipated during the construction or operation of the Project.

Cumulative Impacts

5.6.9 No cumulative impacts are expected.

5.7 Environmental Monitoring and Audit

5.7.1 A water quality monitoring and site auditing programme is proposed, to ensure mitigation measures during construction phase will be implemented to protect the water bodies in the sensitive area from being further degraded. A water quality monitoring programme for the created wetland during operational phase is also recommended, to ensure the effectiveness of the water circulating system and the self sustainability of the wetland. The monitoring and audit details are given in the EM&A Manual and the wetland restoration plan in **Appendix H**.

5.8 Conclusions

5.8.1 With the phasing of the implementation programme to tie in with the provision of public sewers, it is anticipated that this Project will not cause net increase in pollution load to Deep Bay. Water quality impacts during the construction phase will be controlled through the implementation of good site practice. Once operational the water on-site in the restored wetland will be managed through a Wetland Restoration Plan with appropriate monitoring. The provision of appropriate site drainage including soft landscaping and measures to prevent incursion of surface runoff from roads into the restored wetland will further protect water quality.

5.9 References

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6 SEWERAGE AND SEWAGE TREATMENT IMPLICATIONS

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

6.1 Summary

6.1.1 This section of the EIA responds to Item 3.9.4 of the Study Brief. The fact that the timing of the development has been arranged to tie in with the provision of a new public sewer for the area means there will be no sewage treatment plant on site. This will ensure compliance with the 'no net increase' requirement for Deep Bay. During construction, temporary facilities will be provided by the contractor as part of the site establishment.

6.2 Introduction

6.2.1 The proposed residential development has an area of about 21.36 hectares and a maximum plot ratio of 0.4. The development will serve a population of 1053 persons. This section of the EIA has identified and assessed the sewerage and sewage treatment implications arising from the proposed residential development at Wo Shang Wai, determine the necessary mitigation measures and formulate proposals for sewage treatment and disposal with an objective to compliance with the discharge standards as required by the Environmental Protection Department (EPD).

6.3 Assessment Approach and Methodology

6.3.1 The assessment was undertaken in accordance with the criteria and guidelines for evaluating and assessing impacts on the downstream public sewerage, sewage treatment and disposal facilities as stated in section 6.5 in Annex 14 of the Technical Memorandum. The following approach and methodology has been adopted in this sewerage and sewage treatment implications assessment:-

- Carry out the desk study, water sampling, topography survey and site visit to collect the relevant information for the assessment.

- Investigate the existing/planning sewerage facilities in the vicinity of the development and determine the sewage flow and pollutant loading generated from the existing site.
- Determine the potential sewage and pollutant loading arising from the proposed development.
- Study and assess the need and impacts of discharging sewage to the existing/planning sewerage systems in North west New Territories.
- Investigate and determine the need and the feasibility of having a separate sewage treatment plant within the Assessment Area.
- Formula options to mitigate the sewerage impacts identified and recommend the design, operation and maintenance requirements for the sewage disposal system.

Collected Information

6.3.2 A desk study, topographical survey, water sampling of the existing Mai Po River and site visit have been undertaken to collect the relevant information for the assessment. The relevant information collected is summarized below:-

- The existing/planning sewerage facilities layout plan in North West New Territories
- The layout plan for the proposed residential development
- The proposed planning data of the development
- Water sampling data at Mai Po River from 29 March 2006 to 20 June 2006
- Topographic survey plan for the proposed development

Design Standards, Guidelines and Reference

6.3.3 The sewage flow and pollutant loading generated from the proposed residential development are based on the following standards, guidelines and reference for the sewerage and sewage treatment design:-

- Sewerage Manual published by DSD
- Guidelines for the Design of Small Sewage Treatment Plant published by EPD

6.4 Design Assumptions, Parameters and Criteria

Design Average Daily Sewage Flow

6.4.1 In accordance with the Guidelines for the Design of Small Sewerage Treatment Plants, the design average daily sewage flow for the proposed development is 460 litres per day per person.

Design Pollutant Loadings

6.4.2 The sewage loadings such as suspended solid (SS), biological oxygen demand (BOD), total nitrogen (TN), inorganic nitrogen (NH_3N) and Faecal Coliforms (*E. coli*) have been identified to be used in this implications assessment to assess the discharging requirements for the proposed residential development.

6.4.3 The pollutant loadings of the sewage are estimated based on the global unit load factors given in Table 4 of the Sewerage Manual and the Guidelines for the Design of Small Sewerage Treatment Plants. The design global unit load factors adopted in this assessment are summarised in **Table 6–1**.

Table 6-1 Design Unit Load Factors

Loading Type	Unit Load Factor
SS (kg/d/person)	0.055
BOD (kg/d/person)	0.055
TN (kg/d/person)	0.0135
NH_3N (kg/d/person)	0.005
E. coli (no./d/person)	4.3×10^{10}

Note:-
1. The total nitrogen (TN) is equal to the sum of inorganic nitrogen (NH_3N) and the organic nitrogen (TKN). The TKN loading can be referred to Table 4 of the Sewerage Manual which is about 0.0085 kg/d/person.
2. The unit load factors for BOD and SS are based on Appendix 2 of the Guidelines for the Design of Small Sewage Treatment Plants, for other parameters, the unit load factors are based on Table 4 of the Sewerage Manual.

Assessment Criteria for the Sewerage Facilities

6.4.4 It is understood that the site is within a sensitive area where additional pollutant loadings from the proposed residential development is not allowed to be discharged to the existing water body in environmental view point. Therefore, the criteria of "**no net increase"** in pollutant loading, particularly for the BOD, SS, TN and NH_3N, in the nearby water body from the proposed development has been set in deriving the proposals of the sewerage and sewage treatment facilities assessment.

6.5 Existing Sewerage Conditions

Existing Land Uses of the Project Area to be Developed

6.5.1 The existing Project Area is mainly degraded wetland without any development. The proposed residential development is located at Wo Shang Wai, Yuen Long and is bounded by the side of Castle Peak Road and San Tin Highway. To the immediate south and west of the Project Area there are the existing residential developments, Royal Palms and Palm Springs. Open storage area exists to the immediate northeast with fishponds to the northwest and village development to the east of the development site. The gross site area for the Project Area is approximately 21.36 hectares.

Existing Sewerage and Sewage Treatment Facilities

6.5.2 Based on the information collected from Government and the site inspections, no existing sewerage system is located within the site. The nearby developments such as the local villages, Royal Palms and Palm Springs are all served by their own sewage treatment facilities such as septic tanks/soak away facilities or secondary treatment works.

Estimated Sewage Flow and Pollutant Loading from the Existing Site

6.5.3 No sewage or pollutants are generated from the existing site as there are no on-site activities within the proposed development site area at present.

Planned Public Sewerage in North West New Territories

6.5.4 It is understood that a number of sewerage projects have been proposed to upgrade the existing sewerage system in North West New Territories. Based on the information provided by the Drainage Services Department (DSD) and Environmental Protection Department (EPD), a gravity trunk sewer will be provided along Castle Peak Road between Ngau Tam Mei and San Tin under PWP Item 235DS and will be in place by 2012. This trunk sewer will eventually connect to the existing Yuen Long Sewage Treatment Works via a pumping station at Nam Sang Wai which is currently under construction (**Figure 6.1**). A close liaison and co-ordination with relevant government departments to review the latest status and funding approval of the project is required to confirm if the design of the public sewers and the proposed sewerage system for the development site will fit each other. This also provides a way for government departments to take heed of this development at the planning and detailed design stage.

6.6 Estimated Pollutant Loads to the Existing Water Body due to the Proposed Development

Description of the Proposed Development

6.6.1 The proposed residential development consists of residential buildings, refuse collection point, car parks, a club house, and two tennis courts. Internal roads are to be provided within the Project Area for access. Proposed landscape open space areas for residents are situated at different locations of the development. The total Project Area is approximately 213,600m^2. The estimated total number of flats is 351 units and the estimated population is 1053 persons. The anticipated occupation date of the proposed development is in 2013.

Estimated Sewage Flow from the Proposed Development

6.6.2 Based on the average daily sewage flow rate 460 litres per day per person and the design population of 1053, the increase in sewage flow from the proposed development is about 484m^3/d (0.46 x 1053).

Estimated Pollutant Loads from the Proposed Development

6.6.3 The estimation of the pollutant loads arising from the proposed development has been detailed in **Appendix F**. The following table summarizes the pollutant loads arising from the raw sewage of the proposed development:-

Table 6-2 Pollutant Loads arising from the Raw Sewage of the Proposed Development

Parameters	Loading from the Proposed Development (kg/d)
SS	57.92
BOD	57.92
TN	14.22
NH_3N	5.27
E. coli (no./d)	4.53×10^{13}

6.6.4 In order to meet the design criteria of **no net increase** in the pollutant loading to the nearby water body, mitigation measures are required to be provided. The proposed schemes for achieving the design requirements are detailed in following paragraphs of this assessment.

6.7 Proposed Mitigation Measures

6.7.1 It is understood that a new trunk sewer will be constructed along Castle Peak Road and will be available for use by 2012. This trunk sewer will connect into the existing Yuen Long Sewage Treatment Works. The tentative sewage disposal scheme for the Project is to discharge the sewage to this planned trunk sewer via the sewer system as shown on **Figure 6.2**. The proposed network comprises sewers to be laid under the future internal roadwork which will convey the sewage generated within the development to the future trunk sewer in Castle Peak Road. Gravity sewers will be used to collect the sewage as far as possible. However, should there be any discharge level constraints imposed by the future trunk sewer, a local pumping station will be provided within the development, at a location before the terminal manhole of the development, to lift up the sewage to a level that can be connected to the trunk sewer. The sewers will be protected by concrete surrounds to minimize the risk of sewer bursts. All the sewers and sewerage facilities within the proposed development before the terminal manhole will be operated and maintained by the owner. The gravity sewer outside the development connecting the terminal manhole to the future public sewer will be maintained by DSD subject to their agreement in the detailed design stage.

6.7.2 As all the sewage generated will be discharged away from the proposed development and conveyed to public sewage treatment plant, there will be no net discharge from this site. This scheme has been discussed with EPD and DSD and they have expressed no objection in principle on the option, however, the arrangement will need to be further discussed with DSD and EPD during the detailed design stage. It has been estimated that a 300mm diameter sewer will have adequate flow capacity to handle the sewage arising from the proposed development. As EPD and DSD have both confirmed that their proposed upgrading/new sewers at Castle Peak Road in North West New Territories will be adequate to receive the sewage arising from the proposed development, the use of computerized analysis techniques to assess the impact on the public sewer is not considered to be required. Close monitoring of the implementation programme will be undertaken to ensure the sewage generated from the proposed development can discharge to the planned trunk sewer at the planned design horizon.

6.7.3 The construction of the sewers and manholes (general civil works), and the pumping station if required, will be carried out in line with the construction of the substructure and superstructure works for the proposed development. Installation of electrical and mechanical equipment will follow, with testing and commissioning being carried out after the successful installation of the required electrical and mechanical equipment.

6.8 Short Term Measures during Construction Stage

6.8.1 The sewage generated during the construction stage from the on-site workers will be collected in chemical toilets and disposed of off-site. Therefore, no sewerage impacts are expected from the site during the construction stage.

6.9 Conclusion and Recommendations

6.9.1 Confirmation has been received from both the Environmental Protection Department and Drainage Services Department in respect of discharging the domestic effluent into the planned trunk sewer along Castle Peak Road. Therefore, the sewage generated from the development will be collected through the internal sewerage network and then discharged to this planned trunk sewer. There is therefore no (net) discharge from the development.

7 WASTE MANAGEMENT

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

7.1 Summary

7.1.1 This section of the EIA Report identifies the potential wastes arising from the construction of the proposed development at Wo Shang Wai and provides an assessment of the likely environmental impacts associated with the handling and disposal of these wastes as per the requirements of the Study Brief item 3.9.5. This section also provides an assessment of the potential environmental impacts associated with sediment quality and biogas, as required under Section 3.9.3 of the Study Brief.

7.1.2 The options for reuse, minimisation, recycling treatment, storage, collection, transport and disposal of wastes arising from the Project have been examined both during construction and operational phases. Where appropriate, procedures for waste reduction and management are considered and environmental control measures for avoiding and minimising the potential impacts are recommended. During the operational phase, waste management issues relate to the municipal wastes and "green" wastes from the wetland restoration area as well as the landscaping works. A waste management plan will be prepared by the management company in accordance with usual practice for residential developments. This could include initiatives such as on-site composting and reuse of compost for fertilizers in the landscaped areas of the residential development.

7.2 Environmental Legislation and Standards

Legislation

7.2.1 The following legislation encompasses the storage, collection treatment and disposal of the wastes arising from the Project:

- Waste Disposal Ordinance (Cap 354);

- Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);
- 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; and
- Environment, Transport and Works Bureau (Works) Technical Circular (ETWB(W)TC) No. 34/2002A Management of Dredged/Excavated Sediment and Practice Note for Authorised Persons (PNAP) 252.

Guidelines

7.2.2 The following documents, guidelines and circulars provide guidance on waste management as follows:

- Waste Reduction Framework Plan, 1998 to 2007, Planning, Environment and Lands Bureau, Government Secretariat (5 November 1998);
- Environmental Guidelines for Planning in Hong Kong (1990), Hong Kong Planning and Standards Guidelines, Hong Kong Government;
- New Disposal Arrangements for Construction Waste (1992); Environmental Protection Department & Civil Engineering Department;
- 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. 16/96, Wet Soil in Public Dumps; and
- Environment, Transport and Works Bureau Technical Circular (Works) No. 19/2005, Environmental Management on Construction Sites.

7.3 Assessment Methodology

General

7.3.1 The potential environmental impacts due to the management of the wastes arising from the Project have been assessed in accordance with the criteria presented in Annexes 7 and 15 of the EIAO-TM and are summarized as follows:

- estimation of the types and quantities of the wastes to be generated;
- assessment of the secondary environmental impacts due to the management of waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges and traffic; and
- assessment of the potential impacts on the capacity of waste collection, transfer and disposal facilities.

7.4 Construction Waste Impact

Potential Sources of Impact

7.4.1 The Project will involve the construction of the following main works:

- residential development and associated infrastructure; and

- wetland restoration area and linear landscape area.

7.4.2 The construction activities to be carried out for the proposed developments will result in the generation of a variety of wastes which may include:

- site clearance waste;
- excavated materials;
- construction and demolition (C&D) materials;
- chemical waste; and
- general refuse.

7.4.3 If not properly managed, the handling and disposal of these wastes may cause adverse environmental nuisance and impacts. The nature of each of these wastes is discussed below.

Site Clearance Waste

7.4.4 The Project Area is currently covered with patchy vegetation. This will be removed at the start of the project and set aside for reuse.

Excavated Materials/Imported Filling Material

7.4.5 Bulk import of inert fill material is required to raise site levels and to form the linear landscape areas. The majority of excavated materials will only be generated from the following activities:

- Excavation of the Project Area to form the wetland restoration area.

Construction and Demolition Waste

7.4.6 Construction and demolition (C&D) material will mainly be generated from construction of the residential structures and associated infrastructure. C&D material may include:

- wood from formwork and falsework;
- materials and equipment wrappings;
- unusable/surplus concrete/grouting mixes; and
- damaged /surplus construction materials.

Chemical Waste

7.4.7 Chemical waste, as defined under the Waste Disposal (Chemical Waste) (General) Regulation, includes any substance being scrap material, or unwanted substances specified under Schedule 1 of the Regulation. Chemical wastes are expected to mainly be generated through maintenance of equipment and may include:

- scrap batteries or spent acid/alkali from their maintenance;
- used engine oils hydraulic fluids and waste fuel;
- spent mineral oils/cleaning fluids from mechanical machinery; and
- spent solvents/solutions, some of which may be halogenated, from equipment clearing activities.

7.4.8 Hazards associated with the improper handling, storage or disposal of chemical wastes may include:

- toxic effects to workers;
- fire hazards; and
- possible disruption of sewage treatment works if chemical waste enters the sewerage system.

General Refuse

7.4.9 It is estimated that a maximum of 300 workers will be working on-site during the peak construction period. General refuse including paper and food waste will be generated from the works site. On-site chemical toilets will need to be provided to deal with the generation of sewage from the work force. The storage, handling and disposal of general refuse have the potential to give rise to adverse environmental impacts if not properly managed. These include odour (if waste is not collected frequently), windblown litter, and visual impact. This work site may also attract pests and vermin if the waste storage areas are not well maintained and cleaned regularly. In addition, disposal of waste at sites other than approved waste transfer or disposal facilities could also have adverse impacts.

7.5 Evaluation of Impacts

7.5.1 The main construction works at Wo Shang Wai is scheduled to commence in 2009 with an occupation date of 2013. The finishing and fitting out of the residential units will continue after the main construction works are completed and thus construction waste management remains an issue through the entire construction and fitting out period. The estimates of wastes arising from the construction activities and the potential environmental impacts associated with the handling, storage, transport and disposal of these wastes are discussed below.

Site Clearance Waste

7.5.2 The major construction works at Wo Shang Wai is in the development of residential buildings and other associated facilities (club house, tennis courts, etc). The amount of site clearance works will be limited to the removal of a thin layer of vegetation. Approximately 10,000m^3 will be generated. This can be stored and reused in landscape areas. The impacts are therefore negligible.

Excavated Material

7.5.3 The excavated materials will consist of inert soil and sediment (identified in section 7.8). Estimated excavation volumes are:-

topsoil material:	10,000m^3 (see Paragraph 7.5.2 above)
sediment:	2,140m^3 (see **Table 7–22**)

7.5.4 The inert material will be generated at the start of construction, commencing January 2009, whilst the sediment will be generated during excavation for the wetland restoration area between March and November 2009.

7.5.5 The overall intention is to maximise the reuse of excavated materials as on-site fill materials. All excavated inert material will be reused within the Project Area if it is suitable for reuse. Landfill disposal will be the last resort after exploration of other alternatives, in which case tests shall be conducted to confirm the contaminated soil can meet the TCLP Requirements. Excavated sediment will be either re-used within the Project Area or disposed to an appropriate marine disposal site.

7.5.6 As shown in Section 7.7, no land contamination was found in the wetland restoration area to be excavated. Therefore no contaminated material is required to be excavated.

Imported Filling Material

7.5.7 Approximately 640,000m^3 of inert soil will be imported to bring the Project Area up to the required ground level. The material will be imported during site formation of Phases C, D, E and F between January 2009 and July 2010. It should be noted that there will be no infilling of fishponds as a result of this Project.

Construction and Demolition Material

7.5.8 Approximately 3,000m^3 C&D material will be generated during the course of the works between 2009 and 2012. The C&D material will be sorted into inert C&D materials, metals, timber and non-inert C&D material. All inert materials will be reused within the Project Area. Non inert C&D waste will be disposed directly to landfill. Methods to minimise the generation of C&D material will be addressed during detail design and in planning of the construction works. A Waste Management System will be incorporated into the Waste Management Plan (WMP) to effectively manage and avoid/reduce/minimise the generation of C&D material during construction.

Chemical Waste

7.5.9 It is difficult to quantify the amount of chemical waste, if any, generated as this will depend on the works within the Project Area. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent, produced from plant maintenance will be relatively small. These types of waste will be readily accepted at the Chemical Waste Treatment Centre at Tsing Yi. Waste oil could also be delivered to other licensed facilities for recycling.

7.5.10 Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Waste published by the EPD. Provided that this occurs, and the chemical waste is disposed of at a licensed chemical waste treatment and disposal facility, the potential environmental impacts arising from the storage, handling and disposal of a small amount of chemical waste generated from the construction activities will be negligible.

General Refuse

7.5.11 During the course of the works between 2009 and 2012, the construction workforce will generate refuse comprising food scraps, waste paper, empty containers, etc. Such refuse will be properly managed so intentional or accidental release to the surrounding environment does not occur. Disposal of refuse at sites other than approved waste transfer or disposal facilities will be prohibited. Effective collection of site wastes will prevent waste materials being blown around by wind, or creating an odour nuisance or pest and vermin problem. Waste storage areas will be well maintained and cleaned regularly.

7.5.12 The maximum number of construction workers to be employed is estimated to be about 300 workers. Based on a generation rate of 0.65 kg per worker per day, the maximum daily arising of general refuse during the construction period would be approximately 195kg and this waste can be effectively controlled by normal measures. This general waste also includes packaging materials associated with fit out and finishing works. With the implementation of good waste management practices at the site, adverse environmental impacts are not expected to arise from the storage, handling and transportation of workforce wastes.

7.6 Mitigation Measures

Introduction

7.6.1 This section sets out recycling, storage, transportation and disposal measures which are recommended to avoid or minimise potential adverse impacts associated with waste arising from the construction of the proposed development at Wo Shang Wai. The recommendations should be incorporated into an on-site waste management plan for the construction works to be undertaken by the Contractor. The waste management plan should incorporate site-specific factors, such as the designation of areas for the segregation and temporary storage of reusable and recyclable materials.

7.6.2 It is the Contractor's responsibility to ensure that only approved licensed waste collectors are used and that appropriate measures to minimise adverse impacts, including windblown litter and dust from the transportation of these wastes are employed. In additional, the Contractor must ensure that all the necessary waste disposal permits are obtained.

Waste Management Hierarchy

7.6.3 Various waste management options are as follows:

- avoidance and minimisation, i.e. not generating waste through changing or improving practices and design;
- reuse of materials, thus avoiding disposal (generally with only limited reprocessing);
- recovery and recycling, this avoiding disposal (although reprocessing may be required); and
- treatment and disposal, according to relevant laws, guidelines and good practice.

7.6.4 This hierarchy should be used to evaluate waste management options, thus allowing waste reduction measures to be introduced at the detailed design stage and carried through to the construction phase.

7.6.5 Training and instruction of construction staff should be given at the site to increase awareness and draw attention to waste management issues and the need to minimise waste generation. The training requirement should be included in the site waste management plan.

Storage, Collection and Transport of Waste

7.6.6 Permitted waste haulers should be used to collect and transport wastes to the appropriate disposal points. Measures to minimise adverse impacts should be instigated as appropriate and as far as practical, for example:

- handle and store wastes in a manner which ensures that they are held securely without loss or leakage, thereby minimising the potential for pollution;
- use waste haulers authorised or licensed to collect specific category of waste;
- remove wastes on a daily basis;
- maintain and clean waste storage areas daily;
- minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers;
- obtain the necessary waste disposal permits from the appropriate authorities, if they are required, in accordance with Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354), the Land (Miscellaneous Provisions) Ordinance (Cap 28);
- Dispose of waste at licensed waste disposal facilities;
- Develop procedures such as ticketing system to facilities tracking of loads, particularly for chemical waste, and to ensure that illegal disposal of wastes does not occur; and
- Maintain records of the quantities of wastes generated, recycled and disposal.

Excavated Material/Imported Filling Material

7.6.7 The excavated/imported filling material may have to be temporarily stockpiled on-site. Control measures should be taken at the stockpiling area to prevent the generation of dust and pollution of stormwater channels. However, to eliminate the risk of blocking drains in the wet season, it is recommended that stockpiling of excavated materials during the wet season should be avoided as far as practicable.

Dust:

- wetting the surface of the stockpiled soil with water when necessary, especially during the dry season;
- covering the stockpiled soil with sheets;
- minimising disturbance of the stockpiled soil; and
- enclosure of stockpiling area.

Water Quality:

- installation of silt traps for the surface water drainage system; and
- covering stockpiled material with tarpaulin during heavy rainstorm.

7.6.8 In addition, potential dust impacts due to the haulage of excavated/imported filling materials should be minimised by undertaking the following control measures:

- dropping heights for those materials should be controlled to a practical height to minimise the fugitive dust arising from unloading;
- materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport;

- the travelling speed should be reduced to 10 km hr-1 to reduce dust dispersion and re-suspension from the operating haul trucks; and
- wheel washing facilities should be installed and used by all vehicles leaving the Project Area.

Construction & Demolition Materials

7.6.9 In order to minimise waste arisings and to keep environmental impacts within acceptable levels, environmental control measures are recommended.

7.6.10 Careful design, planning and good site management can minimise over-ordering and generation of waste materials such as concrete, mortars and cement grouts. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse.

7.6.11 The Contractor should recycle as much of the C&D material as possible on-site. Proper segregation of wastes on site will increase the feasibility of recovery of certain components of the waste stream by recycling contractors.

7.6.12 Government has established a differentiated charging scheme for the disposal of waste to landfill, construction waste sorting facilities and public fill facilities. This will provide additional incentives to reduce the volume of waste generated and to ensure proper segregation of wastes.

Chemical Waste

7.6.13 For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.

7.6.14 Chemical waste that is produced, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, should be handed in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Waste as follows:

Containers used for the storage of chemical wastes should:

- be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed:
- have a capacity of less than 450 litres unless the specification has been approved by the EPD; and
- display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations.

The storage area for chemical wastes should:

- be clearly labelled and used solely for the storage of chemical waste;
- be enclosed on at least 3 sides;

- have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area whichever is the greatest;
- have adequate ventilation;
- be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary); and
- be arranged so that incompatible materials are adequately separated.

Disposal of chemical waste should:

- be via a licensed waste collector;
- be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers; or
- be to a re-user of the waste, under approval from the EPD.

7.6.15 The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist finding receivers or buyers for the small quantity of chemical waste to be generated from the project.

General Refuse

7.6.16 General refuse should be stored in enclosed bins or compaction units separate from C&D materials and chemical wastes. The Contractor should employ a reputable waste collector to remove general refuse from the Project Area, separate from C&D materials and chemical wastes, on a regular basis to minimise odour, pest and litter impacts. Burning of refuse on construction sites is prohibited by law.

Construction Waste Management Plan

7.6.17 A construction waste management plan (CWMP) will be developed by the contractor to ensure proper collection, treatment and disposal of waste on site. This CWMP will also take into account the requirement to provide chemicals on site which will need to be managed by a licensed waste collection contractor.

7.7 Land Contamination

Land contamination Environmental Legislation and Standards

7.7.1 Comprehensive ground investigation for land contamination assessment was carried out between March and May 2006. The ground investigation and laboratory testing was based on a contamination assessment plan (CAP) agreed in advance within EPD. At that time, the following legislation, guidelines and guidance notes were in force for land contamination assessment:

- Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM);
- Professional Persons Environmental Consultative Committee Practice Note 3/94 - Contaminated Land Assessment and Remediation (ProPECC PN 3/94); and
- EPD Guidance Notes for Investigation and Remediation of Contaminated Sites of: Petrol Filling Stations; Boatyards; and Car Repair/Dismantling Workshops (1999).

7.7.2 The above legislation, guidelines and guidance notes have therefore been adopted for the land contamination assessment.

7.7.3 Under the EIA Ordinance, Annex 19: Guidelines for Assessment of Other Impacts, and EPD's *Guidance Notes*, consideration must be given to a number of potentially contaminating historical land uses, including petrol filling stations, oil installations, shipyards/boatyards, car repairing and dismantling, power plants and gas works. If these land uses are identified, then the applicant is required to generate a Contamination Assessment Plan (CAP).

7.7.4 Under ProPECC PN 3/94 and EPD's *Guidance Notes*, and in the absence of any formal legislation requiring cleanup of land contamination in Hong Kong, the "Dutch Ministry of Housing, Planning and Environmental Soil and Groundwater Standards" (the Dutch Guidelines) (1994) are used as reference criteria by the EPD for the classification of contaminated materials. It should be noted that whilst the Dutch Guidelines are widely recognised and generally applicable on a global scale, they are not enforceable standards in Hong Kong. In the Netherlands, the Dutch Guidelines were developed in the specific case where the drinking water supply is source entirely from groundwater. Hence, the Dutch Guidelines are very strict in regard to some specific contaminants, but must be viewed in the relative context of the Hong Kong situation.

Assessment Methodology

7.7.5 In accordance with *ProPECC PN 3/94* and the EPD Guidance Notes, an assessment evaluation should:

- provide a clear and detailed account of the present use of the land in question and the relevant past land use history, in relation to possible land contamination;
- identify those areas of potential contamination and associated impacts, risks or hazards; and
- if required, submit a plan to evaluate the actual soil contamination conditions.

7.7.6 The potential environmental impacts due to the land contamination at the Project Area have therefore been assessed as follows: -

(i) desk study of past land uses and identification of potential contamination;
(ii) ground investigation and laboratory testing for possible contaminants (based on a contamination assessment plan (CAP) agreed with EPD);
(iii) assessment of the environmental impacts due to land contamination; and
(iv) presentation of appropriate remediation options.

Potential for land contamination

Desk study of past land uses

7.7.7 Aerial photographs show that in the 1940s and 1950s, the Project Area consisted of brackish paddies that were influenced by tidal inflows. In the 1960s, when fresh water fish farming was burgeoning in the New Territories, the rice fields were converted into commercial fishponds. The fishponds within the Project Area began to be filled around 1987. By 1990, some 90% of ponds within the Project Area were filled and by 1991 the Project Area was completely filled. In 1991, the north eastern portion of the Project Area was used for open storage of vehicles and containers. This usage has continued to present day. The remainder of the Project Area has been unused grassland since its' formation in 1991.

7.7.8 Currently, the Project Area is relatively flat, with a drainage ditch running along its western boundary. The northeastern portion of the Project Area is currently used for open storage of vehicles and containers whilst the remainder of the Project Area is vegetated. Walkover of the Project Area in January 2006 indicated no specific land use or industrial/commercial activities which could result in land contamination. The potential for land contamination was therefore considered to be low.

Potential land contamination sources

7.7.9 The Project Area for the proposed development was formed by filling of existing fishponds between 1987 and 1991. The source of the fill material is not known. Low levels of contaminated material could therefore be present if the fill was contaminated prior to being imported to the Project Area.

7.7.10 The northeastern portion of the Project Area is currently used for lorry parking and storage of vehicles and containers. Environmental impacts due to contamination from this land use would only arise if any historic spillage/leakage of contaminants occurred either directly within the area or outside the area and with subsequent migration into the Project Area. It was considered unlikely that material would be significantly contaminated by this land use as there was no evidence of spillage or leakage.

7.7.11 A plan of current land uses at the Project Area is presented in **Figure 7.1** and the associated potential contaminants are listed in **Table 7–1**.

Table 7-1 Potential contaminants

Source	Potential Contaminants	Contaminant parameters to be tested
Lorry parking area	Metals, solvents, hydraulic fluids, fuels, lubricating oils, coolants	• Heavy metals (Copper, Chromium, Lead and Zinc); • BTEX (benzene, toluene, ethyl benzene, xylenes); • total petroleum hydrocarbons (TPHs); • polyaromatic hydrocarbons (PAHs); • Phenols • TCLP & asbestos
Filled ground	Unknown	As above

7.7.12 These contaminants may cause negative impacts to sensitive receivers, including humans, during construction works or during the operational phase. The general hazardous effects of these contaminants are described in **Table 7–2**.

Table 7-2 General hazardous effects of contaminants potentially present

Contaminants	Hazardous effect
Heavy Metals (incl. Copper, Chromium, Lead and Zinc)	Can be toxic by ingestion and contact. Toxic to fish, plants and marine plants (especially copper).
BTEX and TPH	Can be toxic by inhalation, ingestion and contact. May be flammable at high concentrations.
PAH's	Can be toxic by inhalation, ingestion and contact.

Ground investigation and laboratory testing

Contamination assessment plan (CAP)

7.7.13 Comprehensive ground investigation and laboratory testing was conducted under the Project to provide accurate information on land contamination and allow recommendations to be made on appropriate treatment / disposal options.

7.7.14 The ground investigation and laboratory testing was based on a contamination assessment plan (CAP) agreed in advance within EPD. The ground investigation comprised fifteen boreholes, spaced at approximately 100m centres in the north-east portion of the Project Area and at 200m centres elsewhere within the Project Area. The borehole locations are shown on **Figure 7.2**.

Ground investigation field work

7.7.15 The ground investigation fieldwork and soil sampling was carried out by Chung Shun Boring Engineering Company Limited between 22 March and 3 May 2006. All boreholes were drilled to a depth of 5m below ground level (bgl) with continuous soil sampling to identify the vertical profile. Groundwater samples were collected from the base of each borehole. All samples were collected and stored in clean sealed containers, kept at 4ºC and delivered to the laboratory the same day.

Laboratory testing

7.7.16 Laboratory testing was carried out for the parameters listed in **Table 7–1**. The testing was carried out by ALS Technichem (HK) Pty Limited, a HOKLAS accredited laboratory.

7.7.17 Sub-samples of marine sediment were tested separately in accordance with procedures listed in Section 7.8 below. Subsamples for land contamination assessment were therefore taken to suit the actual depths of fill and alluvium encountered. The actual sub-sample depths tested are summarised in **Table 7–3** below.

Table 7-3 Ground conditions encountered and depth of subsamples tested

Drillhole Ref.	Ground Level (mPD)	Strata thickness (m)			Depth of subsamples tested (m)
		Fill	Marine deposit	Alluvium	
BH-LC1	+4.43	2.00	2.00	1.00	0.75; 1.75; 3.25
BH-LC2	+4.13	1.50	3.00	3.90	0.75; 1.25; 3.0; 5.0
BH-LC3	+4.17	1.00	3.50	0.50	0.75; 1.25
BH-LC4	+3.52	0.50	3.50	1.00	0.9; 1.9; 2.9
BH-LC5	+3.18	0.50	4.00	0.50	0.9; 1.9; 2.9
BH-LC6	+2.48	1.50	2.50	1.00	0.9; 1.9; 2.9
BH-LC7	+2.87	1.50	2.00	1.50	0.75; 1.25; 2.9
BH-LC8	+2.89	1.50	2.50	1.00	0.75; 1.25; 2.9
BH-LC9	+2.91	1.50	3.50	-	0.75; 1.25; 2.9
BH-LC10	+2.78	2.00	1.50	1.50	0.75; 1.25; 1.75; 2.9
BH-LC11	+3.29	2.00	2.90	0.10	0.5; 1.5; 2.9
BH-LC12	+3.44	2.00	1.00	2.00	0.75; 1.5; 3.5
BH-LC13	+3.93	3.00	0.50	4.80	0.75; 1.75; 2.75; 5.0
BH-LC14	+3.30	2.00	2.00	1.00	0.5; 1.5; 3.0
BH-LC15	+2.94	2.00	2.00	1.00	0.5; 1.5; 3.0

Results of laboratory testing

7.7.18 The results of the laboratory testing on soil and groundwater samples, along with the associated classification to Dutch Guidelines, are presented in **Table 7–14**, **Table 7–5** and **Table 7–6**. Results below Dutch ‘A’ limits suggest no contamination, results between Dutch ‘A’ and ‘C’ levels indicate low level contamination, and results exceeding Dutch ‘C’ limits indicate significant contamination requiring remediation.

Table 7-4 Summary of chemical test results on soil samples

		Analyse	Chromium	Copper	Lead	Zinc	Total Sulphur	TPH	BTEX	Phenols	PAH's	TCLP	Asbestos	Classification
		Unit (In dry Wt basis)	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	Mg/L		
		Reporting Limits	1.0	1.0	1.0	1.0	0.05	various	various	0.1	various	various		
		Dutch 'A'	100	20	50	200	2	100	0.1	0.02	1	various		
		Dutch 'B'	250	100	150	500	20	1000	7	1	20			
		Dutch 'C'	800	500	600	3000	200	5000	70	10	200			
Borehole	**Depth**	**Material**												
BHLC1	0.75	Fill	15	33	182	832	0.06	All < reporting limits	All BTEX are < reporting limits	All Phenols are < reporting limits	All polynuclear aromatics are < reporting limits	All TCLP are < landfill disposal criteria limits [all TCLP < reporting limits, except lead and zinc)	not detected	Pb & Zn > Dutch B
BHLC1	1.75	Fill	7	6	104	433	0.25						not detected	< Dutch 'A'
BHLC1	3.25	Marine deposit	28	13	58	193	0.54						-	< Dutch 'A'
BHLC2	0.75	Fill	14	27	63	364	0.14	433					not detected	<< Dutch 'B'
BHLC2	1.25	Fill	10	35	170	179	0.05						not detected	Pb > Dutch B
BHLC2	3.00	Marine deposit	19	43	161	100	0.13	136					not detected	Pb > Dutch B
BHLC2	5.00	Alluvium	24	10	47	69	1.25	All TPHs are < reporting limits					-	< Dutch 'A'
BHLC3	0.75	Fill	30	17	53	166	0.11						not detected	< Dutch 'A'
BHLC3	1.25	Marine deposit	32	17	64	943	0.09						not detected	Zn > Dutch B
BHLC4	0.75	Marine deposit	30	11	32	86	2.95						not detected	< Dutch 'A'
BHLC4	1.25	Marine deposit	31	13	41	95	1.06						not detected	< Dutch 'A'
BHLC5	0.90	Marine deposit	34	15	51	152	0.53						not detected	< Dutch 'A'
BHLC5	1.90	Marine deposit	41	19	50	94	0.59						not detected	< Dutch 'A'
BHLC5	2.90	Marine deposit	43	16	44	110	1.97						-	< Dutch 'A'
BHLC6	0.90	Fill	8	8	138	103	0.11						not detected	< Dutch 'A'
BHLC6	1.90	Marine deposit	29	14	72	182	0.97						not detected	< Dutch 'A'
BHLC6	2.90	Marine deposit	31	12	43	76	1.12		0.3				-	<< Dutch 'B'
BHLC7	0.75	Fill	13	16	95	501	0.57		All BTEX are < reporting limits				not detected	Zn > Dutch B
BHLC7	1.25	Fill	8	8	55	204	0.15						not detected	< Dutch 'A'
BHLC7	2.90	Marine deposit	27	20	74	121	1.45						-	< Dutch 'A'

		Analyse	Chromium	Copper	Lead	Zinc	Total Sulphur	TPH	BTEX	Phenols	PAH's	TCLP	Asbestos	Classification
		Unit (In dry Wt basis)	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	Mg/L		
		Reporting Limits	1.0	1.0	1.0	1.0	0.05	various	various	0.1	various	various		
		Dutch 'A'	100	20	50	200	2	100	0.1	0.02	1			
		Dutch 'B'	250	100	150	500	20	1000	7	1	20	various		
		Dutch 'C'	800	500	600	3000	200	5000	70	10	200			
Borehole	Depth	Material												
BHLC8	0.75	Fill	17	48	59	177	0.28						not detected	< Dutch 'A'
BHLC8	1.25	Fill	9	6	34	35	0.09						not detected	< Dutch 'A'
BHLC8	2.90	Marine deposit	30	12	39	77	1.21		0.4				-	<< *Dutch 'B'*
BHLC9	**0.75**	Fill	11	23	88	**590**	0.34		All BTEX are < reporting limits				not detected	**Zn > Dutch B**
BHLC9	**1.25**	Fill	10	43	**275**	**538**	0.22						not detected	**Pb & Zn > Dutch B**
BHLC9	2.90	Marine deposit	32	13	44	84	1.56						-	< Dutch 'A'
BHLC10	0.75	Fill	15	23	78	214	0.14						not detected	< Dutch 'A'
BHLC10	1.25	Fill	13	21	76	88	0.06						not detected	< Dutch 'A'
BHLC10	1.75	Fill	10	15	79	221	0.11						-	< Dutch 'A'
BHLC10	2.90	Marine deposit	29	13	51	87	1.19						-	< Dutch 'A'
BHLC11	**0.50**	Fill	9	56	**214**	322	0.25						not detected	**Pb > Dutch B**
BHLC11	**1.50**	Fill	12	24	**159**	319	0.18						not detected	**Pb > Dutch B**
BHLC11	2.90	Marine deposit	39	14	39	92	1.56						-	< Dutch 'A'
BHLC12	0.75	Fill	11	16	101	221	0.29						not detected	< Dutch 'A'
BHLC12	1.50	Fill	14	20	63	60	0.25						not detected	< Dutch 'A'
BHLC12	3.50	Marine deposit	17	4	21	26	0.08						not detected	< Dutch 'A'
BHLC13	**0.75**	Fill	32	45	36	**862**	0.12						not detected	**Zn > Dutch B**
BHLC13	1.75	Fill	9	21	130	101	0.3						not detected	< Dutch 'A'
BHLC13	**2.75**	Fill	9	36	**173**	114	0.07						not detected	**Pb > Dutch B**
BHLC13	**5.00**	Alluvium	16	7	60	**691**	<0.05						-	**Zn > Dutch B**

		Analyse	Chromium	Copper	Lead	Zinc	Total Sulphur	TPH	BTEX	Phenols	PAH's	TCLP	Asbestos	Classification
		Unit (In dry Wt basis)	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	Mg/L		
		Reporting Limits	1.0	1.0	1.0	1.0	0.05	various	various	0.1	various	various		
		Dutch 'A'	**100**	**20**	**50**	**200**	**2**	**100**	**0.1**	**0.02**	**1**	**various**		
		Dutch 'B'	**250**	**100**	**150**	**500**	**20**	**1000**	**7**	**1**	**20**			
		Dutch 'C'	**800**	**500**	**600**	**3000**	**200**	**5000**	**70**	**10**	**200**			
Borehole	**Depth**	**Material**												
BHLC14	0.50	Fill	18	36	102	130	0.32						not detected	**< Dutch 'A'**
BHLC14	**1.50**	Fill	8	26	**306**	218	0.14						not detected	**Pb > Dutch B**
BHLC14	3.00	Marine deposit	25	11	59	72	1.1						-	**< Dutch 'A'**
BHLC15	0.50	Fill	10	13	59	33	0.19						not detected	**< Dutch 'A'**
BHLC15	1.50	Fill	9	25	140	122	0.1						not detected	**< Dutch 'A'**
BHLC15	3.00	Marine deposit	26	16	65	89	1.1						-	**< Dutch 'A'**

Table 7-5 Summary of chemical test results on ground water samples

Analyse	Chromium	Copper	Lead	Zinc	TPH	BTEX	Phenols	PAH's	Classification
Unit (In dry Wt basis)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
Reporting Limits	1.0	1.0	1.0	10.0	various	various	0.1	various	
Dutch 'A'	20	20	20	50	20	1	0.5	0.2	
Dutch 'B'	50	50	50	200	200	30	15	10	
Dutch 'C'	200	200	200	800	600	100	50	40	
BHLC1	<1	<1	<1	<10	314	All BTEX are < reporting limits	All Phenols are < reporting limits	All polynuclear aromatics are < reporting limits	TPH above Dutch 'B'
BHLC2	<1	1	<1	11	*613*				TPH above Dutch 'C'
BHLC3	<1	<1	<1	<10	310				TPH above Dutch 'B'
BHLC4	<1	<1	<1	<10	*738*				TPH above Dutch 'C'
BHLC5	2	10	<1	48	162				below Dutch 'B'
BHLC6	1	12	<1	24	389				TPH above Dutch 'B'
BHLC7	3	8	<1	38	391				TPH above Dutch 'B'
BHLC8	2	4	<1	<10	*615*				TPH above Dutch 'C'
BHLC9	2	9	<1	20	367				TPH above Dutch 'B'
BHLC10	3	6	<1	14	289				TPH above Dutch 'B'
BHLC11	<1	10	<1	<10	*1568*				TPH above Dutch 'C'
BHLC12	<1	2	<1	<10	399				TPH above Dutch 'B'
BHLC13	1	<1	<1	<10	510				TPH above Dutch 'B'
BHLC14	1	<1	<1	<10	206				TPH above Dutch 'B'
BHLC15	<1	<1	<1	<10	368				TPH above Dutch 'B'

Table 7-6 Summary of additional TPH test results on ground water samples

Analyse	TPH	Classification
Unit (In dry Wt basis)	mg/kg	
Reporting Limits	various	
Dutch 'A'	20	
Dutch 'B'	200	
Dutch 'C'	600	
BHLC1	<LoR	Below Dutch 'A'
BHLC2	<LoR	Below Dutch 'A'
BHLC9	<LoR	Below Dutch 'A'
BHLC11	<LoR	Below Dutch 'A'
BHLC15	<LoR	Below Dutch 'A'
BHSQ6	<LoR	Below Dutch 'A'
BHSQ8	<LoR	Below Dutch 'A'
BHSQ10	<LoR	Below Dutch 'A'

LoR = Limit of Reporting

Assessment of Impacts

Results of laboratory testing

7.7.19 From **Table 7–4**, the majority of measured parameters were below the reporting limits and/or below Dutch ‘A’ criteria levels. However, eight samples exceeded the Dutch ‘B’ criteria for lead and seven samples exceeded the Dutch ‘B’ criteria for zinc. These are tabulated below:-

Table 7-7 Summary of land contamination locations

Location	Depth	Soil type	Contaminant exceeding Dutch ‘B’ criteria
BHLC1	0.75	Fill	Pb & Zn
BHLC2	1.25	Fill	Pb
BHLC2	3.00	Marine deposit	Pb
BHLC3	1.25	Marine deposit	Zn
BHLC7	0.75	Fill	Zn
BHLC9	0.75	Fill	Zn
BHLC9	1.25	Fill	Pb & Zn
BHLC11	0.50	Fill	Pb
BHLC11	1.50	Fill	Pb
BHLC13	0.75	Fill	Zn
BHLC13	2.75	Fill	Pb
BHLC13	5.00	Alluvium	Zn
BHLC14	1.50	Fill	Pb

7.7.20 The above contaminant values are of a low-level exceedance (i.e. > Dutch B levels, but < Dutch C levels), indicating low level lead and zinc contamination at isolated locations.

7.7.21 The Geochemical Atlas of Hong Kong (GEO, 1999) records typical background levels of lead and zinc to be 74 - 173ppm and 144 - 267ppm respectively. This compares to average detected values of 90ppm and 230ppm for all samples at the Project Area and average values of 205ppm and 708ppm for those samples exceeding Dutch ‘B’ levels. Thus, whilst most of the ‘hotspots’ are found in the north-east portion of the Project Area, close to the existing lorry parking area, the levels of lead and zinc detected suggest that the contaminants are related to background levels rather than anthropogenic activity. This is further supported by the fact that the samples with elevated lead and zinc levels do not show elevated levels of other contaminants, particularly copper.

7.7.22 From **Table 7–5**, the majority of measured groundwater parameters were below the reporting limits and/or below Dutch ‘A’ criteria levels. However, all but one of the groundwater samples exceeded the Dutch ‘B’ criteria for TPH and four samples exceeded the Dutch ‘C’ criteria for TPH. Given the Project Area is primarily open unused grassland, the TPH results were considered highly unusual. Additional groundwater sampling was therefore undertaken from eight boreholes which had standpipes installed. The results for the additional samples are presented in **Table 7–6**. This showed that all eight samples were below Dutch 'A' limits. The original results are therefore considered to have been anomalous, probably as a result of cross-contamination due to small amounts of oil lubricant from the investigation drill rigs.

Assessment of land contamination impacts

7.7.23 Exposure to slightly elevated levels of lead and zinc can be toxic by ingestion and contact. The potential impacts to the Project from low-level lead and zinc contaminated soil are judged to be the following:

- health risks to site workers;
- disposal of contaminated soil, where encountered; and
- potential health risks to future users of the sites.

Health Risk to Site Workers

7.7.24 Site construction workers may become exposed to lead and zinc contaminated soils during earth moving operations for constructing the wetland. The main exposure routes for site construction workers are accidental direct ingestion of the contaminated materials through poor hygiene and eating or smoking on site, or through direct contact with the contaminants in excavated soil.

Disposal of Contaminated Soil

7.7.25 Lead and zinc contaminated soils must be dealt with appropriately in accordance with *ProPECC Note 3/94*, which requires the concentration of contaminants to be assessed against the Dutch list. The remediation measures and the final disposal requirements are also required to be agreed with EPD.

Potential Health Risks to Future Users of the Site

7.7.26 During the operational phase, there is low potential for impacts associated with contaminated soils. Firstly, appropriate remedial measures will have been undertaken either to ensure this material is mitigated or removed. Also, ground levels at the Project Area will be raised by some 2m to 3m above existing levels. This will ensure that future, direct contact with existing *in-situ* materials is avoided.

Extent and excavated volume of contaminated land

7.7.27 Although lead and zinc contaminants are not highly mobile, it is recommended that a section of bulk excavated soils of 25m radius and 0.75m vertical depth above and below the sampling point be considered as contaminated. This equates to an area of $1963m^2$ around each 'hotspot' location.

7.7.28 Existing ground levels will generally be raised by between 2m and 3m, whilst excavation will only be carried out for the wetland restoration area. No land contamination was found in the wetland restoration area (see **Figure 7.3**). Therefore no contaminated material is required to be excavated for the development.

7.7.29 The identified contaminated locations (LC1, LC2, LC3, LC7, LC9, LC11, LC13 & LC14) will be covered with 2m to 3m of inert soil. As the contaminants are not mobile in groundwater (all groundwater results were below Dutch 'A' levels), it is beneficial that the contaminants should remain at depth below the Project Area and not be potentially remobilised through excavations. However, the need to remediate these locations and the depth of any such remediation will be assessed in the Contamination Assessment Report (CAR) and the Remediation Assessment Plan (RAP) to be prepared upon finalisation of the detailed design.

Remediation of excavated contaminated material

Remediation techniques

7.7.30 The assessment shows that no contaminated soil would be excavated during excavation for wetland restoration. Subject to the results of the CAR and RAP, contaminated soil in other areas may need to be treated. *ProPECC Note 3/94* outlines a number of remediation measures for contaminated sites including recovery wells, soil venting, bio-treatment, immobilisation and excavation/ landfilling.

7.7.31 Of these methods, only the latter two methods (immobilisation and excavation/landfilling) are appropriate for remediation of the lead and zinc heavy metal contaminants found at the Project Area.

7.7.32 The principle of immobilisation is that stabilising reagents are added to the soil so that heavy metals present will be immobilised by chemical or physical reaction. The principle of excavation / landfilling is that the contaminated material is removed off-site to landfill.

Immobilisation - typical treatment process

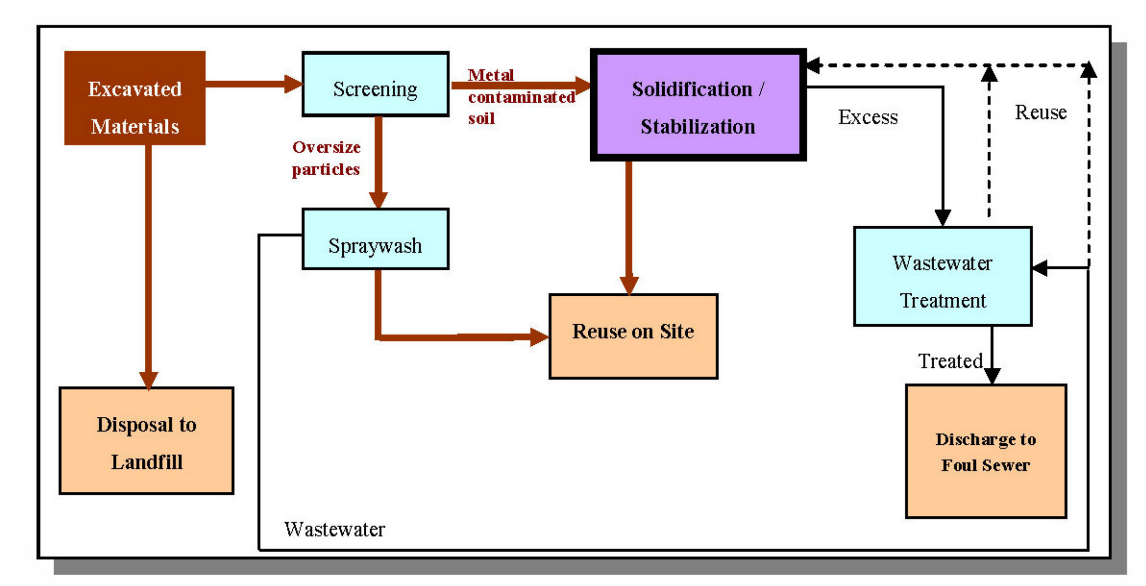
7.7.33 Upon excavation, the contaminated material should be isolated from other excavated material by stockpiling separately from non-contaminated soils in a designated storage area for on-site solidification works. Fencing with warning signs should also be erected around the contaminated soil stockpile to prevent unauthorised entry, pending treatment.

7.7.34 Contaminated soil should be excavated by conventional earthmoving equipment. During the excavation process, dust should be controlled by the use of water sprays. Where possible, the contaminated soil should be solidified as soon as practicable after excavation.

7.7.35 As the contaminant levels found at the Project Area are between Dutch B & C, the cement ratio required is unlikely to be extensive. From similar solidification processes in Hong Kong, up to 30% ratio of cement to soil/ash material will be sufficient. As the pre-treated soils have shown they are below the TCLP criteria, there is no requirement to undertake further contaminant testing on solidified soils. The acceptable cement content should therefore be determined by pilot tests to achieve a workable soil mix with a minimum compressive strength 1.03 N/mm^2 (150psi or 1034 kPa). Pilot tests should be carried out using mixes of 5%, 10%, 15%, 20%, 25% and 30% ratios of cement to soil, with three replicate 300mm cube blocks being carried out for each ratio. The required proportion of cement to soil mixture ratio and the setting period can be determined once an acceptable compressive strength is achieved. Results from pilot tests should be submitted to EPD for confirmation of the required cement to soil ratio. Full-scale solidification works can commence following EPD's acceptance of the pilot tests. During the works, three cube blocks for every 100 m^3 of treated soil should be tested to confirm the treated soils meet the minimum required compressive strength. TCLP results of the pre-treated soils are below the landfill disposal criteria. Therefore, no further contaminant testing on solidified soils is considered necessary at this stage. If, during the preparation of the CAR and RAP, further contamination testing of treated soils is considered necessary, the Universal Treatment Standards will be applied.

7.7.36 The solidified material should be placed in backfill areas which will not be adversely affected by the compressive strength of the solidified material. Any wastewater generated from the solidification process should be reused in the cement solidification process where possible, or treated and then discharged to foul sewer if reuse is not possible. The typical process to be followed is shown in the flow chart below.

7.7.37 The remediation works should be supervised by a Land Contamination Specialist. The Land Contamination Specialist should also be responsible for the supervision of the pilot tests, deciding the correct cement/soil mixing ratio. The cement stabilisation method should be approved by DEP and the progress of the stabilisation works should be reported to EPD periodically.



Excavation/ landfilling - typical treatment process

7.7.38 Whilst immobilisation is a remediation option for contaminated soils, it is also possible to dispose of the contaminated soils to landfill. Landfill disposal should only be considered as a last resort after exploration of other alternatives.

7.7.39 Chemical testing (**Table 7–4**) has shown that the Toxicity Characteristic Leaching Procedure (TCLP) results are well below allowable limits (i.e. Table E1 of EPD's *Guidance Notes*). The lead and zinc contaminated soils are therefore not prone to leaching. Thus, in the event disposal to landfill is necessary, the contaminated material may be disposed directly to landfill.

7.7.40 If this approach is adopted, the Project proponent is required to obtain prior approval from EPD and shall utilise a licensed contractor appointed for the collection, transportation and disposal of the contaminated soils. The necessary waste disposal permits should also be obtained, from the appropriate authorities, in accordance with the Waste Disposal Ordinance.

Final remediation option of contaminated material

7.7.41 Ground investigation and laboratory testing in accordance with Contamination Assessment Plan (CAP) has shown elevated levels of lead and zinc at isolated 'hotspot' locations at the project Area. Upon finalisation of the detailed design, the findings of the investigations shall be presented in a Contamination Assessment Report (CAR) and the final remediation option shall be presented in a Remediation Assessment Plan (RAP). The RAP shall address the detail remediation design, along with phasing of the works, layout of treatment plant and stockpile areas. Both the CAR and the RAP shall be submitted as a combined report to the EPD for approval prior to the implementation of any remediation works. The contaminated material shall then be remediated in accordance with the approved CAR/RAP.

Mitigation measures

7.7.42 In addition to specific remediation of excavated contaminated land, standard good practice measures should be implemented as appropriate and practical during the construction phase to minimise any potential exposure to contaminated soils, for example: -

- Bulk earth-moving equipment shall be used to minimise construction worker's potential contact with contaminated materials. Manual excavation shall be avoided where possible.
- Exposure to any contaminated materials shall be minimised by use of appropriate clothing and Personal Protective Equipment (PPE) such as gloves (when interacting directly with contaminated material), preventing smoking and eating during such activities, and providing adequate hygiene and washing facilities.
- Vehicles transporting contaminated materials shall be covered to limit potential dust emissions, and truck bodies and tailgates shall be sealed to prevent any discharge during transport or during wet conditions.
- Only reputable waste haulers shall be used to collect and transport any contaminated material. Records of the quantities of wastes generated and disposed of shall be maintained and procedures shall be developed to ensure that illegal disposal of wastes does not occur.
- The necessary waste disposal permits shall be obtained from the appropriate authorities, in accordance with the Waste Disposal Ordinance. Wastewater shall be disposed of in accordance with the WPCO, and its discharge license requirements.

7.8 Sediment Quality and Potential Biogas

Sediment Quality Environmental Legislation and Standards

7.8.1 Environment, Transport and Works Bureau (Works) Technical Circular (ETWB(W)TC) No. 34/2002 and Practice Note for Authorised Persons (PNAP) 252 provide the framework procedures to be followed in the Management of Dredged/Excavated Sediment for disposal at sea (see **Figure 7.4**). The guidelines require chemical screening to allow the sediment to be classified in accordance with **Table 7–8** and **Table 7–9** below.

Table 7-8 Criteria for the chemical screening of sediment (from ETWB(W)TC 34/2002)

Contaminant	Lower chemical exceedance level (LCEL)	Upper chemical exceedance level (UCEL)
Metals (mg/kg dry wt.)		
Cadmium (Cd)	1.5	4
Chromium (Cr)	80	160
Copper (Cu)	65	110
Mercury (Hg)	0.5	1
Nickel (Ni)	40	40
Lead (Pb)	75	110
Silver (Ag)	1	2
Zinc (Zn)	200	270
Metalloid (mg/kg dry wt.)		
Arsenic (As)	12	42
Organic-PAHs (µg/kg dry wt.)		
Low molecular weight PAHs	550	3060
High molecular weight PAHs	1700	9600
Organic-non-PAHs (µg/kg dry wt.)		
Total PCBs	23	180
Organometallics (TBT in interstitial water)		
Tributyltin (TBT)	0.15	0.15

Table 7-9 Criteria for classification of sediment (from ETWB(W)TC 34/2002)

Criteria	Category
All contaminant levels do not exceed the LCEL	L
One or more contaminant levels exceed the LCEL but none exceed the UCEL	M
One or more contaminant levels exceed the UCEL	H

7.8.2 Further (biological) screening is required for Category M sediment and for any Category H sediment which exceeds the LCEL by more than 10 times. The results of biological screening are then combined with the classification category to determine the appropriate location for marine disposal of the sediment. The disposal options are summarised in **Table 7-10** below.

Table 7-10 Criteria for disposal of sediment at sea

Results of chemical screening	Classification category	Results of biological screening	Disposal
All contaminant levels < LCEL	L	N/A	Type 1 - open sea disposal
One or more contaminant levels > LCEL and < UCEL	M	Pass	Type 1 - open sea disposal (dedicated site)
		Fail	Type 2 – confined marine disposal (e.g. East Sha Chau mud pits)

Results of chemical screening	Classification category	Results of biological screening	Disposal
One or more contaminant levels > UCEL	H	N/A	Type 2 – confined marine disposal
One or more contaminant levels > 10 x LCEL	H	Pass	Type 2 – confined marine disposal
		Fail	Type 3 – special treatment / disposal to be agreed with EPD

7.8.3 The guidelines require a Sediment Quality Report (SQR) to be submitted to the Environmental Protection Department for approval at least 3 months prior to tendering of the dredging/excavation contract. Based on the results of the SQR, the Fill Management Committee (FMC) of Civil Engineering and Development Department will allocate the most appropriate open sea or confined marine disposal site. After contract award, the dredging/excavation contractor must apply for a dumping permit under the Dumping at Sea Ordinance (DASO) from EPD are also required prior for marine disposal of dredged materials.

Sediment Sampling and Testing

7.8.4 A comprehensive sediment assessment was conducted under the Project to provide detailed information on the sediment quality and to allow recommendations to be made on appropriate disposal in the event excavated sediment is to be disposed at sea.

7.8.5 The sediment assessment was based on a sampling and testing proposal agreed in advance with EPD. The sediment investigation comprised twenty three boreholes at approximately 100m centres within the Project Area. The borehole locations are shown on **Figure 7.5**.

7.8.6 The fieldwork and soil sampling was carried out by Chung Shun Boring Engineering Company Limited between 22 March and 3 May 2006. All boreholes were drilled to a depth of 5m below ground level (bgl) with continuous soil sampling to identify the vertical profile. All samples were collected and stored in clean sealed containers, kept at 4ºC and delivered to the laboratory the same day.

Objectives of Sediment Sampling and Testing

7.8.7 The sediment assessment was designed to satisfy the requirements for an EIA study under the Environmental Impact Assessment Ordinance (EIAO), and the Study Brief: -

(i) To characterise the sediment quality (Study Brief Section 3.9.3.4 (xx)).
(ii) To identify the categories of sediments which are to be disposed of in accordance with a permit issued under the Dumping at Sea Ordinance and to estimate their quantities (Study Brief Section 3.9.3.4 (xxi)).

Scope of Sediment Sampling and Testing

7.8.8 Tier II chemical screening tests and Tier III biological testing, following the procedures set out in ETWB(W) No.34/2002, were carried out on recovered samples of Pond & Estuarine Deposits as detailed in **Table 7–11**. The testing was carried out by ALS Technichem (HK)

Pty Limited who are a HOKLAS accredited laboratory and approved to undertake Tier II and Tier III testing.

7.8.9 Subsamples were taken to suit the actual depths of marine deposits encountered. The actual depths of sediment encountered and the sub-sample depths tested are summarised in **Table 7–11** below. Sub-samples taken from the overlying fill or underlying alluvium were tested separately for land contamination (see Section 7.7).

Table 7-11 Depth of marine sediment encountered and subsamples tested

Drilhole	Ground Level	POND DEPOSIT			MARINE DEPOSIT			Depth of sub-sample tested (bgl)
		From	To	Thick	From	To	Thick	
	(mPD)	(mPD)		(m)	(mPD)		(m)	
BH-SQ1	+2.69	-	-	-	+0.69	-2.31	3.00	*2.90 & 5.00*
BH-SQ2	+2.69	-	-	-	+2.69	-1.31	4.00	*0.90, 1.90 & 2.90*
BH-SQ3	+2.86	+1.86	+1.36	0.50	+1.36	-0.64	2.00	*1.90 & 2.90*
BH-SQ4	+2.94	-	-	-	+0.94	-0.56	1.50	*2.90*
BH-SQ5	+3.29	-	-	-	+1.79	-0.71	2.50	*1.90 & 2.90*
BH-SQ6	+3.22	-	-	-	+2.22	-1.78	4.00	*1.90, 2.90 & 5.00*
BH-SQ7	+2.84	+0.84	+0.34	0.50	+0.34	-0.66	1.00	*2.90*
BH-SQ8	+3.15	+2.65	+2.15	0.50	+2.15	-0.85	3.00	*0.90, 1.90 & 2.90*
BH-SQ9	+2.78	+1.28	+0.78	0.50	+0.78	-1.22	2.00	*1.90 & 2.90*
BH-SQ10	+2.97	-	-	-	+0.47	-1.53	2.00	*2.90*
BH-SQ11	+3.10	-	-	-	+0.10	-0.90	1.00	*3.50*
BH-SQ12	+2.37	+2.37	+1.37	1.00	+1.37	-0.63	2.00	*0.90 & 1.90*
BH-LC3	+4.17	+3.17	+1.67	1.50	+1.67	-0.33	2.00	*1.90 & 2.90*
BH-LC4	+3.52	+3.02	+2.52	0.50	+2.52	-0.48	3.00	*1.90 & 2.90*
BH-LC5	+3.18	+2.68	+0.68	2.00	+0.68	-1.32	2.00	*0.90, 1.90 & 2.90*
BH-LC6	+2.48	+0.98	+0.48	0.50	+0.48	-1.52	2.00	*0.90, 1.90 & 2.90*
BH-LC7	+2.87	+1.37	+0.37	1.00	+0.37	-0.63	1.00	*1.90 & 2.90*
BH-LC8	+2.89	+1.39	+0.89	0.50	+0.89	-1.11	2.00	*1.90 & 2.90*
BH-LC9	+2.91	+1.41	+0.91	0.50	+0.91	-2.09	3.00	*1.90, 2.90 & 5.00*
BH-LC10	+2.78	+0.78	+0.28	0.50	+0.28	-0.72	1.00	*1.90 & 2.90*
BH-LC11	+3.29	+1.29	+0.29	1.00	+0.29	-1.61	1.90	*2.90 & 5.00*
BH-LC12	+3.44	+1.44	+0.44	1.00	-	-	-	*2.50*
BH-LC13	+3.93	+0.93	+0.43	0.50	-	-	-	*3.25*

Results of Chemical Screening and Sediment Classification

7.8.10 The results of the chemical screening along with the associated sediment classification category are presented in **Table 7–15**. As can be seen from **Table 7–15**, all samples exceed the lower chemical exceedance level (LCEL) and/or the upper chemical exceedance level (UCEL) for arsenic. This is consistent with the Geochemical Atlas of Hong Kong (GEO, 1999), which records high natural background levels of arsenic in the northern New Territories including the Project Area.

Results of Biological Screening

7.8.11 In accordance with ETWB(W)TC 34/2002, Tier III biological screening should be carried out on Category M samples and on Category H samples which exceed the LCEL by more than ten times. Selected Category M samples and Category H samples were identified for biological screening as shown in **Table 7–12**. The results of the biological testing are presented in **Table 7–13** and **Table 7–14**.

Table 7-12 Samples for Tier III biological testing

Borehole Ref.	Sample depth (bgl)	Classification category
LC5	1.9	M
LC6	0.9	H *
LC6	2.9	H *
LC10	1.9	M
LC12	2.5	H *
LC13	3.25	M
SQ12	0.9	M

Table 7-13 Results of Tier III Testing

Borehole Ref.	Sample depth (bgl)	Pass/Fail		
		10-day amphipod[1]	20 day polychaete[2]	48 hour bivalve[3]
LC5	1.9	fail	fail	fail
LC6	1.9	fail	pass	pass
LC6	2.9	fail	pass	pass
LC10	1.9	fail	pass	fail
LC12	2.5	fail	pass	pass
LC13	3.25	fail	fail	fail
SQ12	0.9	fail	fail	fail

1. Failure defined as mean survival in test sediment is significantly different from reference sediment.
2. Failure defined as mean dry weight in test sediment is significantly different from reference sediment.
3. Failure defined as mean survival in test sediment is significantly different from reference sediment.

Table 7-14 Results of Tier III Testing

Borehole Ref.	Sample depth (bgl)	Tier II Category	Tier III Test[1]	Disposal route
LC5	**1.9**	**M**	**Fail**	**Type 2 (Confined Marine)**
LC6	**0.9**	**H ***	**Fail**	**Type 3 (Special Treatment)**
LC6	**2.9**	**H ***	**Fail**	**Type 3 (Special Treatment)**
LC10	**1.9**	**M**	**Fail**	**Type 2 (Confined Marine)**
LC12	**2.5**	**H ***	**Fail**	**Type 3 (Special Treatment)**
LC13	**3.25**	**M**	**Fail**	**Type 2 (Confined Marine)**
SQ12	**0.9**	**M**	**Fail**	**Type 2 (Confined Marine)**

1. Test sample is classified as 'fail' if any Tier III test (see **Table 7–13**) fails.

Table 7-15 Summary of chemical screening results and sediment classification

		Silver	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Zinc	Mercury	Total PCB	Low PAHs	High PAHs	Tributyltin	Classification
LCEL		**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1700**	**0.15**	
UCEL		**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**1**	**180**	**3160**	**9600**	**0.15**	
10 x LCEL		**10**	**120**	**15**	**800**	**650**	**400**	**750**	**2000**	**5**	**230**	**5500**	**17000**	-	
BH-SQ1	2.90	0.3	**48**	<0.2	11	23	6	**132**	71	<0.05	All PCB congeners are <3 ug/kg limit of reporting	<550	<1700	N/A	**H**
BH-SQ1	5.00	0.2	**21**	<0.2	32	15	17	55	82	0.05		<550	<1700	N/A	**M**
BH-SQ2	0.90	0.2	**15**	<0.2	41	16	30	35	107	<0.05		<550	<1700	N/A	**M**
BH-SQ2	1.90	0.2	**45**	<0.2	36	17	21	54	93	<0.05		<550	<1700	N/A	**H**
BH-SQ2	2.90	0.2	**15**	<0.2	35	15	23	35	92	0.06		<550	<1700	N/A	**M**
BH-SQ3	1.90	0.2	**17**	<0.2	39	14	22	40	99	<0.05		<550	<1700	N/A	**M**
BH-SQ3	2.90	0.2	**17**	<0.2	35	13	18	43	87	<0.05		<550	<1700	N/A	**M**
BH-SQ4	2.90	0.2	**31**	<0.2	30	14	15	45	81	0.22		<550	<1700	N/A	**M**
BH-SQ5	1.90	0.2	**21**	<0.2	17	20	9	58	56	<0.05		<550	<1700	N/A	**M**
BH-SQ5	2.90	0.2	**53**	<0.2	53	17	18	**113**	84	<0.05		<550	<1700	N/A	**H**
BH-SQ6	1.90	0.3	**99**	<0.2	12	26	8	**101**	80	<0.05		<550	<1700	N/A	**H**
BH-SQ6	2.90	0.2	**17**	<0.2	27	12	15	49	74	0.06		<550	<1700	N/A	**M**
BH-SQ6	5.00	0.1	**15**	<0.2	**81**	12	**40**	39	68	0.06		<550	<1700	N/A	**M**
BH-SQ7	2.90	0.1	**13**	<0.2	27	12	17	38	75	<0.05		<550	<1700	N/A	**M**
BH-SQ8	0.90	0.2	**48**	<0.2	30	15	19	47	**439**	<0.05		<550	<1700	N/A	**H**
BH-SQ8	1.90	0.2	**248 ***	<0.2	8	12	4	**161**	58	<0.05		<550	<1700	N/A	**H ***
BH-SQ8	2.90	0.2	**55**	<0.2	42	24	21	68	113	<0.05		<550	<1700	N/A	**H**
BH-SQ9	1.90	0.2	**48**	<0.2	26	14	17	47	80	<0.05		<550	<1700	N/A	**H**
BH-SQ9	2.90	0.1	**13**	<0.2	36	14	25	33	93	<0.05		<550	<1700	N/A	**M**

		Silver	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Zinc	Mercury	Total PCB	Low PAHs	High PAHs	Tributyltin	Classification
	LCEL	**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1700**	**0.15**	
	UCEL	**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**1**	**180**	**3160**	**9600**	**0.15**	
	10 x LCEL	**10**	**120**	**15**	**800**	**650**	**400**	**750**	**2000**	**5**	**230**	**5500**	**17000**	-	
BH-SQ10	2.90	0.2	**16**	<0.2	29	11	14	41	73	<0.05	All PCB congeners are <3 ug/kg limit of reporting	<550	<1700	N/A	**M**
BH-SQ11	3.50	0.2	**16**	<0.2	24	10	10	45	70	<0.05		<550	<1700	N/A	**M**
BH-SQ12	0.90	0.2	**32**	<0.2	36	19	20	47	106	<0.05		<550	<1700	N/A	**M**
BH-SQ12	1.90	0.2	**36**	<0.2	37	20	24	53	89	<0.05		<550	<1700	N/A	**M**
BH-LC3	1.90	0.3	**76**	0.2	33	22	18	**95**	105	0.05		<550	<1700	N/A	**H**
BH-LC3	2.90	0.3	**69**	0.2	31	21	16	**85**	97	0.08		<550	<1700	N/A	**H**
BH-LC4	1.90	0.3	**51**	<0.2	34	17	15	53	88	<0.05		<550	<1700	N/A	**H**
BH-LC4	2.90	0.2	**20**	<0.2	31	13	18	45	86	<0.05		<550	<1700	N/A	**M**
BH-LC5	0.90	0.2	**48**	<0.2	23	23	13	**82**	184	0.07		<550	<1700	N/A	**H**
BH-LC5	1.90	0.2	**36**	0.3	37	16	21	61	115	0.08		<550	<1700	N/A	**M**
BH-LC5	2.90	0.2	**32**	<0.2	36	12	20	41	83	0.08		<550	<1700	N/A	**M**
BH-LC6	0.90	0.1	**151 ***	<0.2	11	10	4	**89**	43	<0.05		<550	<1700	N/A	**H ***
BH-LC6	1.90	0.1	**26**	<0.2	25	13	14	42	**358**	<0.05		<550	<1700	N/A	**H**
BH-LC6	2.90	0.2	**316 ***	<0.2	13	9	5	**93**	38	0.05		<550	<1700	N/A	**H ***
BH-LC7	1.90	0.3	**77**	0.3	19	15	12	73	118	0.07		<550	<1700	N/A	**H**
BH-LC7	2.90	0.2	**60**	0.3	33	23	20	62	140	0.1		<550	<1700	N/A	**H**
BH-LC8	1.90	0.3	**175 ***	<0.2	18	28	6	58	**639**	0.05		<550	<1700	N/A	**H ***
BH-LC8	2.90	0.2	**26**	<0.2	28	14	16	42	83	<0.05		<550	<1700	N/A	**M**
BH-LC9	1.90	0.2	**46**	<0.2	9	37	3	**154**	**448**	<0.05		<550	<1700	N/A	**H**
BH-LC9	2.90	0.3	**55**	0.3	34	20	20	**85**	119	0.06		<550	<1700	N/A	**H**
BH-LC9	5.00	0.2	5	<0.2	24	19	8	**85**	39	0.06		<550	<1700	N/A	**M**
BH-LC10	1.90	0.2	**25**	<0.2	30	16	17	52	115	<0.05		<550	<1700	N/A	**M**
BH-LC10	2.90	0.2	**23**	<0.2	30	14	15	57	84	<0.05		<550	<1700	N/A	**M**

		Silver	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Zinc	Mercury	Total PCB	Low PAHs	High PAHs	Tributyltin	Classification
	LCEL	**1**	**12**	**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**23**	**550**	**1700**	**0.15**	
	UCEL	**2**	**42**	**4**	**160**	**110**	**40**	**110**	**270**	**1**	**180**	**3160**	**9600**	**0.15**	
	10 x LCEL	**10**	**120**	**15**	**800**	**650**	**400**	**750**	**2000**	**5**	**230**	**5500**	**17000**	**-**	
BH-LC11	2.90	0.2	**35**	<0.2	27	12	17	38	75	0.08		<550	<1700	N/A	**M**
BH-LC11	5.00	0.2	**70**	<0.2	26	16	14	50	74	0.06		<550	<1700	N/A	**H**
BH-LC12	2.50	0.2	**186**	<0.2	12	35	4	**140**	54	<0.05	All PCB < LoR	<550	<1700	N/A	**H ***
BH-LC13	3.25	0.2	**42**	.2	8	23	3	**104**	103	<0.05		<550	<1700	N/A	**M**
Reference sediment		0.2	**8**	<0.2	14	12	9	70	54	0.39		<550	<1700	<0.05	

Sampling and Testing for Potential Biogas

7.8.12 A comprehensive biogas assessment was conducted under the Project to provide accurate information on the potential for biogas arising from leaving pond mud in place. The biogas assessment was based on a sampling and testing proposal agreed in advance within EPD. The investigation comprised a gas spike survey at eighty-nine locations, SS01 to SS89, at approximately 50m centres and drilling of twenty seven boreholes to identify the presence, or otherwise, of pond deposit across the Project Area. The gas spike and borehole locations are shown on **Figure 7.6**.

7.8.13 Gas concentrations of oxygen (O_2), methane (CH_4) and carbon dioxide (CO_2) were measured at each gas spike location by the use of appropriately calibrated gas meters. Careful logging of the boreholes were undertaken to identify organic rich layers in the Pond Deposit (representing the former fish pond bases) and the upper Estuarine Deposit. Where such layers were identified appropriate subsampling of the extruded piston samples was undertaken for Total Organic Content (TOC) laboratory testing.

7.8.14 The borehole sampling was carried out by Chung Shun Boring Engineering Company Limited between 22 March and 3 May 2006. The spike survey was also carried out by Chung Shun Boring Engineering Company Limited on 13 April, 2 May and 23 June 2006.

Objectives of Biogas Sampling and Testing

7.8.15 The biogas assessment was designed to satisfy the requirements for an EIA study under the Environmental Impact Assessment Ordinance (EIAO), and Section 3.9.3.4 (xxvi) of the Study Brief.

Pond Deposit Sampling and Testing

7.8.16 Pond deposit was encountered in nineteen of the twenty seven boreholes. Where encountered, subsamples of pond deposit were taken for laboratory testing. The depths of pond deposit encountered and the sub-sample depths tested are summarised in **Table 7–16** below.

Table 7-16 Depth of pond deposit encountered and tested for TOC

Drillhole	Ground Level	POND DEPOSIT			Depth of sub-sample tested for TOC (bgl)
		From	To	Thick	
	(mPD)	(mPD)		(m)	
BH-SQ3	+2.86	+1.86	+1.36	0.50	1.25
BH-SQ7	+2.84	+0.84	+0.34	0.50	2.25
BH-SQ8	+3.15	+2.65	+2.15	0.50	0.90
BH-SQ9	+2.78	+1.28	+0.78	0.50	1.90
BH-SQ12	+2.37	+2.37	+1.37	1.00	0.25 & 0.90
BH-LC1	+4.43	+2.43	+1.43	1.00	2.50
BH-LC2	+4.13	+2.63	+2.13	0.50	1.75
BH-LC3	+4.17	+3.17	+1.67	1.50	1.25 & 1.90
BH-LC4	+3.52	+3.02	+2.52	0.50	0.75

Drillhole	Ground Level	POND DEPOSIT			Depth of sub-sample tested for TOC (bgl)
		From	To	Thick	
	(mPD)	(mPD)		(m)	
BH-LC5	+3.18	+2.68	+0.68	2.00	0.90 & 1.90
BH-LC6	+2.48	+0.98	+0.48	0.50	0.90 & 1.90
BH-LC7	+2.87	+1.37	+0.37	1.00	1.90
BH-LC8	+2.89	+1.39	+0.89	0.50	1.90
BH-LC9	+2.91	+1.41	+0.91	0.50	1.90
BH-LC10	+2.78	+0.78	+0.28	0.50	1.90
BH-LC11	+3.29	+1.29	+0.29	1.00	2.90
BH-LC12	+3.44	+1.44	+0.44	1.00	2.50
BH-LC13	+3.93	+0.93	+0.43	0.50	3.25
BH-LC15	+2.94	+0.94	-0.06	1.00	2.25
		Average thickness (m)		0.59	

7.8.17 Laboratory testing for total organic content of pond deposits was carried out by ALS Technichem (HK) Pty Limited who are a HOKLAS accredited laboratory.

Results of Spike Survey and TOC Testing

7.8.18 The results of the gas spike survey are presented in **Table 7–17**. As can be seen from **Table 7–17**, zero methane (CH_4) concentration was recorded at eighty-eight of the eighty-nine spike locations. This suggests that biogas generation is not occurring at the Project Area. A low CH_4 concentration (1.2%) was recorded at location SS39, which is located between boreholes LC8 and SQ4. No pond deposit was encountered in borehole SQ4, whilst only 0.5m of pond deposit was encountered in borehole LC8. Also, the TOC result for borehole LC8 is around average for the Project Area. Furthermore, the gas readings at SS39 did not show a corresponding reduction in oxygen levels. The single CH_4 reading is therefore considered to be inconsistent with other results and not a true reflection of the prevailing situation.

7.8.19 Background levels of carbon dioxide (CO_2) would typically be expected in the range 1% to 3%. Slightly elevated CO_2 levels were recorded at two locations, namely SS8 and SS11, whilst a highly elevated CO_2 level was recorded at SS21. Monitoring at SS11 did not show a corresponding reduction in oxygen levels. This carbon dioxide reading is therefore inconsistent with the other results and not a true representation of the situation. Location SS8 and SS21 are located between a group of boreholes, namely LC6, SQ9, LC10, SQ7, SQ8 and SQ2. No pond deposit was encountered in borehole SQ2, whilst only 0.5m of pond deposit was encountered in the other five boreholes. The TOC results for the five boreholes range from 0.62% to 2.13%, which is typical for pond deposit and average for the Project Area. The elevated CO_2 readings at SS8 and SS21 are therefore considered to be anomalous readings which are not consistent with other results.

7.8.20 Oxygen (O_2) background levels are typically expected in the order of 20% (v/v), which is highly consistent with the O_2 concentrations measured in eighty-seven of the eighty-nine spike survey locations. Only two locations (SS8 and SS21 discussed above) showed reduced levels (17.8% and 10.2% respectively). The gas spike survey is therefore considered to show no evidence that biogas is currently being generated from pond mud left in place below the Project Area.

Table 7-17 Results of Gas Spike Test Survey

Spike ref.	Gas reading (% v/v)				Spike ref.	Gas reading (% v/v)			
	CH_4	CO_2	O_2	ºC		CH_4	CO_2	O_2	ºC
SS1	0.0	0.6	19.4	30.3	SS46	0.0	0.0	19.9	36.6
SS2	0.0 0.0	0.0 0.1	19.4 19.7	24.7[1] 31.6[3]	SS47	0.0	0.3	19.6	30.0
SS3	0.0 0.0	0.4 0.2	18.8 19.7	24.5[1] 31.5[3]	SS48	0.0	0.3	20.1	29.3
SS4	0.0 0.0	0.3 0.2	18.9 19.7	25.0[1] 32.8[3]	SS49	0.0	0.0	19.5	34.8
SS5	0.0 0.0	0.2 0.0	20.0 19.9	24.6[1] 29.5[3]	SS50	0.0 0.0	0.0 0.0	19.4 19.9	34.6[4] 28.7[2]
SS6	0.0	0.0	19.6	32.8	SS51	0.0 0.0	0.0 0.0	19.5 19.9	35.4[4] 33.3[2]
SS7	0.0	0.0	19.9	24.6	SS52	0.0 0.0	0.0 1.3	19.3 18.3	35.1[4] 33.5[2]
SS8	0.0	4.3	17.8	25.3	SS53	0.0	0.0	19.7	31.6
SS9	0.0	0.0	19.2	30.0	SS54	0.0 0.0	0.0 0.0	19.9 20.0	33.0[2] 28.6[3]
SS10	0.0	0.0	19.6	29.6	SS55	0.0	0.0	19.8	33.2
SS11	0.0	4.1	19.1	28.7	SS56	0.0	0.0	19.8	33.9
SS12	0.0	0.0	20.0	24.5	SS57	0.0	0.0	19.8	27.1
SS13	0.0	0.0	20.0	24.5	SS58	0.0 0.0	0.0 0.0	19.4 19.6	34.8[4] 33.9[2]
SS14	0.0	0.0	19.9	24.6	SS59	0.0	0.0	19.9	30.3
SS15	0.0	0.0	19.9	25.2	SS60	0.0	0.0	19.8	31.6
SS16	0.0	0.5	19.9	25.0	SS61	0.0	0.0	19.6	31.2
SS17	0.0	0.0	19.9	28.9	SS62	0.0	0.0	19.7	33.3
SS18	0.0	0.3	19.8	25.2	SS63	0.0	0.0	19.8	31.5
SS19	0.0	0.1	19.9	24.6	SS64	0.0	0.0	19.8	29.8
SS20	0.0	0.5	19.7	24.8	SS65	0.0	0.0	19.9	33.1
SS21	0.0 0.0	10.7 0.3	10.20 19.7	26.70[1] 24.8[3]	SS66	0.0	0.0	20.0	27.5
SS22	0.0	0.0	19.9	25.1	SS67	0.0 0.0	0.4 0.8	19.0 18.6	34.1[4] 32.9[2]
SS23	0.0	0.0	19.9	24.7	SS68	0.0	0.0	20.0	35.1
SS24	0.0	0.5	19.7	29.5	SS69	0.0	0.0	19.7	33.9
SS25	0.0	0.3	19.5	26.9	SS70	0.0	1.0	19.6	29.0
SS26	0.0	0.2	19.8	26.3	SS71	0.0	1.5	18.8	26.4
SS27	0.0	0.6	19.6	26.8	SS72	0.0	0.2	20.0	25.8
SS28	0.0	0.0	19.9	26.6	SS73	0.0	1.2	19.3	25.1
SS29	0.0	0.1	19.9	26.7	SS74	0.0	1.4	19.2	25.3
SS30	0.0	0.0	19.9	26.2	SS75	0.0	1.7	18.9	25.9

Spike ref.	Gas reading (% v/v)				Spike ref.	Gas reading (% v/v)			
	CH_4	CO_2	O_2	ºC		CH_4	CO_2	O_2	ºC
SS31	0.0	0.0	20.0	28.5	SS76	0.0 0.0	0.0 0.0	19.2 20.0	34.3[4] 30.9[2]
SS32	0.0 0.0	0.0 0.0	19.5 19.9	37.2[4] 27.4[1]	SS77	0.0 0.0	0.0 0.0	19.4 19.7	35.2[4] 30.2[2]
SS33	0.0 0.0	0.0 0.0	19.7 19.9	32.7[4] 26.2[1]	SS78	0.0	0.0	19.5	32.5
SS34	0.0 0.0	0.0 0.0	19.9 19.9	29.0[1] 28.2[3]	SS79	0.0 0.0	0.2 0.3	19.1 19.3	35.7[4] 34.1[2]
SS35	0.0	0.4	19.5	29.9	SS80	0.0	0.0	19.7	30.4
SS36	0.0	0.0	19.9	30.3	SS81	0.0 0.0	0.0 0.1	19.4 19.8	35.4[4] 30.8[2]
SS37	0.0	0.5	19.6	27.3	SS82	0.0	0.2	19.6	32.4
SS38	0.0 0.0	0.0 0.0	19.9 20.1	27.4[1] 29.3[3]	SS83	0.0	0.3	18.9	32.2
SS39	1.2 0.0	1.6 0.0	19.3 20.1	26.6[2] 29.1[3]	SS84	0.0	0.1	19.1	33.1
SS40	0.0	0.1	19.5	34.8	SS85	0.0	0.0	19.5	32.7
SS41	0.0 0.0	0.0 0.0	19.1 19.6	35.2[4] 28.1[1]	SS86	0.0 0.0	0.0 0.0	19.3 19.5	37.3[4] 33.4[2]
SS42	0.0	0.0	19.8	32.5	SS87	0.0	0.0	19.6	31.9
SS43	0.0 0.0	0.0 0.5	19.7 19.5	32.4[4] 33.6[2]	SS88	0.0 0.0	0.0 0.0	19.4 19.6	34.2[4] 33.6[2]
SS44	0.0	0.0	19.9	33.4	SS89	0.0	0.0	19.7	33.8
SS45	0.0	0.0	19.8	34.8					

Notes:
1 Readings taken on 13/04/2006
2 Readings taken on 12/05/2006
3 Readings taken on 22/06/2006
4 Readings taken on 23/07/2006

7.8.21 The results of TOC testing are presented in **Table 7–18**. These show an average TOC level of 1.56%, with an average moisture content of 27.1%.

Table 7-18 Results of TOC Testing on Pond Mud

Drillhole	Sample depth (bgl)	Laboratory test result	
		Moisture content (%)	Total organic content (TOC) (bgl)
BH-SQ3	1.25	20.70	0.69
BH-SQ7	2.25	30.00	1.14
BH-SQ8	0.90	27.30	2.13
BH-SQ9	1.90	19.70	0.62
BH-SQ12	0.90	43.60	4.08
BH-SQ12	0.90	42.10	4.40
BH-LC1	2.50	19.40	1.05
BH-LC2	1.75	18.70	0.62

Drillhole	Sample depth (bgl)	Laboratory test result	
		Moisture content (%)	Total organic content (TOC) (bgl)
BH-LC3	1.25	26.10	1.08
BH-LC3	1.90	33.80	1.53
BH-LC4	0.75	22.50	1.48
BH-LC5	0.90	28.20	1.74
BH-LC5	1.90	30.70	2.09
BH-LC6	0.90	18.70	1.17
BH-LC6	1.90	37.80	2.17
BH-LC7	1.90	29.40	2.05
BH-LC8	1.90	27.70	1.80
BH-LC9	1.90	18.70	0.49
BH-LC10	1.90	36.60	2.05
BH-LC11	2.90	33.70	1.43
BH-LC12	2.50	20.30	0.64
BH-LC13	3.25	18.90	0.78
BH-LC15	2.25	13.40	0.52
	Average (%):	**27.10%**	**1.56%**

Assessment of Potential Biogas Generation

7.8.22 When pond deposit, which is rich in organic matter, is covered over by reclamation fill, anaerobic degradation of the organic matter in the sediments could generate biogas (methane and carbon dioxide) which could pose a potential risk to the overlying future development. Notwithstanding the fact that the pond deposits have been filled since 1990, a conservative assessment of the biogas results has been undertaken to satisfy the Study Brief.

7.8.23 The rate of biogas generation is dependent on the amount of organic matter, degradability of organic matter, extent of anaerobic conditions, temperature, and transport medium for bacteria. From experience in several anaerobic degradation projects (with waste as well as sludge), it is known that the biogas formation can be described as a *first order* degradation process. This process is characterised by high gas generation rates at the start, followed by an exponential decrease over the course of time.

7.8.24 The document 'Reference Manual, Vol 3., Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories' provides the following first order decay model to assess methane generation in landfills.

$$Q_{T,x} = K R_x L_o e^{-K(T-x)} \quad , \quad \text{where}$$

$Q_{T,x}$ = the amount of methane generated in current time T by waste R_x
x = year of waste input
R_x = amount of waste input in year
T = current year

7.8.25 For the purpose of biogas assessment, the model can be simplified to: -

$$\frac{dQ}{dT} = A\,e^{-bt} \quad , \text{ where}$$

Q = the amount of methane generated
t = time in years since start of emission of CH_4
A & b = constants with respect to time

7.8.26 Assuming a half-life cycle of T (years) and V to be the total amount of CH4 potential (kgm3) yields: -

$$b = \frac{\text{Ln } 2}{T}$$

$$\frac{A}{b} = V$$

7.8.27 Combining these yields: -

$$\text{Peak annual CH4 potential (kg)} = V \left(1 - \frac{1}{T\sqrt{2}}\right) \qquad (1)$$

$$\text{\% of total methane after t years} = \left(1 - 2^{-t/T}\right) \qquad (2)$$

7.8.28 Whilst not all organic carbon present in the pond deposit would be biodegradable, the use of TOC to estimate methane potential provides a worst case over-estimate of that potential because it assumes all organic matter is biodegradable and convertible to methane.

7.8.29 It is difficult to estimate the half life of substrates in systems such as pond deposits. However, at low substrate concentrations in engineered systems such as facultative ponds, half lives of substrates in the anaerobic could be of the order of half a year. In landfills, the average half life of organic substrates could be 5 years. A range of half lives has therefore been considered.

7.8.30 The quantity of pond mud is estimated to be 128,200 m^3 :

Volume of mud left *in-situ*	=	Total site area x depth of pond mud
	=	21.36 ha x 0.6 m
	=	128,160 m^3

7.8.31 From equations (1) and (2) above, the estimated methane flux for half-lives of 2 and 5 years is shown in **Table 7–19**,

Table 7-19 Assessment of Biogas potential using TOC results

	Half-life of 5 years	Half-life of 2 years	Basis of calculation
Volume (m^3)	128,200	128,200	Total Area x thickness
Density (Kg m^{-3})	1,590	1,590	Assumed from previous works
Dry Matter (% w/w)	72.90	72.90	Calculated from Laboratory Works
Dry Matter (Kgm^{-3})	1,159	1,159	Density x Dry Matter (% w/w)
TOC (%)	1.56	1.56	From Laboratory Tests
TOC (kg m^{-3})	18.08	18.08	Dry Matter (Kgm-3) x TOC (%)/100
CH_4 potential (Kg m^{-3})	12.12	12.12	TOC x 0.67 (2C -> CH_4+CO_2, so methane potential =(12+4)/(2x12) =0.67 times TOC
Peak annual CH_4 potential (Kg)	300,080.27	678,963.76	Equation (1) above
Total area (m^2)	213,600	213,600	Measured from layout drawing
Total potential CH_4 flux (kgm^{-2} per year)	1.40	3.18	Peak Annual CH_4 potential/ Total Area
Total potential CH_4 flux (gm^{-2} per year)	1,405	3,179	Total potential CH_4 flux (kgm^{-2} per year) x 1000
Total potential CH_4 flux (mol m^{-2} per year)	87.8	198.7	Gm^{-2} per year/16
Total potential CH_4 flux (L m^{-2} per year)	1,966.82	4,450.14	mol m^{-2} per year x 22.4
Total potential CH_4 flux (L m^{-2} per day)	5.39	12.19	Lm^{-2} per year/365
Total potential CH_4 concentration (% v/v), assuming 100% of TOC biodegradable	0.54	1.219	Lm^{-2} per day/10

7.8.32 From equation (2) above, the percentage of methane emitted in different years assuming half-lives of 0.5 to 4 years is shown in **Table 7–20**.

Table 7-20 Percentage % of methane emitted after June 2006

	Year			
Half-life (years)	**1**	**2**	**3**	**4**
0.5	75%	94%	98%	100%
1	50%	75%	88%	94%
1.5	37%	60%	75%	84%
2	29%	50%	65%	75%
2.5	24%	43%	56%	67%
3	21%	37%	50%	60%
3.5	18%	33%	45%	55%
4	16%	29%	41%	50%

7.8.33 Combining the results from **Table 7–19** and **Table 7–20** provides a conservative assessment of the potential for methane generation equation (2) above, the percentage of methane emitted in different years assuming half-lives of 0.5 to 4 years is shown in **Table 7–21**.

Table 7-21 Maximum potential CH_4 generation in June 2008

Half-life (years)	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**4**	**5**
Peak annual CH_4 potential (kg)	1,738,555	1,159,037	857,687	678,964	561,433	478,412	368,955	300,080
Total potential CH_4 flux (L m^{-2} per day)	31.21	20.81	15.40	12.19	10.08	8.59	6.62	5.39
Total potential CH_4 concentration (% v/v)	3.12	2.08	1.54	1.22	1.01	0.86	0.66	0.54
Potential CH_4 concentration (% v/v) after two years (June 2006 to June 2008)	0.195	0.520	0.611	0.609	0.579	0.541	0.446	0.381

7.8.34 There is no primary legislation in Hong Kong covering hazards to development caused by methane gas generated from anthropogenic organic deposits. The most relevant guidance is the EPD guideline, '*Landfill Gas Hazard Guidance Note'*, which states that no works should be allowed if the methane concentration of the development site exceeds 1.0% (v/v).

7.8.35 Based on the range of half-lives of 0.5 to 4 years as shown in **Table 7–21**, the worst case scenario methane potential in June 2008 (i.e. 6 months before commencement of during substructure construction) is estimated to be between 0.2% and 0.61%. These values are below EPD's guidance value and are thus acceptable.

Assessment of Impacts

Sediment Excavation

7.8.36 There are no existing ponds within the Project Area; however some excavation works for establishing the wetland restoration area is required.

7.8.37 Excavation for the wetland restoration area would have some impact on the adjacent environment. Excavation can release sediments into the existing water ditches and pond water in the vicinity of the Project Area, hence increasing suspended solids concentrations whilst any contaminants originally trapped in the sediments could also be released into the pond water column. However, all of these potential impacts are locally confined to the Project Area and will be managed under the construction environmental management plan which will be prepared by the Contractor.

7.8.38 Existing ground levels will generally be raised by between 2m and 3m using imported inert fill, whilst bulk excavation will only be carried out for the wetland restoration area. The majority of bulk excavation will not extend to the level of the marine sediment. Excavation of marine sediment will be limited to excavation open water in the northern part of the Project Area close to boreholes BH-LC4, BH-LC5 and BH-SQ12 (see **Figure 7.7**).

Table 7-22 Estimated volume and classification of excavated sediment

Location	Area	Volume of contaminated material to be excavated	
		Category M	Category H
Wetland restoration area	1,200 m^2	520 m^3	0
Wetland restoration area	2,400 m^2	0	1,620 m^3
	Total:	**2,140 m^3**	

7.8.39 For the avoidance of doubt, it should be noted that there will be no infilling of fishponds as a result of this Project.

Release of Contaminants during Excavation

7.8.40 During excavation for the wetland area, fine sediment around boreholes BH-LC4, BH-LC5 and/ or BH-SQ12 could potentially be suspended into the water column. However, the Project Area is enclosed and the water column is not open to tidal influence. Any losses of fine sediment to suspension during excavation will be contained by the existing perimeter bunds. Thus no sediment plume will be formed and no sediment can be transported to sensitive areas. Therefore, no impacts to water quality will arise due to release of contaminants during excavation.

7.8.41 Similarly, if vertical band (wick) drains are adopted in order to accelerate the settlement, any potential release of contaminants due to band drain construction will be contained by the existing perimeter bunds. Thus no contaminants can be transported to sensitive areas. Therefore, no impacts to water quality will arise due to release of contaminants if band drain construction is adopted.

Disposal of Excavated Sediment at Sea

7.8.42 Based on the preliminary design, the total volume of excavated sediment is estimated to be approximately 520m^3 of Category M sediment 1,620m^3 of Category H sediment. If disposed at sea, excavated Category M sediment must be disposed to either Type 1 (dedicated site) disposal or Type 2 confined marine disposal, whilst excavated Category H sediment must be disposed to either Type 2 confined marine disposal or Type 3 special treatment/ disposal. Subject to finalisation of the detailed design, biological testing will be carried out on sediment samples to be excavated to confirm if Type 2 or Type 3 marine disposal is warranted. In order to minimise any potential adverse impacts arising from the excavated marine sediment, the sediment should be excavated, transported and disposed of in a manner that minimises the loss of contaminants either into solution or by resuspension. Adverse marine impacts from disposal of excavated material of this type can be reduced by the reuse of such deposits within the Project Area in the construction of new wetland areas, and possibly by use in landscaping or construction of low site boundary bunds.

7.8.43 Mitigation measures to minimise potential environmental impacts are recommended below. There is no dredging work required for this development. It is considered that, with the implementation of mitigation measures, no unacceptable impacts would result from the excavation and disposal of the excavated sediment.

Reuse of Excavated Sediment on Site

7.8.44 As an alternative to marine disposal, excavated sediment could be reused within the Project Area. The Category H sediment to be excavated in the vicinity of boreholes LC4 and LC5 was found to exceed the UCEL for arsenic. The Geochemical Atlas of Hong Kong (GEO, 1999) indicates that sediment in north New Territories, including the Wo Shang Wai area, has high natural background levels of arsenic and zinc. Cursory inspection of the sediment results in **Table 7–15** shows that the prevalent low levels of arsenic and zinc encountered at the Project Area are consistent with high natural background levels. Reuse of the excavated sediment would not therefore lead to increased exposure and could be reused within the Project Area with no requirement for treatment or other mitigation. Notwithstanding, the need to treat contaminated sediment prior to reuse will be assessed at the detailed design stage of the Project.

Cumulative Impacts

7.8.45 There are no known dredging, filling or dumping activities within the study area. Thus there are no cumulative impacts of the construction works.

Potential Problem of Biogas on Reclamation (Pond Filling)

7.8.46 Spike surveys between April and June 2006 have shown that no methane or carbon dioxide gases are being generated at the Project Area. Calculations show that the potential for generation of methane gas in June 2008 (6 months before site formation work commences) is below the threshold value set out in EPD’s *Guidance Note*. The calculation in highly conservative as it assumes all TOC is readily biodegradable.

7.8.47 There will be no infilling of fishponds as a result of this Project. The original ponds were filled by 1990. Any anaerobic degradation of the organic matter in the sediments will have commenced in 1990 and is likely to be substantially complete by present day.

7.8.48 It is considered that no discernible risk from biogas generation is present and no specific control measures are required.

Mitigation Measures

Soil excavation and stockpiling

7.8.49 Excavated material which needs to be temporarily stockpiled should be stored in a specially designated area and provided with a tarpaulin cover to avoid run-off. Excavated inert material should be reused within the Project Area.

Disposal of Excavated Sediment at Sea

7.8.50 The requirements and procedures for excavated sediment disposal at sea are specified under the ETWB TCW No. 34/2002 and PNAP 252. The management of the excavation, use and disposal of sediment is monitored by Fill Management Committee, whilst the licensing of marine dumping is the responsibility of the Director of Environmental Protection (DEP).

7.8.51 The excavated sediment would be loaded onto barges or other appropriate vessel and transported to the designated marine disposal site. Category M and H sediment would require either dedicated site disposal, confined marine disposal or special treatment/disposal.

7.8.52 During transportation and disposal of the excavated sediment, the following measures should be taken to minimise potential impacts on water quality:

- Bottom opening transport vessels should be fitted with tight fitting seals to prevent leakage of material. Excess material should be cleaned from the decks and exposed fittings of vessels before the vessel is moved.

- Monitoring of the vessel loading should be conducted to ensure that loss of material does not take place during transportation. Transport vessels should be equipped with automatic self-monitoring devices as specified by the DEP.

7.9 Environmental Monitoring and Audit Requirements

7.9.1 It is recommended that auditing of each waste stream should be carried out periodically to determine if wastes are being managed in accordance with approved procedures and the site waste management plan. The audits should look at all aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal. An appropriate audit programme would be to undertake the first audit at the commencement of the construction works should be defined as the commencement of any related physical activity undertaken within the Project Area boundary.

7.10 Conclusions

Site construction waste

7.10.1 Waste types generated by the construction activities are likely to include site clearance, excavated soil, C&D material, chemical waste from the maintenance of construction plant and equipment and general refuse from the workforce. Provided that these wastes are handled, transported and disposed of using approved methods and that the recommended good site practices are strictly followed, adverse environmental impacts are not expected during the construction phase.

7.10.2 The main construction waste type generated during the operation phase is a small amount of general refuse, which will have no adverse environmental impact.

Land contamination

7.10.3 Comprehensive ground investigation and laboratory testing in accordance with Contamination Assessment Plan (CAP) has shown low-level lead and zinc contamination at isolated locations within the Project Area.

7.10.4 Bulk excavation for the wetland restoration area will not require any contaminated material to be excavated.

7.10.5 Upon finalisation of the detailed design, the findings of the investigations should be presented in a Contamination Assessment Report (CAR) and the final remediation option should be presented in a Remediation Assessment Plan (RAP). The CAR and RAP should consider the need to remediate contamination identified at borehole locations LC1, LC2, LC3, LC7, LC9, LC11, LC13 & LC14. Both the CAR and the RAP should be submitted as a combined report to the EPD for approval prior to the implementation of any remediation works and before any construction work which may disturb the ground. Suitable remediation methods of excavated material include in-situ solidification or direct disposal to landfill. Landfill disposal will be the last resort after exploration of other alternatives.

7.10.6 Implementation of the RAP can begin once the CAR and RAP submission are approved by the EPD. The essential steps in remedial programme are detailed in the EPD's *Guidance Notes*. Regardless of whether the contaminated soil is remediated on site or disposed of to landfill, the material must be managed in an environmentally sound manner, including compliance with all relevant legislation and Government requirements.

Sediment Quality and Potential Biogas

7.10.7 Comprehensive sediment sampling and testing shows that the sediment below the Project Area is classified as Category M or Category H due to either high natural background levels of arsenic and/or elevated levels of lead and zinc contamination. Comprehensive testing and assessment for biogas shows that there is no potential for biogas to adversely affect the development.

7.10.8 Bulk excavation for the wetland restoration area will require an estimated $520m^3$ of Category M sediment to be excavated around borehole SQ12, and an estimated $1,620m^3$ of Category H sediment to be excavated around boreholes LC4 and LC5. Suitable remediation methods include disposal at sea (Type 1 Dedicated Site or Type 2 confined disposal for category M sediment and Type 2 confined disposal or Type 3 special treatment/ disposal for Category H sediment). Alternatively, the excavated sediment may be reused on site. If disposal at sea is adopted, biological testing must be carried out on sediment samples to be excavated to confirm if Type 1, Type 2 or Type 3 marine disposal is warranted. A Sediment Quality Report (SQR) must be submitted to EPD for approval at least 3 months prior to tendering the excavation works contract. The Fill Management Committee (FMC) will then allocate a suitable marine disposal site based on the results of the SQR. If reuse on site is adopted, the detail design should consider the need to remediate sediment prior to reuse.

8 ECOLOGICAL IMPACT ASSESSMENT

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

8.1 Summary

8.1.1 This Ecological Impact Assessment has been prepared by Asia Ecological Consultants Ltd., based on data collected by Mott Connell Ltd. 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, as well as all areas within 500 m (the Assessment Area) and the egretries at Mai Po Village, Mai Po Lung and Tam Kon Chau. Baseline surveys were conducted between April 2005 and June 2006 to describe habitats present in the Project Area and Assessment Area, and wildlife uses of these habitats. The Project Area was found to include 4.69 ha of wetland (Seasonal Marsh and Freshwater Marsh/Reedbed) which would be lost in the proposed development, with consequent impacts to the availability of foraging habitat for ardeids, including breeding egrets. This habitat loss is mitigated by provision of a Wetland Restoration Area (containing 4.74 ha of wetland habitat) on the northern edge of the Project Area. Potentially significant impacts were also identified from impedance of bird flight paths and disturbance of waterbirds in nearby fishponds; these issues have been addressed in the design of the residential areas. 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 low significance and thus are ecologically acceptable.

8.2 Introduction

8.2.1 The Project Area referred to in this report comprises an area of land at Wo Shang Wai, to the north of the residential developments at Palm Springs and Royal Palms. Land here comprises formed land, fishponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan and partially-filled marshland. The western portion of the Project Area is currently vacant, while the eastern area is largely occupied by a mix of uses including open storage area, container yards and container vehicle parks.

8.2.2 The Project Area lies within the Deep Bay wetland ecosystem. This is an ecologically sensitive area of international importance. The core of the wetlands is contained within the Mai Po Inner Deep Bay Ramsar Site, listed under the Ramsar Convention. According to the Ramsar Convention, any negative impacts to the ecological value of a listed site require compensation or provision of additional nature reserves. In order to further protect the ecological integrity of the Deep Bay wetlands, the Town Planning Board of the Hong Kong SAR Government has designated areas surrounding the Ramsar Site as Wetland Conservation Area (WCA) and Wetland Buffer Area (WBA). The planning intention of these areas is, respectively, 'to conserve the ecological value of the fish ponds which form an integral part of the wetland ecosystem in the Deep Bay Area' and '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' (TPB PG-No. 12B).

8.2.3 The northern boundary of the Project Area is contiguous with the boundary of the WCA, while the entire Project Area lies within the WBA. The Project Area itself is zoned principally as OU(CDWRA), for which the planning intention is to provide incentive for the restoration of degraded wetlands adjoining existing fishponds (within the WCA) and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved by comprehensive residential or recreational developments on the degraded wetlands. Such development schemes should include proposals for the creation of a wetland restoration area to separate the development from adjoining wetland habitats, in order to minimise the impacts of the development on the existing wetlands and thus conserve the ecological integrity of the Deep Bay ecosystem. New buildings should be located farthest away from existing wetlands (Approved Mai Po and Fairview Park OZP No. S/YL – MP/6).

8.2.4 No sites of recognised conservation importance lie within the Project Area; however, several sites are nearby, including the Mai Po Nature Reserve, Mai Po Inner Deep Bay Ramsar Site, Mai Po Marshes SSSI, Mai Po Village SSSI and Inner Deep Bay SSSI. Adverse impacts to these ecologically-sensitive areas should be avoided during planning and construction of the project (**Figure 8.1**).

8.3 Assessment Area

8.3.1 The Assessment Area for all aspects of the project includes the area within 500 m of the Project Area boundary, including the site access road (**Figure 8.1**), together with any areas/elements beyond this which may potentially be impacted by the development of the Project Area (for example egretries, or watercourses downstream). This includes village land around Mai Po Village as well as the residential estates at Palm Springs and Royal Palms. To the north and west of the Assessment Area are extensive fishponds forming a part of the Deep Bay wetland ecosystem. To the east is the Maple Garden residential estate as well as surrounding hillsides and abandoned agricultural land. These areas in the east are isolated from the Project Area by the San Tin highway, which forms a significant ecological barrier, and consequently show minimal ecological linkage to the Deep Bay wetlands. It is therefore anticipated that ecological impacts to areas east of the highway will be minimal.

8.4 Sites of Conservation Importance in the Area

8.4.1 The Project Area lies within the Deep Bay wetland ecosystem, an area which is acknowledged to have very high ecological importance in a Hong Kong context. In the surrounding area are a number of sites of ecological importance, in a local and international context, and any development of the area is required to consider potential impacts to these (**Figure 8.1**).

Mai Po Inner Deep Bay Ramsar Site

8.4.2 The Mai Po Inner Deep Bay Ramsar Site forms the core of the Deep Bay wetland ecosystem. The Ramsar Site covers an area of 1,500 ha of fishponds, *gei wai* and intertidal mudflats, which includes the Mai Po Marshes and Inner Deep Bay Sites of Special Scientific Interest (SSSIs). The site was designated a wetland of international importance under the Ramsar Convention on 4th September 1995. The site is of particular importance to migratory waterbirds, supporting internationally important numbers of several species, including a number of globally-threatened species. In addition, there is a number of restricted-range invertebrates present within the Ramsar site.

Wetland Conservation Area (WCA)

8.4.3 The Town Planning Board has designated the wetland areas immediately adjacent to the Ramsar Site as Wetland Conservation Area (WCA); the planning intention of this is to conserve the ecological value of the fish ponds in the Deep Bay wetland ecosystem (Town Planning Board Guideline No.12B). Development within the WCA will not normally be permitted unless it supports the conservation of the area or provides essential infrastructural development with overriding public interest. The Project Area lies outside the WCA, but fishponds in the north and west of the Assessment Area are included in the WCA, so *impacts to these are to be considered in this assessment.*

Wetland Buffer Area

8.4.4 The Wetland Buffer Area (WBA) lies on the landward side of the WCA, with the intention of protecting the ecological integrity of wetland habitats within the WCA (Town Planning Board Guideline No.12B). Developments within the WBA are required to demonstrate that ecological impacts to the WCA (including indirect disturbance impacts) will be minimised and any negative ecological impacts will be fully mitigated through positive measures. Residential developments are permitted in this area, especially where these replace existing open storage and/or include wetland restoration projects. A wetland buffer should be included in sites immediately abutting the WCA. The current Project Area lies within the WBA.

Sites of Special Scientific Interest and Mai Po Nature Reserve

8.4.5 Three sites of special scientific interest (SSSIs) lie in the vicinity of the proposed project: Mai Po Marshes SSSI, Inner Deep Bay SSSI and Mai Po Village SSSI (**Figure 8.1**).

8.4.6 The Mai Po Marshes SSSI was designated in September 1976 and comprises 393 ha, mostly *gei wai* (shallow shrimp ponds) (209 ha) but also dwarf mangrove and tidal creeks. Most of the SSSI is contained within the Mai Po Nature Reserve, which is managed for the Hong Kong SAR Government by World Wide Fund for Nature Hong Kong (WWF-HK). The *gei wai* form an important roosting habitat for internationally important numbers of waterbirds, including several globally-threatened species. The Reserve and SSSI are located approximately 700 m to the west of the Project Area.

8.4.7 The Inner Deep Bay SSSI comprises the intertidal mudflats of Inner Deep Bay, to the north and west of Mai Po Marshes SSSI, and is bordered by Shenzhen SEZ to the north. The site provides habitat for internationally-important numbers of migratory waterbirds as well as aquatic fauna of economic value and scientific importance. The SSSI lies approximately 2 km to the west of the Project Area, and is separated by the Mai Po Nature Reserve. Given the distance involved and the scale and nature of the proposed development at Wo Shang Wai, it is not anticipated that the development will have a negative impact on the Inner Deep Bay SSSI.

8.4.8 The Mai Po Village SSSI contains 5.3 ha of *fung shui* woodland located to the east of Mai Po Village. This site was designated an SSSI in 1979 on the basis of an egretry containing several hundred pairs of Little Egret, Cattle Egret and Chinese Pond Heron. Egrets no longer breed within the boundaries of the SSSI, although Little Egrets (and, until recently, Cattle Egrets) breed in a plantation south of the SSSI and Chinese Pond Herons have recently colonised trees just north of the SSSI. The SSSI lies less than 400 m from the Project Area, so potential impacts to the egretry are to be considered in this EIA.

Egretries

8.4.9 In addition to the egretry at Mai Po Village, egretries are also known from Mai Po Lung and from Tam Kon Chau (Anon 2006b). These sites lie 1250 m and 650 m from the Project Area, respectively, and potential impacts of the development on these egretries are to be considered. (**Figure 8.1**)

8.5 Survey Methodologies

Habitats

8.5.1 Habitats within the Project Area and Assessment Area were initially identified by reference to recent aerial photographs (taken during 2005), and a preliminary map of all habitats within 500 m of the Project Area boundary was produced. Habitats were later confirmed by ground-truthing during 2005-2006; this included surveys during both the wet and dry seasons to confirm the existing habitat types and identify any habitats which could not be recognised from aerial photographs (for example, seasonal marsh).

Floral survey

8.5.2 Floral surveys were conducted during April, October - November 2005 and May - June 2006, to include surveys in both the wet and dry seasons. Relative abundance of plant species was estimated for habitats within the Project Area, while lists of species were compiled for other habitats within the Assessment Area. General characteristics of the floral community present in each habitat were noted for use in habitat descriptions.

Mammals

8.5.3 Transect surveys for mammals were conducted in conjunction with herpetofaunal surveys, with six daytime and ten night-time transect surveys conducted between May 2005 and June 2006 (**Figure 8.2**). In addition to any observations of mammals, suitable locations were searched for evidence of mammal activity (footprints, scats, burrows or food remains). Surveys were conducted on ten dates between May 2005 and June 2006, including six wet season and four dry season surveys. Since this group is difficult to observe in the field, sightings of mammals (including bats) during surveys for other faunal groups have also been included in the assessment.

8.5.4 Transect surveys for large mammals were supplemented by trapping of small mammals (rodents and shrews, which are not generally recorded on transect surveys), conducted under the permission of AFCD. Small-mammal trapping was conducted on three consecutive days and was carried out by placing 20 Sherman live traps (live traps designed for trapping of small mammals such as mice and shrews) and ten common rat traps (spring-action live traps designed to catch larger rodents, especially rats) in suitable locations on site under shrubs, in the freshwater marsh, near ditches and in the grassland (**Figure 8.2**). Traps were baited using oatmeal mixed with deep-fried bread, and all traps were checked daily to ensure adequate food and bedding was available. All mammals trapped were identified, weighed and released on site. Trapping was carried out during December 2005, April 2006 and June 2006, for a period of three consecutive days on each occasion.

Birds

Transect counts

8.5.5 Birds were recorded on transects within the Project Area and Assessment Area. The transects covered all habitats in the Project Area (access road, drainage ditches, grassland and freshwater marsh) as well as wetland habitats in the north and west of the Assessment Area (**Figure 8.2**). Other habitats in the Assessment Area (for example woodland and grassland) were not surveyed because these are isolated from the Project Area with little or no ecological linkage, and birds present are unlikely to be impacted by the development. Transect surveys were conducted between April 2005 and June 2006, including eight wet season surveys and 12 dry season surveys. The surveys started during the early morning, at the period of peak bird activity, and all birds seen or heard within 30 m on either side of the transect route were recorded.

8.5.6 Bird species were also recorded during site visits to the Project Area and Assessment Area to supplement the species list obtained during the transect surveys. This included four evening visits (two during the wet season, two during the dry season) to the Project and Assessment Areas, to account for possible daily variation in bird presence.

Egretries

8.5.7 Three egretries are located in the general area of the study site. Mai Po Village egretry is located less than 250 m from the entrance to the Project Area; during the 2006 breeding season, this egretry contained 35 nests of Little Egret (Anon 2006b), however no birds were present in the egretry during 2007 (AEC unpubl. data). Birds in this part of the egretry nest mostly in bamboo *Bambusa* sp. and plantation trees, especially *Eucalyptus citriodora*. A satellite egretry is located in *Celtis sinensis* trees around village houses near the junction of Castle Peak Road and Tam Kon Chau Road; during 2006 this area contained 50 nests of Chinese Pond Heron (Anon 2006b). During 2007, there were 23 Chinese Pond Heron and one Little Egret nest at the satellite egretry but no birds bred in the plantation south of Mai Po (AEC unpubl. data); it is not yet clear whether this part of the egretry has been permanently abandoned. The Mai Po Village egretry also previously contained nests of Cattle Egret (last bred 2004 (Anon 2004a)), Great Egret (last bred 2003 (Wong and Woo 2003)) and Black-crowned Night Heron (last bred 2002 (Wong 2002b)).

8.5.8 Mai Po Lung egretry is located about 1250 m north-west of the Project Area, and comprised 12 nests of Little Egret and 74 nests of Chinese Pond Heron during 2006 (Anon 2006b). During 2007 there were 20 Chinese Pond Heron and 17 Little Egret nests at Mai Po Lung (AEC unpubl. data). Nests in the Mai Po Lung egretry are mostly located in trees, including *Celtis sinensis*, *Dracontomelon duperreanum* and *Dimocarpus longan*.

8.5.9 The egretry at Tam Kon Chau is located approximately 650 m north-west of the Project Area and contained 37 nests of Chinese Pond Heron during 2006 (Anon 2006b). A total of 26 nests were recorded in 2007 (Anon. in prep.). Birds in this egretry nest in large *Ficus microcarpa* trees.

8.5.10 One of the key issues regarding developments close to egretries is the possible disruption of regular flight paths between the colony and foraging sites. Any disruption to these flight paths may reduce foraging efficiency, leading to a reduction in survival or productivity. Previous observations have found that most flights from the Mai Po Village egretry are to sites within 1500 m of the colony, although birds sometimes fly more than 4 km to foraging sites (Anon 1997). The Project Area is thus considered to be within typical foraging distance of all three egretries.

8.5.11 To investigate possible impacts to flight paths from Mai Po Village egretry (the closest colony to the Project Area), a flight path survey was conducted from a vantage point behind Maple Garden (overlooking the Mai Po Village egretry and the Project Area; see **Figure 8.2**) during June 2006, towards the end of the egret breeding season. This count aimed to follow the flight paths of egrets leaving the colony, in order to determine the routes followed and, wherever possible, the foraging locations. The count lasted for two hours in the morning, during which time the flight paths of ardeids were plotted onto a base map, and the estimated flight height of birds was recorded to assess whether flight paths were within the range of heights of buildings proposed in the development.

8.5.12 This count was supplemented with results from a previous study into the flight paths of birds leaving the Mai Po Village egretry (Anon 1997). Analysis of impacts to flight paths in relation to the egretry considers only those birds leaving the egretry to forage outside the Project Area; impacts to birds foraging within the Project Area are considered to be primarily an issue of habitat loss rather than impedance of flight paths.

On-site Flight path Counts for non-breeding birds

8.5.13 Flight path counts were also conducted from a tower (approximately 7 m high) within the Project Area (**Figure 8.2**) to investigate whether other regular flight paths for wetland-dependent bird species exist over the Project Area (for example between foraging areas and roost sites or between two favoured foraging areas). During these counts the flight paths of all birds recorded flying over the Project Area were recorded, including the height of flight. Birds flying onto or off the Project Area itself were not recorded, as it is assumed that these individuals would be recorded during the transect counts. On-site flight path counts were conducted for three hours during the early morning and three hours in the late afternoon to account for possible daily variation in bird activity. Counts were carried out between November 2005 and June 2006, including two wet season and six dry season surveys; more counts were conducted during the dry season because of the greater abundance of waterbirds, especially migratory birds, present at this time.

8.5.14 For assessment of potential impacts to bird populations, a distinction was made between the regular flight paths used frequently by birds of a particular species, connecting foraging and/or roosting sites, and the flight paths of individual birds across the Project Area, which are not used on a regular basis. Impedance of regular flight paths could potentially impact a bird population through increased energy demand by forcing birds to divert around the development or by causing birds to abandon favoured feeding, breeding or roosting locations. However, other birds flying over the Project Area on an occasional basis would not be significantly impacted by the development, as deviations or interruptions to irregular or occasional flight paths would not have any material consequence at either a population or an individual level.

Herpetofauna (Amphibians and Reptiles)

8.5.15 Herpetofauna transect surveys were conducted both during the day and at night. The transects followed were the same as for bird surveys, to cover all habitats present in the Project Area and adjacent wetland habitats in the Assessment Area (**Figure 8.2**). During the surveys all individuals seen foraging or basking in the open were recorded and appropriate microhabitats and potential refugia were inspected for more cryptic species. Hand or head torches were used as necessary during night-time surveys. Amphibians were also recorded by identification of advertising calls. Six daytime surveys (five wet season and one dry season) and ten night surveys (seven wet season and three dry season) were conducted between May 2005 and June 2006; effort was concentrated in the early part of the wet season because this is the peak period for herpetofaunal activity (especially vocalising amphibians).

Fish

8.5.16 Fish surveys were conducted in drainage channels and ditches around the Project Area (**Figure 8.2**). Surveys were conducted between May 2005 and June 2006, including six daytime surveys (three wet season and three dry season) and two night-time surveys (one each in the wet season and dry season). Surveys were only conducted in fine weather, avoiding cold weather, when fish are inactive, or periods of heavy rainfall, when stream flow was too fast for observation. Three survey methods were used.

8.5.17 Bankside counting comprised observation of fish in clear, shallow water and identification with the aid of binoculars where necessary. The species abundance was estimated and riparian vegetation recorded.

8.5.18 Baited pot traps were placed in deeper water with emergent vegetation. Traps were left in place for 20 minutes, during which time disturbance to the trap was avoided, and the fish trapped were identified and counted.

8.5.19 Fish were also trapped using a D-framed net while actively searching in suitable microhabitats or in turbid water. Hand netting was performed at 50 m intervals, starting at the downstream end of the channel. Live fish trapped by hand net were identified and released.

Butterflies / Dragonflies

8.5.20 Butterflies and dragonflies were recorded on daytime transect counts in the Project Area and in adjacent fishpond areas within the Assessment Area (**Figure 8.2**). All individuals recorded within 5 m of the transect route were recorded. Where the identity of species was not certain in the field, individuals were trapped using a fine mesh insect net for identification and release on site. Twelve surveys were carried out for each species group between May 2005 and June 2006. Nine dragonfly surveys were conducted during the wet season and three during the dry season; the emphasis was placed on early wet season surveys because this is the period of peak activity for this group. Butterfly surveys were more evenly split between wet and dry seasons (six surveys in each season) to reflect the more extended period of activity of these species.

Aquatic Invertebrates

8.5.21 Benthic macro-invertebrates were sampled in three ditches surrounding the Project Area (**Figure 8.2**). Invertebrates were trapped by kick-sampling using a fine mesh D-frame hand net. Contents of the net were preserved and taken to the laboratory for sorting, identification and counting. Three samples were collected in each of the three ditches, on two dates during the dry season and two during the wet season.

Literature Review

8.5.22 No research has previously been conducted into ecological conditions within the Project Area, and little work has been carried out within the Assessment Area. There has been considerable ecological research at nearby Mai Po Nature Reserve, however, which has been used to supplement the findings of the surveys as necessary.

8.6 Results of surveys

Habitats/vegetation present within the Project Area

8.6.1 Most of the Project Area is on land derived from the filling of fishponds in the early 1990s, which has since undergone vegetative succession, although this succession has been largely arrested in a relatively early stage due to regular maintenance work on site (especially cutting of vegetation). This has allowed the habitat to become dominated by a relatively low diversity of invasive plant species tolerant of this regular cutting. In lower-lying areas which hold water for some or all of the year, wetland vegetation has become established, creating seasonal and permanent marsh habitats. Six habitats were identified within the Project Area: grassland, seasonal marsh, freshwater marsh/reedbed, drainage channels/ditches, bare ground and developed areas (**Figure 8.3**).

8.6.2 A total of 66 species of plants were recorded in the Project Area during the vegetation surveys, all of which are common or very common species in Hong Kong, including a number of non-native species. No protected plant species or plant species of conservation importance were recorded within the Project Area. Plant species recorded in the Project Area and Assessment Area were summarized in **Appendix G1**.

Grassland

8.6.3 Grassland habitats cover 11.05 ha in the Project Area, this being just over half of the land area of the Project Area. The distribution of plants exhibits a degree of variability, probably resulting from differences in fill material or underlying differences in soil quality and topography across the Project Area.

8.6.4 Within the Project Area, the dominant plant species within the grassland habitats is *Brachiaria mutica*, which accounts for over 60% of the plant coverage within this habitat. This is an invasive alien species, which tends to become dominant in habitats where it is able to establish. It is common on fishpond bunds in the Deep Bay area. Other common plant species in this habitat include the herbs *Bidens alba*, *Conyza bonariensis* and *Sesbania cannabina*, the climber *Ipomoea cairica*, and the grasses *Cynodon dactylon* and *Eleusine indica*. All are very common in early-successional habitats throughout Hong Kong, and most are considered to be invasive weed species.

Seasonal marsh

8.6.5 Within the grassland mosaic, some areas (totally 0.69 ha in five separate locations) are lower-lying and retain water during the wet season, permitting the establishment of a seasonal wetland habitat. The extent of these habitat patches varies between years, according to rainfall levels. Within these patches a number of wetland plant species tolerant of periodic dry conditions have become established, including *Phragmites australis*, *Paspalum paspaloides*, *Cyperus imbricatus*, *Ludwigia octovalvis*, *Rumex trisetifer* and *Alternanthera philoxeroides*. All are common, widespread species found in wetland habitats throughout Hong Kong and are of no particular conservation importance.

Freshwater marsh/reedbed

8.6.6 Towards the west of the Project Area, an area of 4.00 ha is lower and retains rainwater for most of the year, allowing the establishment of a freshwater marsh. There appears to be some pollution of water in this freshwater marsh, due to domestic waste from nearby village areas.

8.6.7 The dominant plant species in this part of the Project Area is *Phragmites australis*, which covers approximately 70% of the habitat. Other wetland plant species present include *Ipomoea aquatica* and *Panicum repens*, as well as smaller areas of *Alternanthera philoxeroides*, *Cyclosorus interruptus*, *Ludwigia octovalvis* and *Murdannia nudiflora*. Some shallow open water is also present.

8.6.8 As with other parts of the Project Area, the freshwater marsh has been subject to routine maintenance, including vegetation cutting and spraying with mosquito insecticide, in response to concern from adjacent residential areas. These activities have limited the development of vegetation in the area (especially *Phragmites*, which typically grows taller and denser than is the case in this Project Area), as well as limiting the potential for use by wetland fauna. In the absence of regular cutting, it is anticipated that the *Phragmites* would become more dominant, causing the freshwater marsh on site to develop into reedbed. This would increase the ecological value of the Project Area, especially for birds, including several reedbed-dependent species of conservation importance.

Drainage channels and ditches

8.6.9 Drainage channels are located around the perimeter of the Project Area. These are narrow, and the water within is shallow and relatively polluted by domestic discharge and surface run-off. Smaller drainage ditches within the Project Area dry out for a period of several weeks during the dry season. Riparian vegetation along the channels was structurally simple and dominated by species typical of disturbed habitats around Deep Bay, including *Brachiaria mutica*, *Panicum* spp., *Paspalum* spp., *Eleusine indica* and *Bidens alba*.

Developed area and Bare ground

8.6.10 The north-eastern corner of the Project Area is currently developed land used for open storage and is therefore subject to regular human disturbance. The access track into the Project Area and land surrounding the open storage has been cleared of vegetation and regularly disturbance limits the regrowth of vegetation into this habitat, creating an area of bare soil. No significant vegetative community is established, the only plants present being common roadside weeds such as *Rhynchelytrum repens*, *Panicum maximum* and *Brachiaria mutica*.

Habitats/vegetation present within the Assessment Area

Grassland

8.6.11 Away from the Project Area, the only grassland within the Assessment Area is located on the hillsides and engineered slopes behind Maple Garden, to the east of the San Tin highway. Plant species diversity is low and is dominated by the fern *Dicranopteris pedata* and grasses, including *Panicum maximum*, *Imperata koenigii* and *Saccharum* spp. A few isolated trees (*Macaranga tanarius* and *Pinus elliottii*) are also present.

Seasonal marsh

8.6.12 A small area of artificial wetland has recently been created to the west of Mai Po Village for use as a floodwater storage area. This area periodically holds water during the wet season but is dry throughout the dry season. The area has been created very recently (less than five years) and is lined with grasscrete; as a result the plant species community shows very low diversity and complexity. Wetland plants have not yet become established because of the lack of wetland soils, isolation from other wetlands and relatively recent creation of the habitat.

Freshwater Marsh/Reedbed

8.6.13 Outside the Project Area, several small patches of marsh lie within the Assessment Area. These are derived from overgrown abandoned fishponds or vegetated areas alongside drainage channels. Vegetation in each site varies slightly according to local conditions and origin of the marsh habitat; dominant species present include *Brachiaria mutica*, *Panicum maximum*, *Eichhornia crassipes*, *Typha angustifolia*, *Ipomoea aquatica*, *Cyclosorus interruptus* and *Ludwigia octovalvis*. Two patches comprise reedbed habitat, dominated by *Phragmites australis*: one immediately west of Mai Po Village and the other on the northern side of Tam Kon Chau Road.

Active and Abandoned Fishponds

8.6.14 Fishponds form the dominant habitat type to the north and west of the Assessment Area. These form part of the extensive Deep Bay wetland area. The majority of ponds in the north and north-west of the Assessment Area are currently used for cultivation of a variety of fish species such as Grey Mullet *Mugil cephalus*, Tilapia *Oreochromus* sp., Grass Carp *Ctenopharyngodon idellus* and Bighead Carp *Aristichthys nobilis*. These ponds are regularly drained during the dry season to harvest fish and to permit management of pond substrate.

8.6.15 Active fishponds have very little emergent vegetation, while bund vegetation is managed to allow access to ponds and is dominated by a small number of widespread species, including *Brachiaria mutica*, *Panicum maximum*, *Panicum repens*, *Paspalum paspaloides*, *Eleusine indica*, *Cynodon dactylon*, *Digitaria sanguinalis* and *Bidens alba*.

8.6.16 Fishponds in the south-west of the Assessment Area, between Palm Springs and Fairview Park residential estates, have not been used for fish cultivation for a number of years. Many of these inactive ponds contain extensive emergent vegetation, especially *Phragmites australis*. Bund vegetation in this area is less disturbed than around commercial fishponds and is dominated by large grasses and exotic herbs (mostly *Bidens alba*, *Euphorbia hirta*, *Conyza bonariensis* and *Ipomoea cairica*). There are also a few fruit trees, including *Dimocarpus longan* and *Litchi chinensis*, and some naturally established tree species such as *Macaranga tanarius* and *Melia azedarach.*

Drainage channels

8.6.17 Several drainage channels are located between the fishponds within the Assessment Area. These are moderately large and bounded by fairly high, steep bunds; the water is generally shallow but the channels do not dry out during the dry season. These channels drain into Deep Bay, and some are tidal in the lower reaches. Several of the channels, especially in the north of the Assessment Area, are overgrown with vegetation, especially *Brachiaria mutica* and *Eichhornia crassipes*. Riparian vegetation is dominated by *Brachiaria mutica*, *Panicum maximum* and *Bidens alba* but there are also a number of riparian trees, especially *Melia azedarach* and *Macaranga tanarius*, which are used by roosting waterbirds. The channel forming the western boundary of Palm Springs residential estate is concrete-lined, as are a few smaller drainage channels in the eastern part of the Assessment Area.

Secondary Woodland

8.6.18 Woodland on the small hill to the east of Mai Po Village is derived from *fung shui* woodland. Much of the woodland is designated as an SSSI, largely due to the former presence of a significant egretry, although this has since moved to a nearby roadside plantation (see section 8.6.19). Dominant tree species in this area include *Macaranga tanarius*, *Melia azedarach*, *Microcos paniculata*, *Schefflera heptaphylla*, *Sterculia lanceolata*, *Sapium sebiferum* and *Schima superba*. The understorey is moderately well-developed and diverse.

Plantation

8.6.19 The roadside verges of San Tin Highway and Castle Peak Road are planted with a variety of tree species, especially non-native species, used primarily for landscaping purposes. Non-native tree species used locally in plantations include *Eucalyptus citriodora*, *Bombax ceiba*, *Acacia auriculiformis*, *Acacia confusa* and *Albizia lebbeck*, while native species include *Ficus microcarpa*, *Hibiscus tiliaceus* and *Celtis sinensis*. Roadside plantations suffer from a high level of disturbance. Understorey vegetation is poorly developed and is intensively managed by regular trimming. These habitats are generally of very low quality but the bulk of the Mai Po Village egretry is in a patch of roadside plantation containing a few clumps of bamboo; in most years egrets nest in both the bamboo and plantation trees, although no birds bred here during 2007 (see section 8.5.7). The presence of the egretry greatly increases the ecological value of this habitat, which would otherwise be low. Plantation habitats also extend away from the road in a few places, especially in the extreme north-east of the Assessment Area.

Active Dry Agricultural Land

8.6.20 Two small, isolated areas of actively cultivated agricultural land are located in the Assessment Area. Crops in this area include *Ipomoea batatas*, *Zea mays*, *Zingiber officinale* and *Ficus carica*. There are also a few fruit trees present, including *Dimocarpus longan*, *Psidium guajava*, *Carica papaya* and *Musa x paradisiaca*. Other plant species are managed to avoid competition with crops, therefore the floral community is very poorly developed.

Inactive Dry Agricultural Land

8.6.21 In the east of the Assessment Area is an extensive area of inactive dry agricultural land. This area still shows some signs of former agricultural use, for example the presence of fruit trees including *Dimocarpus longan* and *Litchi chinensis*. Most of the area, however, has become overgrown with a variety of common exotic weed species, including *Ipomoea cairica*, *Mikania micrantha*, *Panicum maximum* and *Bidens alba*.

Wasteland

8.6.22 Two areas of wasteland are located in the Assessment Area: near the entrance to the Palm Springs/Royal Palms development and on the western side of Mai Po Village. These are derived from land which was previously developed but has been allowed to fall derelict. Several pioneer trees are present, especially the exotic *Leucaena leucocephala* and the native *Macaranga tanarius*. Other abundant species include the grasses *Panicum maximum* and *Lophatherum gracile*, the exotic herbs *Sesbania cannabina* and *Bidens alba* and the exotic creepers *Mikania micrantha* and *Ipomoea cairica*.

Developed Land

8.6.23 Developed Land in the Assessment Area includes village land (Mai Po Village and Tam Kon Chau), residential developments (Palm Springs, Royal Palms and Maple Garden) and major roads (Castle Peak Road and the San Tin Highway). All areas are heavily disturbed by human activity. There is little natural vegetation present, although the residential developments have some vegetation for landscaping purposes.

8.6.24 Photographic illustration of each type of habitats referred to in **Table 8–1** were presented in **Plates 8.1 – 8.13**.

Table 8-1 Habitats present in Project Area and Assessment Area

Habitat type	Project Area		Rest of Assessment Area	
	Area (ha)	%	Area (ha)	%
Grassland	11.05	51.73	5.03	2.64
Seasonal Marsh	0.69	3.23	0.51	0.27
Freshwater Marsh/Reedbed	4.00	18.73	4.17	2.18
Active Fishponds	-	-	62.21	32.59
Abandoned Fishponds	-	-	18.71	9.80
Drainage Channels/ Ditches	0.81	3.79	4.46	2.34
Secondary Woodland	-	-	1.06	0.56
Plantation	-	-	5.42	2.84
Active Dry Agricultural Land	-	-	0.79	0.41
Inactive Dry Agricultural Land	-	-	6.15	3.22
Wasteland	-	-	1.03	0.54
Developed Land & Bare Ground	4.81	22.52	81.33	42.61
Total	**21.36**	**100**	**190.87**	**100**

Mammals

8.6.25 A total of five mammal species was recorded in the Project Area during mammal surveys: one bat species was seen during night-time surveys and four small mammal species were trapped.

8.6.26 Japanese Pipistrelle *Pipistrellus abramus* was observed in the Project Area during night-time surveys. This species is very common in wetland areas throughout Hong Kong and is not of conservation importance. No suitable locations for bat roosts are present within the Project Area, but Japanese Pipistrelle and Short-nosed Fruit Bat *Cynopterus sphinx* are known to roost in the Assessment Area, at Mai Po village and Palm Springs. Lesser Yellow Bat *Scotophilus kuhlii* and Brown Noctule *Nyctalus noctula* have also been recorded nearby (Shek 2006) and may also forage over wetlands in the Project Area.

8.6.27 Four small mammal species were recorded by trapping in the Project Area, including Musk Shrew *Suncus murinus*, House Mouse *Mus musculus*, Ryukyu Mouse *Mus caroli* and Brown Rat *Rattus norvegicus*. All species are common and widespread in Hong Kong in anthropogenic habitats, except for Ryukyu Mouse, which has a restricted distribution in

Hong Kong but has previously been recorded nearby from Mai Po Nature Reserve (Shek 2006). House Mouse and Brown Rat are not native to Hong Kong.

8.6.28 One further mammal species was observed in the Assessment Area during the surveys: Small Asian Mongoose *Herpestes javanicus*, which was observed on two dates in fishponds north-west of Palm Springs. This species is considered likely to be introduced into Hong Kong and is abundant in the Deep Bay area (Shek 2006). Although it was not recorded on surveys in the Project Area, it probably occurs here as suitable habitat is present in the grassland and freshwater marsh.

8.6.29 Other mammal species known to occur at Mai Po Nature Reserve, for which suitable habitat is also present in the grassland and freshwater marsh within the Project Area, include Greater Bandicoot Rat *Bandicota indica*, Chestnut Spiny Rat *Niviventer fulvescens*, Indochinese Forest Rat *Rattus andamanensis*, Asiatic House Rat *Rattus tanezumi*, Small Indian Civet *Viverricula indica* and Leopard Cat *Prionailurus bengalensis* (Shek 2006). Greater Bandicoot Rat is considered to be of Local Concern by Fellowes *et al*. (2002).

Birds

Results of transect surveys

8.6.30 A total of 65 species was recorded during transect surveys, of which 49 were recorded in the Project Area. An additional eight species were recorded outside the transect surveys, making a total of 73 species recorded in the Assessment Area (including the Project Area). Five species were recorded in the Project Area at times other than during the transect surveys, giving a total of 54 species recorded in the Project Area. A full list of species recorded is given in **Appendix G2**. Among these, 35 species are considered to be wetland-dependent or wetland-associated (19 species in Project Area) and 27 species are of conservation importance (14 species in Project Area) (**Table 8–2**).

8.6.31 The species recorded within the Project Area are all common and widespread throughout the Deep Bay Area, although most of the wetland-dependent species are uncommon or rare elsewhere in Hong Kong. The numbers of individuals recorded on site are not exceptional in a Deep Bay context, although peak counts of 48 Little Egrets and 151 Yellow Wagtails suggest the marsh habitats in the Project Area can, at times, be used by reasonable numbers of wetland-dependent birds. The number of individuals of species within the Assessment Area is also typical for fishpond habitats around Deep Bay.

Table 8-2 Mean and maximum number of individuals of bird species of conservation importance and wetland-dependent bird species recorded on morning transect counts in Project Area (PA) and in other parts of the Assessment Area (AA), April 2005-June 2006. (Level of Concern based on Fellowes et al. 2002)

Species	Wetland-dependent	Level of Concern	Mean in PA†	Max. in PA†	Mean in other parts of AA†	Max. in other parts of AA†
Little Grebe *Tachybaptus ruficollis*	Y	LC	-	-	0.5	3

Species	**Wetland-dependent**	**Level of Concern**	**Mean in PA†**	**Max. in PA†**	**Mean in other parts of AA†**	**Max. in other parts of AA†**
Great Cormorant *Phalacrocorax carbo*	Y	PRC	0.5	5	54.7	503
Grey Heron *Ardea cinerea*	Y	PRC	0.1	2	2.8	11
Great Egret *Egretta alba*	Y	PRC (RC)	X	X	3.4	22
Intermediate Egret *Egretta intermedia*	Y	RC	-	-	0.4	4
Little Egret *Egretta garzetta*	Y	PRC (RC)	5.5	48	31.5	123
Cattle Egret *Bubulcus ibis*	Y	(LC)	1.3	14	6.4	60
Chinese Pond Heron *Ardeola bacchus*	Y	PRC (RC)	1.3	4	5.4	13
Striated Heron *Butorides striatus*	Y	(LC)	-	-	X	X
Black-crowned Night Heron *Nycticorax nycticorax*	Y	(LC)	0.2	4	0.2	1
Black-faced Spoonbill *Platalea minor*	Y	PGC	-	-	1.1	9
Northern Pintail *Anas acuta*	Y	RC	-	-	1.7	21
Common Teal *Anas crecca*	Y	RC	-	-	1.6	11
Eurasian Wigeon *Anas penelope*	Y	RC	-	-	1.6	27
Osprey *Pandion haliaetus*	Y	RC	-	-	0.1	1
Black Kite *Milvus migrans*	N	(RC)	1.2	5	2.0	9
White-bellied Sea Eagle *Haliaeetus leucogaster*	Y	(RC)	-	-	X	X
Common Moorhen *Gallinula chloropus*	Y	-	-	-	0.3	3
White-breasted Waterhen *Amaurornis phoenicurus*	Y	-	0.2	2	0.7	5
Oriental Pratincole *Glareola maldivarum*	Y	LC	X	X	X	X
Little Ringed Plover *Charadrius dubius*	Y	(LC)	0.1	1	0.1	1
Green Sandpiper *Tringa ochropus*	Y	-	-	-	X	X
Common Sandpiper *Actitis hypoleucos*	Y	-	0.2	1	1.4	6
Common Snipe *Gallinago gallinago*	Y	-	0.1	1	0.1	1
Black-headed Gull *Larus ridibundus*	Y	PRC	-	-	0.1	1
Pacific Swift *Apus pacificus*	N	(LC)	X	X	X	X

Species	Wetland-dependent	Level of Concern	Mean in PA†	Max. in PA†	Mean in other parts of AA†	Max. in other parts of AA†
Pied Kingfisher *Ceryle rudis*	Y	(LC)	-	-	0.2	1
Common Kingfisher *Alcedo atthis*	Y	-	-	-	0.5	5
White-throated Kingfisher *Halcyon smyrnensis*	Y	(LC)	-	-	0.4	2
White Wagtail *Motacilla alba*	Y#	-	0.9	3	2.5	7
Grey Wagtail *Motacilla cinerea*	Y	-	2.2	3	0.5	4
Yellow Wagtail *Motacilla flava*	Y	-	10.0	151	0.3	2
Oriental Reed Warbler *Acrocephalus orientalis*	Y	-	0.1	1	-	-
Zitting Cisticola *Cisticola juncidis*	Y#	LC	0.1	1	-	-
Red-billed Starling *Sturnus sericeus*	Y#	(RC)*	0.9	15	119.3	821
White-shouldered Starling *Sturnus sinensis*	Y#	(LC)	0.1	2	X	X
Collared Crow *Corvus torquatus*	Y#	LC	-	-	0.3	2

Y# - Species is not exclusively dependent on wetland habitats but is usually found around wetlands in Hong Kong

X Species recorded in Project Area or Assessment Area, but not during transect surveys.

† Mean values given are the mean number recorded on all transects; this is included to indicate the relative importance of the site over the year, reflecting the regularity of a species in the Project Area. Max. is the maximum number of individuals recorded during any transects; this is included to indicate whether single large flocks contribute towards the mean abundance.

* 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.

Monthly monitoring of waterbirds by Hong Kong Bird Watching Society

8.6.32 The importance of this fishpond area for waterbirds can also be seen from the data collected for the monthly monitoring of waterbird populations in Deep Bay, conducted by the Hong Kong Bird Watching Society (HKBWS) as part of the long-term monitoring of the Ramsar Site for AFCD (Anon 2005, Anon 2006a). The ponds within the Assessment Area are largely identical to the Tam Kon Chau count area for the monthly monitoring; some ponds in the count area lie just outside the Assessment Area for this report, nevertheless observations from this area can be used to supplement data collected on transect surveys. Results from the monthly monitoring at Tam Kon Chau during the period April 2005 – March 2006 (which coincides with the baseline data collection at Wo Shang Wai) are summarised in **Table 8–3**. These reveal a similar species list to that recorded during baseline transect surveys for this project (**Table 8–2**), although with the addition of four species which were not recorded in the current study (Black-winged Stilt *Himantopus himantopus*, Marsh Sandpiper *Tringa stagnatilis*, Wood Sandpiper *Tringa glareola* and Black-capped Kingfisher *Halcyon pileata*).

Table 8-3 Wetland-dependent bird species recorded in the Tam Kon Chau count area on monthly waterbird counts conducted by the Hong Kong Bird Watching Society, April 2005-March 2006 (data from Anon 2005, Anon 2006a)

Species	Mean recorded	Maximum
Little Grebe *Tachybaptus ruficollis*	10.8	24
Great Cormorant* *Phalacrocorax carbo*	287.2 (5.5)	3098 (32)
Grey Heron *Ardea cinerea*	2.7	10
Great Egret *Egretta alba*	10.8	35
Intermediate Egret *Egretta intermedia*	1.0	6
Little Egret *Egretta garzetta*	74.7	229
Cattle Egret *Bubulcus ibis*	5.5	61
Chinese Pond Heron *Ardeola bacchus*	37.1	60
Black-crowned Night Heron *Nycticorax nycticorax*	1.0	6
Eurasian Wigeon *Anas penelope*	11.2	39
Northern Pintail *Anas acuta*	0.5	6
Common Teal *Anas crecca*	0.1	1
Osprey *Pandion haliaetus*	0.2	1
Black Kite *Milvus migrans*	0.5	4
Common Buzzard *Buteo buteo*	0.1	1
White-breasted Waterhen *Amaurornis phoenicurus*	2.1	6
Common Moorhen *Gallinula chloropus*	10.0	29
Black-winged Stilt *Himantopus himantopus*	0.5	6
Little Ringed Plover *Charadrius dubius*	9.3	66
Marsh Sandpiper *Tringa stagnatilis*	0.5	6
Green Sandpiper *Tringa ochropus*	1.9	10

Species	Mean recorded	Maximum
Wood Sandpiper *Tringa glareola*	13.6	120
Common Sandpiper *Actitis hypoleucos*	10.5	20
Common Snipe *Gallinago gallinago*	0.1	1
Pied Kingfisher *Ceryle rudis*	0.3	2
Common Kingfisher *Alcedo atthis*	6.1	11
White-throated Kingfisher *Halcyon smyrnensis*	2.0	8
Black-capped Kingfisher *Halcyon pileata*	0.1	1
Red-billed Starling *Sturnus sericeus*	6.2	57
Collared Crow *Corvus torquatus*	0.8	4

* The Tam Kon Chau count area includes ponds adjacent to the large roost of Great Cormorant at Mai Po Nature Reserve; the exceptionally high count of 30□8 Great Cormorants in January 2006 undoubtedly included some roosting birds. Values in parentheses discount the results of the count on that date.

Breeding Season Observations of Foraging Egrets

8.6.33 Significant impacts to local egretries would arise if birds from the egretries were flying into the Project Area to forage, because breeding success in the egretry is dependent on the availability of suitable wetland foraging habitat. Transect counts conducted during the egret breeding season (March – July) recorded a maximum count of 20 Little Egrets (mean 4.2) and seven Chinese Pond Herons (mean 1.9). These species were recorded foraging in the Freshwater Marsh/Reedbed, Seasonal Marsh and Drainage Ditches within the Project Area. The total breeding population in the three local egretries (Mai Po Village, Mai Po Lung and Tam Kon Chau) was 47 nests of Little Egret and 161 of Chinese Pond Heron during 2006 (Anon 2006b). This indicates that the Project Area is of moderate importance to Little Egret in the breeding season (recorded on 6 out of 10 surveys during March – July, usually less than 5 birds but including single counts of 8 and 20) and of low importance to breeding Chinese Pond Heron.

Egretry flight path surveys

8.6.34 In the absence of any impacts to foraging habitat, the development of the Project Area would potentially impact the egretry if birds were passing through the Project Area on the way to more distant foraging grounds. The presence of buildings along flight paths between the egretry and foraging grounds would force the birds to divert from their normal route, either changing route or flying at a higher altitude. The additional energy required for these diversions would potentially reduce the breeding success in the egretry.

8.6.35 Small numbers of egrets were present within the Mai Po Egretry at the time of the flight path survey in June 2006, although the number of active nests was not counted on that date.

No birds were recorded leaving the egretry at the time of the survey, however. It is not known whether this was the result of low activity on the day of the survey or whether birds were leaving the egretry along a route that was not visible from the vantage point, perhaps flying north from the egretry; such a flight path would not pass over the Project Area. Ten ardeids were recorded flying over the Project Area during the flight path survey, including six Little Egrets and four Chinese Pond Herons; these counts may include non-breeding birds and young birds after fledging. These numbers are very low in comparison to the total breeding in the three local egretries (totally 47 nests of Little Egret and 161 of Chinese Pond Heron during 2006 (Anon 2006b)), suggesting that the Project Area does not lie on any significant flight paths between the egretry and foraging grounds.

8.6.36 Six of the ten birds recorded on the flight path survey were recorded flying above 15 m (**Table 8–4**). The lowest flight paths (less than 10 m) were mostly in the northern part of the Project Area. A similar observation was made during the non-breeding bird flight path surveys (Section 8.6.44). Adjacent residential estates constitute an obstacle to the egrets flying over the southern part of the Project Area towards other foraging grounds, and any development in the southern part of the Project Area would have a low impact on egret flight paths, unless the buildings were significantly higher than those already present in areas adjacent to the Project Area.

Table 8-4 Heights of ardeids flying over the Project Area, June 2006

Species	**0-5 m**	**6-10 m**	**11-15 m**	**16-20 m**	**21-50 m**	**Total**
Little Egret *Egretta garzetta*	2	–	–	4	–	6
Chinese Pond Heron *Ardeola bacchus*	–	2	–	1	1	4
Total	2	2	0	5	1	10

8.6.37 Previous surveys at the Mai Po Village egretry support the finding that the Project Area does not lie on a significant flight path for breeding egrets. Anon (1997) followed birds leaving the Mai Po Village egretry in 1995. Although actual numbers of birds followed are not reported, this study found that the majority of birds (85%) flew towards fishpond areas to the north and north-east of the Project Area. Only 15% were recorded flying in the general direction of the Project Area, although not all of these would have flown over the Project Area. The size of the Mai Po Village egretry (including the satellite egretry) has declined since these data were collected, from 122 nests in 1995 to 85 in 2006 (the year of fieldwork for this EIA) and 24 nests in 2007 (AEC unpubl. data). Considering this decline, it is not surprising that few birds were recorded flying over the Project Area in the current fieldwork.

On-site Flight path Surveys during the Wet Season

8.6.38 Flight path surveys were carried out within the Project Area during the wet season in May and June 2006. Flight paths were recorded for those species of conservation interest recorded passing through the Project Area but not stopping on site. Birds recorded flying onto or off the Project Area would be impacted by habitat loss rather than obstruction of flight paths, and the flight paths of these birds are not considered here.

8.6.39 Among the individuals recorded passing through the Project Area, only two species of conservation importance were recorded: Little Egret and Chinese Pond Heron. All individuals of these species flying through the Project Area were recorded between 5 and 10 m above the ground. Both species breed in nearby egretries, and birds flying to/from egretries may have been recorded flying over the Project Area. During the count of May 2006, four Little Egrets and four Chinese Pond Herons were recorded passing through the Project Area, while on the survey during June 2006, four Little Egrets and seven Chinese Pond Herons were recorded. The similarity of these numbers to the number recorded during the egretry flight path survey (Section 8.6.35) indicates that similar numbers of individuals of these species pass through the Project Area throughout the egret breeding season. These numbers are low in comparison to the total number of birds breeding in the local egretries.

8.6.40 Ten birds (two Little Egrets and eight Chinese Pond Herons) were recorded flying along an east-west route on the northern edge of the Project Area, along Flight path 1 in **Figure 8.4**. The remaining nine birds (six Little Egrets and three Chinese Pond Herons) flew along Flight paths 2 and 3, following north-south routes in the western part of the Project Area (**Table 8–5**). These routes also pass over the existing Palm Springs residential estate.

8.6.41 On all dates, on-site flight path surveys were conducted for three hours during the morning and three hours during the afternoon. No significant difference was recorded in the use of the Project Area by birds at different times of day.

Table 8-5 Summary of birds using Flight paths 1, 2 and 3, May-June 2006

Species	Flight path 1	Flight path 2	Flight path 3	Total
Little Egret *Egretta garzetta*	2	5	1	8
Chinese Pond Heron *Ardeola bacchus*	8	2	1	11
Total	10	7	2	19

On-site Flight path Surveys during the Dry Season

8.6.42 On-site flight path surveys were also conducted between November 2005 and April 2006 to assess the potential impacts of the development to migratory waterbirds not present in Hong Kong during the breeding season. Flight paths of species of conservation importance passing through the Project Area without stopping were recorded; paths of individuals flying into the Project Area to forage or roost were not recorded, because the impact of habitat loss to these individuals is greater than the impact to flight paths.

8.6.43 Flight paths were recorded for 15 species of conservation importance recorded flying through the Project Area. These flight paths could be grouped into one of eight general flight paths (**Figure 8.4),** some of which were used on a more regular basis while others were used on only one visit. The number of birds recorded using each flight path are given in **Appendices G3-10**.

8.6.44 None of the eight flight paths showed regular use by significant numbers of a particular species. Most activity was concentrated on Flight paths 1, 2, 4 and 5 (in total 271 out of 410 individuals were along these four paths, most of the remaining birds resulting from single flocks of 70 Black-headed Gull and 50 Red-billed Starling). These four flight paths are located in the north, north-west and west of the Project Area. This is the closest part of the Project Area to fishpond habitats, where birds are more abundant and diverse, and also includes the on-site marsh habitat. Most birds recorded on these flight paths are presumably moving between fishpond areas, or moving between the fishponds and roosting sites at Mai Po NR.

8.6.45 The majority of birds on most flight paths (relating to 181 individuals) were recorded in the 21-50 m height range, although a significant proportion (40 out of 96) of birds recorded on Flight path 1 (crossing the northern edge of the Project Area) were in the 5-10 m height range. These birds were presumably making short-distance movements between fishpond areas to the north of the Project Area. All birds on Flight paths 3, 6, 7 and 8, which cross existing residential estates (Royal Palms and Palm Springs) were above 20 m in height in order to pass over buildings in these estates.

8.6.46 Some seasonal variation in the height of birds flying over the Project Area was observed. Birds were recorded below 10 m only during the surveys in February and April, but were higher in other months. This contrasts with the wet season results, in which all birds were recorded below 10 m.

8.6.47 On all dates, on-site flight path surveys were conducted for three hours during the morning and three hours during the afternoon. No difference was recorded in the use of the Project Area by birds at different times of day. Daily variation in abundance may be expected if roost sites were located close to the Project Area, in which case birds leaving or arriving at the roost would be recorded flying past in large numbers. No such roost sites are known around the Project Area.

Herpetofauna

8.6.48 Five species of amphibians were recorded in the Project Area during the surveys (**Table 8–6**), including Asian Common Toad *Bufo melanostictus*, Brown Tree Frog *Polypedates megacephalus*, Günther's Frog *Rana guentheri*, Paddy Frog *Fejervarya limnocharis* and Ornate Pigmy Frog *Microhyla ornata*. All are common, widespread species in Hong Kong of no particular ecological significance, and none was recorded in significant numbers in the Project Area. Asian Common Toad and Günther's Frog were also recorded elsewhere within the Assessment Area.

8.6.49 Only one reptile was recorded in the Project Area (**Table 8–6**), a Chinese Striped Terrapin *Ocadia sinensis* which was found in the south-west corner of the Project Area, close to Palm Springs. This species is widespread in southern China, but is not considered to be native to Hong Kong, and previous records of the species are thought to relate to released individuals as this species is sometimes sold in local markets (Karsen *et al*. 1998). It is thought that the record in the Project Area also relates to a released individual.

8.6.50 Two reptile species were recorded within the Assessment Area during surveys which had not been recorded in the Project Area (**Table 8–6**): Checkered Keelback *Xenochrophis piscator* and Long-tailed Skink *Mabuya longicaudata*. Both are common, widespread species in Hong Kong. Checkered Keelback is largely wetland-dependent and is common around the Deep Bay wetland ecosystem. The full checklist for herpetofauna recorded is given in **Appendix G11**.

Table 8-6 Relative abundance of herpetofauna species recorded in the Project Area and in other parts of the Assessment Area, April 2005 – June 2006

Species	**Project Area**	**Other parts of Assessment Area**
Asian Common Toad *Bufo melanostictus*	+	++
Brown Tree Frog *Polypedates megacephalus*	+	
Günther's Frog *Rana guentheri*	+	++
Paddy Frog *Fejervarya limnocharis*	++	
Ornate Pigmy Frog *Microhyla ornata*	+	
Chinese Striped Terrapin* *Ocadia sinensis*	+	
Checkered Keelback *Xenochrophis piscator*		+
Long-tailed Skink *Mabuya longicaudata*		+

+ 1-5 individuals, ++ 6-10 individuals

* The Chinese Striped Terrapin recorded in the Project Area is considered to relate to an escaped individual.

8.6.51 Although no other reptile species were recorded, the Mai Po area is known to contain a number of other snake species of conservation importance, including Burmese Python *Python molurus*, Indo-Chinese Rat Snake *Ptyas korros*, Common Rat Snake *Ptyas mucosus*, Banded Krait *Bungarus fasciatus*, Many-banded Krait *Bungarus multicinctus*, Chinese Cobra *Naja atra* and King Cobra *Ophiophagus hannah*. Potential habitat for low-density populations of these species also occurs in the grassland and freshwater marsh in the Project Area, although their presence was not recorded during the surveys.

Fish

8.6.52 Fish species diversity in the Project Area was low, with just five species recorded (**Table 8-7**). The fish community was dominated by introduced species which are tolerant of the polluted conditions found in the streams around the Project Area. No species of conservation importance were recorded. (Lee *et al*. 2004).

Table 8-7 Relative abundance of fish species recorded in Project Area and in the drainage channel by Palm Springs, April 2005 – June 2006.

Species	**Project Area**	**Channel by Palm Springs**
Tilapia sp. *Oreochromis* sp.	++++	+++++
Mosquito Fish *Gambusia affinis*	++++	++++
Snakehead Murrel *Channa striata*	++	

Species	Project Area	Channel by Palm Springs
Snakehead *Channa* sp.		+
Swampy Eel *Monopterus albus*	+	
Catfish sp. *Clarius* sp.	+	+
Common Carp *Cyprinus carpio*		+

+ 1-3 individuals, ++ 4-6 individuals, +++ 7-10 individuals, ++++ >10 individuals, +++++ >1000 individuals

Butterflies

8.6.53 A total of 21 butterfly species was recorded within the Project Area during the surveys and a further four species were recorded elsewhere within the Assessment Area (**Table 8–8**). All species are common in Hong Kong except Common Jay *Graphium doson*, Danaid Egg-fly *Hypolimnas misippus* and Yellow Orange Tip *Ixias pyrene*, which are uncommon (Lo and Hui 2004). Danaid Egg-fly is considered to be of Local Concern by Fellowes *et al*. (2002). One individual of this species was recorded in the Project Area on 28th October 2005.

Table 8-8 Butterfly species recorded in the Project Area (PA) and in other parts of the Assessment Area (AA) during surveys, May 2005 – June 2006.

Species	Level of concern	Mean in PA	Maximum in PA	Mean in other parts of AA	Maximum in other parts of AA
Formosan Swift *Borbo cinnara*		0.1	1		
Skipper sp. Hesperiidae sp.				0.1	1
Common Jay *Graphium doson*		0.1	1		
Common Mime *Chilasa clytia*		0.1	1		
Common Mormon *Papilio polytes*				0.1	3
Great Mormon *Papilio memnon*		0.1	1		
Paris Peacock *Papilio paris*		0.2	1	0.2	2
Red-base Jezebel *Delias pasithoe*		0.1	1	0.1	1
Indian Cabbage White *Pieris canidia*		7.7	33	1.5	6
Yellow Orange Tip *Ixias pyrene*		0.1	1	0.1	1
Mottled Emigrant *Catopsilia pyranthe*		0.3	1	0.1	1

Species	Level of concern	Mean in PA	Maximum in PA	Mean in other parts of AA	Maximum in other parts of AA
Lemon Emigrant *Catopsilia pomona*		0.2	2		
Common Grass Yellow *Eurema hecabe*		3.1	18	0.5	2
Pale Grass Blue *Zizeeria maha*		0.3	3	0.1	1
Lime Blue *Chilades lajus*		0.3	4		
Dark-brand Bush Brown *Mycalesis mineus*		0.2	2		
Straight Five-ring *Ypthima lisandra*		0.1	1		
Large Faun *Faunis eumeus*		0.2	1		
Angled Castor *Ariadne ariadne*		0.1	1		
Rustic *Cupha erymanthis*				0.1	1
Great Egg-fly *Hypolimnas bolina*		0.1	1	0.1	1
Danaid Egg-fly *Hypolimnas misippus*	LC	0.1	1	0.1	1
Southern Sullied Sailer *Neptis clinia*				0.1	1
White-edged Blue Baron *Euthalia phemius*		0.1	1		
Blue-spotted Crow *Euploea midamus*		0.1	1		

Dragonflies

8.6.54 A total of 19 dragonfly species was recorded during the surveys; of these, 18 were recorded in the Project Area (**Table 8–9**). All are common, widespread species in Hong Kong. Scarlet Basker *Urothemis signata* is considered to be of Local Concern by Fellowes *et al.* (2002), but has increased considerably in recent years and is now widespread in overgrown fishponds in the Deep Bay area (Wilson 2004).

8.6.55 As would be expected, wetland habitat in the Project Area held the greatest diversity of dragonfly species: 16, 12 and 11 species were recorded in drainage ditches, freshwater marsh/reedbed and seasonal marsh, respectively.

Table 8-9 Dragonfly species recorded in the Project Area (PA) and in other parts of the Assessment Area (AA) during surveys, May 2005 – June 2006.

Species	Level of concern	Mean in PA	Maximum in PA	Mean in other parts of AA	Maximum in other parts of AA
Orange-tailed Midget *Agiocnemis femina*		0.7	4	0.2	2
Orange-tailed Sprite *Ceriagrion auranticum*		0.4	3	0.2	2
Common Bluetail *Ischnura senegalensis*		3.0	13	11.2	129
Black Threadtail *Prodasineura autumnalis*		0.5	5		
Lesser Emperor *Anax parthenope*		0.2	2		
Asian Widow *Palpopleura sexmaculata*		0.2	1		
Asian Amberwing *Brachythemis contaminata*		4.5	41	5.7	57
Crimson Darter *Crocothemis servilia*		1.1	7	0.5	4
Blue Percher *Diplacodes trivialis*		0.3	3		
Pied Percher *Neurothemis tullia*		8.1	67	0.1	1
Blue Skimmer sp.* *Orthetrum* sp.		1.4	12	0.3	3
Common Red Skimmer *Orthetrum pruinosum*		1.5	6	0.4	5
Green Skimmer *Orthetrum sabina*		4.5	15	0.6	4
Wandering Glider *Pantala flavescens*		4.5	29	1.0	6
Variegated Flutterer *Rhyothemis variegata*		5.5	17	3.8	43
Evening Skimmer *Tholymis tillarga*		0.1	1	0.3	2
Saddlebag Glider *Tramea virginia*				0.1	1
Crimson Dropwing *Trithemis aurora*		0.9	6		
Scarlet Basker *Urothemis signata*	LC	0.3	2		

* Three species of blue skimmer may occur on site: Common Blue Skimmer *Orthetrum glaucum*, Lesser Blue Skimmer *Orthetrum triangulare* and Marsh Skimmer *Orthetrum luzonicum*.

Aquatic Invertebrates

8.6.56 The water channels surrounding the Project Area were found to be highly polluted by runoff from adjacent residential areas and open storage. This was reflected in the invertebrates encountered during the surveys, which were dominated by species tolerant of polluted conditions, especially Chironominae sp., *Melanoides tuberculata*, *Pomacea lineata* and Oligochaeta sp. (**Table 8–10**). Invertebrates were relatively abundant in all samples, especially at sampling site D2b on 19th December 2005, when 410 individuals of *Chironomus* sp. were recorded.

Table 8-10 Number of aquatic invertebrates recorded from sampling locations around the Project Area, 2005-2006.

Taxon	Sampling Location D1				Sampling Location D2				Sampling Location D3			
	29 Nov	19 Dec	9 Apr	23 May	29 Nov	19 Dec*	9 Apr	23 May	29 Nov	19 Dec	9 Apr	23 May
Diptera												
Chironomus sp.	11	18	4	2	2	410	5	11	6	2	6	11
Other Chironominae sp.	21	25	189	17	8	70	5	18	14	15	12	19
Tipula sp.	2											
Odonata												
Ischnura sp.	19	1	3		1				5	1		
Trithemis sp.				2			12	3	1		4	2
Mollusca												
Melanoides tuberculata				9	88	3	35	24	70	1	126	3
Pomacea lineata				15	10		7		9	15	4	
Sinotaia quadrata							14				2	
Radix plicatulus			1									
Biomphalaria straminea							2					
Hippeutis cantonensis							1				2	
Oligochaeta spp.		68		23	4	7	13	13	5	73	2	5
Crustacea												
Caridina cantonensis					3				2			
Total Invertebrates	**53**	**112**	**197**	**68**	**116**	**490**	**94**	**69**	**112**	**107**	**158**	**40**

* Samples at D2 collected from a slightly different location on 1□th December, because original location contained no water.

8.7 Ecological Value of habitats in the Project Area and within the Assessment Area

8.7.1 Evaluations of the ecological value of habitats in the Project Area and within the Assessment Area are given in **Tables 8–11** to **8–19**. Habitat descriptions can be found in Sections 8.6.1 – 8.6.24.

Grassland

8.7.2 Grassland habitats present in the Project Area are derived from vegetative succession following the filling of fishponds during the early 1990s. Elsewhere within the Assessment Area, grassland habitats are located on the engineered slopes and hillsides behind Maple Garden residential development. Both habitats are characterised by a low floral diversity and simple plant community structure. Grassland habitats outside the Project Area were not surveyed during faunal surveys because ecological impacts are unlikely due to distance from Project Area and lack of ecological linkage across the San Tin highway.

8.7.3 Fauna recorded in the grassland habitats within the Project Area include 33 bird species, nine dragonfly species and ten butterfly species. These include five bird species of conservation importance (Black Kite, Oriental Pratincole, Pacific Swift, Zitting Cisticola and White-shouldered Starling). The first three of these species are aerial foragers/hunters, which are highly mobile and were recorded foraging not only over the grassland but also other habitats in the area. The other two species were recorded on a single occasion and populations in the Project Area are not considered to be significant.

Table 8-11 Ecological Evaluation of Grassland Habitats

Criteria	**Grassland in Project Area**	**Other Grassland in Assessment Area**
Naturalness	Habitat derived from filling of fishponds and disturbed by annual maintenance work.	Mostly derived from succession on engineered slopes, with some natural hillside grassland.
Size	Medium, about 11.05 ha.	Small, about 5.03 ha.
Diversity	Low plant species diversity, dominated by non-native species. Moderate faunal diversity (33 bird species, 9 dragonfly species, 10 butterfly species).	Plant species diversity low and community structure simple.
Rarity	A fairly common habitat on filled land and fishpond bunds. Small numbers of five bird species of conservation importance recorded.	A common habitat type in Hong Kong.
Re-creatability	Easily re-creatable.	Easily re-creatable.
Fragmentation	Not fragmented within the Project Area. Similar habitat located on bunds around adjacent fishponds.	Not fragmented within the Assessment Area.
Ecological linkage	Ecological linkage with adjacent wetland habitats, especially fishponds.	Ecologically linked to adjacent grassland and shrubland outside the Assessment Area.

Criteria	Grassland in Project Area	Other Grassland in Assessment Area
Potential value	Has the potential to be enhanced if vegetation was suitably managed, although such a management regime is unlikely in practice.	Potential to develop into more diverse shrubland if left undisturbed though remoteness from seed sources is likely to reduce potential shrub species diversity.
Nursery/ breeding ground	Not known to be a significant breeding ground.	No significant breeding grounds known.
Age	14 years (based on aerial photos).	Young.
Abundance/ Richness of wildlife	Moderate abundance of wildlife.	Low richness/abundance of wildlife.
Ecological value	**Low to Moderate**	**Low**

Seasonal Marsh

8.7.4 Within the grassland present in the Project Area there are five very small, isolated areas which hold water for a few months during the wet season. These have developed a simple wetland floral community, and support a small number of wetland-dependent faunal species, especially dragonflies. Variability in rainfall within and between years means that the location and size of these patches of seasonal marsh change to some extent from year to year. Elsewhere within the Assessment Area a small patch close to Mai Po Village is also seasonally wet due to its use for floodwater storage. This area is recently created and wetland vegetation has not yet had time to establish.

8.7.5 A total of 20 bird species, 11 dragonfly species and one butterfly species was recorded in the Seasonal Marsh habitats within the Project Area. Seven birds of conservation importance (Little Egret, Cattle Egret, Chinese Pond Heron, Black Kite, Little Ringed Plover, Pacific Swift and Red-billed Starling) were recorded foraging in this habitat within the Project Area, although Black Kite and Pacific Swift are aerial foragers recorded moving between this and adjacent habitats. The seasonal marsh habitats in the Project Area are not considered to be an important site for any species of conservation importance.

Table 8-12 Ecological Evaluation of Seasonal Marsh

Criteria	Seasonal marsh in the Project Area	Other Seasonal marsh in Assessment Area
Naturalness	Man-made habitat on land derived from filling of fishponds. Disturbed by regular maintenance works.	Artificial habitat comprising grasscrete area used by DSD for floodwater storage.
Size	Small, totally about 0.69 ha.	Small, around 0.51 ha.
Diversity	Low plant species diversity but moderate diversity of common faunal species (20 bird species, 11 dragonfly species, 1 butterfly species).	Low diversity and simple plant community structure.
Rarity	A fairly common habitat in Hong Kong. Seven bird species of conservation importance recorded.	A fairly common habitat type in Hong Kong.

Criteria	**Seasonal marsh in the Project Area**	**Other Seasonal marsh in Assessment Area**
Re-creatability	Easily re-creatable under suitable hydrological conditions.	Easily re-creatable if hydrology is suitable, as substrate is artificial.
Fragmentation	Highly fragmented, consisting of five isolated patches.	Single small isolated area.
Ecological linkage	Ecologically linked to surrounding grassland and nearby freshwater marsh.	Some linkage to nearby wetlands, although this fairly weak as habitat is surrounded by roads and fences.
Potential value	Could be enhanced or converted into freshwater marsh with suitable hydrological conditions and vegetation management, although value still limited by very small size although such a management regime is unlikely in practice under current conditions.	Limited because managed for flood prevention, although may be improved with an increase in vegetative diversity.
Nursery/ breeding ground	Breeding ground for common dragonfly and amphibian species.	No breeding ground known but may support common species of amphibian and dragonfly.
Age	Fishponds were filled about 14 years ago.	Very recent, about 2-3 years.
Abundance/ Richness of wildlife	Moderate abundance of wildlife.	Low abundance and richness of wildlife.
Ecological value	**Low to moderate**	**Low**

Freshwater Marsh/Reedbed

8.7.6 An area towards the west of the Project Area holds water for most of the year, allowing the development of a more permanent marsh community. The vegetation in this area is dominated by *Phragmites australis* and in the absence of management it is anticipated that the habitat would develop into a reedbed. Elsewhere in the Assessment Area, very small areas have developed into marshland on abandoned fishponds and the sides of drainage ditches. This includes a very small reedbed patch close to Mai Po Village. Larger areas of reedbed are established in long-abandoned fishponds in the south-west of the Assessment Area; the ecological value of this is considered in the section concerning fishpond habitats.

8.7.7 Freshwater Marsh/Reedbed was the most diverse habitat within the Project Area in terms of fauna, with records of 35 birds, three amphibian, 12 dragonfly and six butterfly species. These included nine birds (Little Egret, Cattle Egret, Chinese Pond Heron, Black-crowned Night Heron, Black Kite, Oriental Pratincole, Little Ringed Plover, Pacific Swift and Red-billed Starling) of conservation importance, recorded foraging in or over the freshwater marsh/reedbed in the Project Area. One butterfly (Danaid Egg-fly) of conservation importance was recorded flying through this habitat in the Project Area. Faunal abundance was also higher in this habitat than in other habitats within the Project Area; this high species diversity and abundance reflects the ecological importance of wetland habitats. Elsewhere in the Assessment Area the freshwater marsh habitats are smaller in size and this is reflected in a lower faunal diversity, with only eight bird species and two dragonfly species recorded.

Table 8-13 Ecological Evaluation of Freshwater Marsh/Reedbed

Criteria	Freshwater marsh/reedbed in Project Area	Other Freshwater marsh and reedbed in Assessment Area
Naturalness	Artificially created by filling of fishponds. Currently moderately disturbed by annual vegetation management works, especially reed cutting.	Derived from natural succession in wetland habitats (fishponds and drainage channels).
Size	Moderately large for this type of habitat (4.00 ha).	Several small patches; totally 4.17 ha.
Diversity	Plant species diversity is relatively low. Faunal diversity is moderate due to proximity to other wetland habitats and low levels of disturbance (35 bird species, 3 amphibian species, 12 dragonfly species, 6 butterfly species).	Low plant species diversity and low faunal species diversity (8 bird species, 2 dragonfly species).
Rarity	Freshwater marsh is uncommon and declining in Hong Kong; areas over 1 ha are considered to be an important habitat type. Nine bird species and one butterfly of conservation importance recorded.	Similar areas of marsh are fairly common in the Deep Bay area. Reedbed is less common, although small patches like this occur on many abandoned fishponds. One bird species of conservation importance.
Re-creatability	Can be recreated under suitable hydrological conditions.	Easily re-creatable where hydrological conditions are suitable.
Fragmentation	Not fragmented within the Project Area.	Several small, isolated patches, each with different conditions.
Ecological linkage	Good ecological linkage to surrounding grassland and nearby Deep Bay wetland ecosystem.	Patches in the north of the Assessment Area are ecologically linked to nearby fishponds.
Potential value	Could be enhanced with management of water levels and vegetation. Allowing reeds to mature would permit development of reedbed habitat, potentially supporting a variety of uncommon species (especially birds) although such a management regime is unlikely in practice under current conditions.	Could be improved by appropriate management, although the small size of the habitat patches limits the potential value. Also constrained by limited botanical diversity in the absence of introductions.
Nursery/ breeding ground	Breeding ground for common amphibian and dragonfly species.	Not known as a significant breeding ground, but some may support common amphibians and dragonflies.
Age	Evolved on land created by filling of fishponds about 14 years ago.	Fairly recently developed from other wetland habitats.

Criteria	Freshwater marsh/reedbed in Project Area	Other Freshwater marsh and reedbed in Assessment Area
Abundance/ Richness of wildlife	Reasonable abundance of fauna, especially birds and dragonflies. Moderately diverse dragonfly community, with 12 species recorded in the Project Area.	Low abundance of wildlife, largely due to small size of the habitat patches.
Ecological value	**Moderate**	**Low to moderate**

Fishponds

8.7.8 The majority of the north and west of the Assessment Area comprises fishpond habitats. In the northern part, most fishponds are still used for cultivation of a variety of fish species, with management activities including regular drain-down and bund vegetation management.

8.7.9 A high diversity of bird species, including a number of species of conservation importance, was recorded around the active fishponds in the north of the Assessment Area. Bird abundance (especially waterbirds) was also often high in these fishponds. Diversity of other faunal groups was low and no species were considered to be of conservation importance.

8.7.10 In the south-west of the Assessment Area lies a group of fishponds which have been abandoned for a number of years. *Phragmites australis* has established in a number of these fishponds, creating an extensive reedbed habitat in the area. Much of the faunal diversity will be similar to that encountered around other fishpond areas, although with lower numbers of individuals of species requiring open vistas, abundant fish supplies and drained fishponds (especially cormorants and egrets). Human disturbance in the area is very low, however, which may benefit disturbance-sensitive species; for example, a study into the habitat selection of Black-faced Spoonbills in Hong Kong found that these fishponds were regularly used by significant numbers of this species (Anon 2004b). The diversity of species requiring cover, especially reedbeds, will be higher than is the case in other fishpond areas and this will include some species with limited distributions in Hong Kong, for example bitterns and wetland-dependent passerines.

Table 8-14 Ecological Evaluation of Fishponds.

Criteria	Active fishponds in north and west of Assessment Area	Abandoned fishponds in south-west of Assessment Area
Naturalness	Artificial habitat created for cultivation of fish species, moderately disturbed by regular human activities related to fish farming.	Originally created for aquaculture, but have been abandoned for a number of years and have undergone succession.
Size	A large area in the Assessment Area (62.21 ha), contiguous with fishponds throughout the Deep Bay area.	Moderate area in Assessment Area (18.71 ha).

Criteria	**Active fishponds in north and west of Assessment Area**	**Abandoned fishponds in south-west of Assessment Area**
Diversity	Plant species diversity low due to regular disturbance to bunds. Faunal diversity recorded during surveys moderate to high.	Plant species diversity low. Habitats present suggest faunal diversity is likely to be fairly high, especially among birds.
Rarity	Fishpond habitats are common in the North-west New Territories.	Although fishponds are common in this part of Hong Kong, these ponds are developing into reedbed habitat which is comparatively rare.
Re-creatability	Easily re-creatable if a large area of suitable habitat exists.	Could be re-created on abandoned fishponds.
Fragmentation	Mostly unfragmented and continuous with a large area of similar habitat. A few fishponds in the Assessment Area are isolated by residential development.	Not fragmented.
Ecological linkage	Good ecological linkage to surrounding wetlands throughout the Deep Bay area.	Ecologically linked to Deep Bay wetlands, including reedbed habitat nearby at Mai Po Nature Reserve.
Potential value	High potential for enhancement with a suitable management regime.	High potential value with suitable management and protection.
Nursery/ breeding ground	Breeding ground for widespread amphibians and dragonflies. Foraging ground for egrets breeding in the nearby egretries.	No significant nursery or breeding ground known.
Age	Over 30 years.	Fishponds around 30 years old. Not known when these were abandoned but probably fairly recent (10-15 years).
Abundance/ Richness of wildlife	Abundant and diverse wetland community, especially for birds.	Abandoned fishponds and reedbeds support a relatively diverse faunal community, especially birds including significant numbers of Black-faced Spoonbills.
Ecological value	**Moderate to High**	**High**

Drainage Channels/Ditches

8.7.11 Small, narrow and polluted drainage channels and ditches are situated around the perimeter of the Project Area; several of these dry out during the dry season. These feed into slightly larger and deeper drainage channels between the fishponds in the Assessment Area, which stay wet through most of the year.

8.7.12 Drainage ditches in the Project Area contained a moderately high diversity of fauna, especially dragonflies. Total numbers of species for each group were: 21 birds, three amphibians, one reptile (although this is considered to be an ex-captive individual), 16 dragonflies and 13 butterflies. This included six birds (Great Cormorant, Grey Heron, Great Egret, Little Egret, Chinese Pond Heron and Pacific Swift) and one dragonfly (Scarlet

Basker) of conservation importance. Abundance, especially of waterbirds, was lower than in other nearby wetland habitats, however. Bird species of conservation importance were mostly recorded roosting in riparian trees, although the smaller ardeid species (Little Egret and Chinese Pond Heron) were also recorded foraging in small numbers within the drainage ditches. Pacific Swift was only recorded foraging overhead, and was very mobile between this and adjacent habitats. Dragonflies may be breeding in the drainage ditches, but the relatively high levels of organic pollution and low abundance of stream invertebrates suggest that many dragonflies do not breed in the habitat in the Project Area. Moderate faunal species diversity was recorded elsewhere in the Assessment Area, including 27 birds, one amphibian, one reptile, seven dragonflies and three butterflies, including 12 birds and one dragonfly of conservation importance.

Table 8-15 Ecological Evaluation of Drainage Channels/ Ditches.

Criteria	**Drainage channels/ ditches in Project Area**	**Other Drainage channels/ ditches in Assessment Area**
Naturalness	Artificially created drainage ditches subject to organic pollution from surrounding land-use.	Man-made drainage ditches and water channels, including concrete-lined channels. Polluted by surrounding land uses.
Size	Small and narrow (total area 0.81 ha, length about 1.7 km).	Some channels are moderate in size, width and depth (total area 4.46 ha, length about 3.0 km).
Diversity	Riparian vegetation relatively low in diversity. Aquatic invertebrate community low in diversity but riparian fauna moderately diverse (21 bird species, 3 amphibian species, 1 reptile species (non-native), 16 dragonfly species, 13 butterfly species).	Moderately diverse riparian vegetation where disturbance is low. Aquatic invertebrate community low in diversity due to high levels of pollution. Other faunal diversity moderate (27 bird species, 1 amphibian species, 1 reptile species, 7 dragonfly species, 3 butterfly species).
Rarity	A common habitat in Hong Kong. Six bird species of conservation importance recorded, mostly using riparian trees, and one dragonfly species of conservation importance.	A common habitat in Hong Kong. 12 bird species and one dragonfly of conservation importance recorded in channels or riparian trees.
Re-creatability	Habitat is easily re-creatable.	Habitat is easily re-creatable.
Fragmentation	Ditches within the Project Area are small but connected.	Not particularly fragmented.
Ecological linkage	Ecologically linked to nearby wetland habitats.	Strong ecological links top surrounding wetland habitats.
Potential value	Limited potential value, but could be enhanced if pollution was reduced and riparian vegetation was improved.	Ditches could be enhanced by suitable vegetation management and reduction in pollution load.

Criteria	Drainage channels/ ditches in Project Area	Other Drainage channels/ ditches in Assessment Area
Nursery/ breeding ground	Breeding ground for common amphibian and dragonfly species, although low diversity of dragonfly larvae in samples of aquatic fauna suggests most species do not breed in this habitat.	Breeding ground for common amphibian and dragonfly species.
Age	Fairly recent in their current form, created as part of Palm Springs development.	Over 30 years, more recent where modified for residential developments.
Abundance/ Richness of wildlife	Moderate abundance of common dragonfly species and exotic fish. Chinese Striped Terrapin recorded in riparian vegetation, but considered to relate to an escaped individual.	Moderate abundance of common dragonfly species and exotic fish. Some larger channels are used by foraging birds.
Ecological value	**Low**	**Low to moderate**

Woodland

8.7.13 The only secondary woodland present in the Assessment Area is located on the hill to the east of Mai Po Village. This is derived from *fung shui* woodland and is listed as an SSSI on the basis of the egretry which was previously established within the woodland. Faunal surveys were not conducted in the woodland habitats because this habitat shows no ecological linkage to the Project Area, therefore ecological impacts are very unlikely.

Table 8-16 Ecological Evaluation of Woodland Habitats.

Criteria	Woodland in Assessment Area
Naturalness	Semi-natural woodland habitat, partly derived from *fung shui* wood and plantation.
Size	Small, approximately 1.06 ha in Assessment Area.
Diversity	Moderate floral diversity. Faunal diversity lower than in woodlands elsewhere in Hong Kong, due to relative isolation of this patch.
Rarity	Secondary woodland is common in Hong Kong but *fung shui* woods and egretries are rare.
Re-creatability	Could be recreated in long-term if suitable resources are available. *Fung shui* wood would be difficult to recreate. Recolonisation by egrets would be difficult to achieve.
Fragmentation	Not fragmented within the Assessment Area, but this single block is isolated from similar habitats.
Ecological linkage	Some ecological linkage to Deep Bay via foraging egrets. Otherwise, poor linkage due to presence of villages and major road.
Potential value	Value could be enhanced by suitable management, especially if the number of breeding egrets could be increased.
Nursery/ breeding ground	A small egretry at Mai Po Lung and a few pairs of Chinese Pond Herons have recently colonised some trees on the edge of the woodland at Mai Po Village. Both egretries are in trees at the edge of the woodland, rather than within the woodland.

Criteria	**Woodland in Assessment Area**
Age	Fairly old due to *fung shui* functions.
Abundance/ Richness of wildlife	Moderate abundance of wildlife, but lower than in other woodland areas.
Ecological value	**Moderate**

Plantation

8.7.14 Several areas of roadside plantation are located within the Assessment Area. These are mostly narrow strips immediately alongside the road, but slightly larger patches of plantation are present in the north-east of the Assessment Area. The Mai Po Village egretry, formerly located in the Mai Po *fung shui* woodland, relocated to trees and bamboo in an area of plantation between Castle Peak Road and the San Tin highway, which is assessed separately from other plantations present nearby. Faunal surveys were not conducted within the plantations because, apart from the egretry, there is no apparent ecological linkage to the Project Area, therefore ecological impacts are unlikely.

Table 8-17 Ecological Evaluation of Plantation Habitats.

Criteria	**Plantation at Mai Po Village**	**Other Plantation in Assessment Area**
Naturalness	Artificial habitat created by planting of non-native tree species (*Eucalyptus citriodora*).	Habitat created by planting of various non-native tree species, especially roadside planting.
Size	This habitat patch is very small, around 0.43 ha.	Moderate, approximately 4.99 ha.
Diversity	Low plant species diversity and low diversity of other wildlife.	Fairly low plant species diversity dominated by non-native species.
Rarity	A common habitat type in Hong Kong but egretries are comparatively rare.	A common habitat type in Hong Kong. No rare species recorded.
Re-creatability	Habitat is re-creatable but recolonisation of the egretry would be difficult.	Easily recreated by planting of trees.
Fragmentation	One small isolated fragment.	Fragmented by urban land uses (especially roads).
Ecological linkage	Ecologically linked to the Deep Bay wetlands by foraging egrets. Some linkage with adjacent *fung shui* woodland.	Some linkage with woodland near Mai Po village and grassland near Shek Wu Wai.
Potential value	High potential value if the egretry can be maintained and increased.	Moderate if understorey allowed to mature and native woodland species colonise.
Nursery/ breeding ground	Important breeding colony of Little Egret (35 pairs in 2006), although no birds bred here during 2007.	No significant breeding ground recorded.
Age	Young.	Variable but fairly young.
Abundance/ Richness of wildlife	High abundance of egrets, low abundance of other wildlife.	Abundance/Richness of wildlife low.

Criteria	Plantation at Mai Po Village	Other Plantation in Assessment Area
Ecological value	**Moderate to high** due to presence of egretry; **Low** if egretry has relocated.	**Low to moderate**

Active and Inactive Agricultural Land

8.7.15 A few actively cultivated fields are located close to Mai Po Village with a variety of crops and fruit trees. A considerably larger area of abandoned agricultural land is located in the east of the Assessment Area. This land has been abandoned for a number of years, during which time the vegetation has come to be dominated by a relatively small number of common weed species, especially non-native species.

8.7.16 Faunal species diversity in the agricultural land was low, comprising seven bird and two dragonfly species in the active agricultural land and 16 birds, three dragonflies and seven butterflies in the inactive agricultural land. These included three birds (Little Egret, Cattle Egret and Chinese Pond Heron) and one butterfly (Danaid Egg-fly) of conservation importance. Faunal abundance was also low in these habitats.

Table 8-18 Ecological Evaluation of Active and Inactive Dry Agricultural Land.

Criteria	Active Dry Agricultural Land in Assessment Area	Inactive Dry Agricultural Land in Assessment Area
Naturalness	Man-made habitat used for crops.	Derived from natural succession on former cultivated land.
Size	Two small patches, totally 0.79 ha.	Moderate, about 6.15 ha.
Diversity	Species diversity very low due to regular human disturbance (7 bird species, 2 dragonfly species).	Low diversity of plant species, dominated by exotic weeds. Low faunal diversity (16 bird species, 3 dragonfly species, 7 butterfly species).
Rarity	Not a rare habitat in Hong Kong. Two bird species of conservation importance recorded.	A common habitat in Hong Kong. Three bird species and one butterfly species of conservation importance.
Re-creatability	Easily re-creatable.	Easily re-creatable.
Fragmentation	Two very small, isolated patches.	Adjacent developed areas create irregular shape with a degree of fragmentation.
Ecological linkage	Patch at Mai Po Village has some ecological linkage to nearby wetland habitats.	Weak ecological linkage to adjacent plantation of low ecological value.
Potential value	Low, especially due to small size.	Could be enhanced with appropriate vegetation management.
Nursery/ breeding ground	No significant breeding ground known.	No significant breeding ground known.
Age	Not known, apparently fairly recent.	Recently established since the abandonment of agriculture on the land.

Criteria	**Active Dry Agricultural Land in Assessment Area**	**Inactive Dry Agricultural Land in Assessment Area**
Abundance/ Richness of wildlife	Abundance/Richness of wildlife low.	Abundance/Richness of wildlife low.
Ecological value	**Low**	**Low**

Developed Areas, Bare Ground and Wasteland

8.7.17 The north-west of the Project Area is currently used for open storage and has very low ecological value. Adjacent parts of the Assessment Area are also used for open storage, while much of the rest of the Assessment Area is developed as village land (Mai Po Village and Wo Shang Wai), residential development (Palm Springs, Royal Palms and Maple Garden) and major roads (San Tin Highway and Castle Peak Road). The only wasteland within the Assessment Area is adjacent to the entrance to the Palm Springs/Royal Palms development.

8.7.18 Faunal surveys revealed a low species diversity in developed areas and bare ground within the Project Area (13 bird, four dragonfly and two butterfly species) and a slightly higher diversity elsewhere in the Assessment Area (37 bird, one dragonfly and one butterfly species). Only four species of conservation concern were recorded (Black Kite, Pacific Swift, Red-billed Starling and Collared Crow). Faunal abundance was also low in these habitats.

Table 8-19 Ecological Evaluation of Developed Area, Bare Ground and Wasteland.

Criteria	**Developed Area / Bare Ground in Project Area**	**Other Developed Area / Wasteland in Assessment Area**
Naturalness	Entirely man-made habitat, mostly open storage.	Entirely man-made habitat, including villages, residential developments and major roads.
Size	Medium, 4.79 ha.	Large, 82.36 ha.
Diversity	Species diversity low (13 bird species, 4 dragonfly species, 2 butterfly species).	Species diversity low (37 bird species, 1 dragonfly species, 1 butterfly species).
Rarity	Very common habitat in Hong Kong. One bird species of conservation importance.	Very common habitat in Hong Kong. Four bird species of conservation importance.
Re-creatability	Easily re-creatable.	Easily re-creatable.
Fragmentation	Not fragmented.	Slightly fragmented.
Ecological linkage	No significant linkage to other habitats.	No significant linkage to other habitats.
Potential value	Potential value is very low.	Potential value is very low.
Nursery/ breeding ground	No nursery or breeding ground known.	No nursery or breeding ground known.
Age	Fairly recently created from other habitats.	Variable, includes old villages and recent residential developments.
Abundance/ Richness of wildlife	Low diversity of wildlife.	Low diversity of wildlife.
Ecological value	**Very Low**	**Very Low**

8.8 Potential Ecological Impacts

8.8.1 Potential ecological impacts of the project are evaluated under the following categories:

- Direct impacts to habitats and species of conservation importance including habitat loss (both quantitative and qualitative) and reduction of species abundance and/or diversity. Such impacts may be permanent or temporary and may occur on-site and/or off-site.
- Indirect and secondary impacts to habitats and species of ecological significance including disturbance impacts, and loss of feeding, breeding and roosting habitats, loss or reduction of ecological linkages and functions and habitat fragmentation. Again, such impacts may occur on-site or off-site and may be temporary or permanent.
- Cumulative impacts are a form of indirect/secondary impact. However, because of the potential high ecological significance of cumulative impacts these are discussed separately below.

Direct Ecological Impacts

Habitat Loss

8.8.2 Complete development of the Project Area would result in the permanent loss of all habitats within the Project Area to be replaced by residential development. The significance of the loss of each habitat is considered in **Table 8-20**. Impacts to developed areas and bare ground are not included in this Table as these anthropogenic habitats are heavily disturbed on site, are of very low ecological value and support no species of conservation importance.

Table 8-20 Potential Direct Ecological Impacts to habitats in Project Area without mitigation measures.

Criteria	Impacts to Grassland	Impacts to Seasonal Marsh	Impacts to Freshwater Marsh/ Reedbed	Impacts to Drainage Channels/ Ditches
Habitat Quality	Low to moderate.	Low to moderate.	Moderate.	Low, due to high levels of organic pollution and previous channelisation.

Criteria	Impacts to Grassland	Impacts to Seasonal Marsh	Impacts to Freshwater Marsh/ Reedbed	Impacts to Drainage Channels/ Ditches
Species	Moderate species diversity (33 bird species, 9 dragonfly species, 10 butterfly species). The habitat does not appear to be important for species of conservation importance, but small numbers of some species (Black Kite, Oriental Pratincole, Pacific Swift, Zitting Cisticola and White-shouldered Starling) were recorded.	Moderate diversity of fauna (20 bird species, 11 dragonfly species, 1 butterfly species), including foraging Little Egret, Cattle Egret, Chinese Pond Heron, Black Kite, Little Ringed Plover, Pacific Swift and Red-billed Starling.	Moderate to high species diversity (35 bird species, 3 amphibian species, 12 dragonfly species, 6 butterfly species). Used by foraging ardeids, especially Little Egret (maximum count 48) and Cattle Egret (maximum count 14), but also Chinese Pond Heron and Black-crowned Night Heron. Other bird species of conservation importance recorded, including Black Kite, Oriental Pratincole, Little Ringed Plover, Pacific Swift and, Red-billed Starling. Moderately diverse dragonfly community supported, although species are common.	Moderate faunal diversity (21 bird species, 3 amphibian species, 1 reptile species, 16 dragonfly species, 13 butterfly species). Great Cormorant, Grey Heron, Great Egret, Little Egret, Chinese Pond Heron and Pacific Swift recording roosting in riparian trees or foraging in/over the drainage ditches. Dragonflies include Scarlet Basker of Local Concern. Chinese Striped Terrapin recorded but considered to be an escaped individual. Aquatic invertebrate community low in diversity.

Criteria	Impacts to Grassland	Impacts to Seasonal Marsh	Impacts to Freshwater Marsh/ Reedbed	Impacts to Drainage Channels/ Ditches
Size/Abundance	Fairly large area (11.05 ha) to be lost permanently. Fauna not particularly abundant (no large flocks recorded).	Five separate fragmented patches, totalling 0.69 ha. Faunal abundance low due to small size of habitat patches, and individuals must also be reliant on surrounding habitats (grassland, freshwater marsh).	Approximately 4.00 ha, a large area for this habitat type in Hong Kong. Birds sometimes moderately abundant, including foraging ardeids and up to 150 Yellow Wagtail, although numbers very variable between surveys.	Small in size (area 0.81 ha, length 1.7 km). Stream invertebrates moderately abundant but dominated by common, pollution-tolerant species. Some dragonfly species fairly numerous but these are common species in Hong Kong.
Duration	Permanent loss of existing habitat.	Permanent loss of existing habitat.	Permanent loss of existing habitat.	Permanent loss of existing habitat.
Reversibility	Habitat loss would be permanent.	Habitat loss would be permanent.	Habitat loss would be permanent.	Habitat loss would be permanent.
Magnitude	Existing habitat would be totally lost during development of the scheme.	Existing habitat would be totally lost during development of the scheme.	Existing habitat would be totally lost during development of the scheme.	Existing habitat would be totally lost during development of the scheme.
Overall Impact Severity	Loss of grassland habitats of **Low Significance** despite permanent loss because habitat is of comparatively low ecological value.	Impacts of **Low to Moderate Significance**. Any loss of wetland in the Deep Bay area is of significance and this site supports a moderate diversity of dragonflies and a few bird species, but the habitat patches are not large enough to support self-sustaining populations in the absence of adjacent habitats.	Impacts to freshwater marsh/reedbed of **Moderate Significance**. Freshwater marsh of this size is of importance in a Hong Kong context and within the Project Area was found to support a moderately diverse faunal community (especially dragonflies) with high potential value for species of conservation importance if allowed to mature into reedbed.	Impacts to existing water ditches of **Low Significance** despite permanent loss because ditches are small, polluted and of low ecological value.

Direct Impacts to Species of Conservation Importance

Vegetation

8.8.3 No floral species of conservation importance were recorded in the Project Area, therefore no direct impacts are predicted.

Mammals

8.8.4 No mammal species of conservation importance were recorded in the Project Area, therefore no direct impacts are predicted. No bat roosts are present in the Project Area which would be directly impacted. The only bat species recorded in the Project Area (Japanese Pipistrelle) is very common and widespread in Hong Kong; no other bat species are recorded in the Project Area, and it is not considered that any will be significantly impacted.

Birds

8.8.5 Fourteen species recorded in the Project Area are considered by Fellowes *et al*. (2002) to be of conservation importance in Hong Kong. Potential impacts to these species are considered in **Table 8-21**.

Table 8-21 Potential Ecological Impacts to bird species of conservation importance in Project Area, without mitigation measures.

Criteria	**Impacts to Roosting Water birds**	**Impacts to Foraging Ardeids**	**Impacts to Other Bird Species of Conservation Importance**
Habitat Quality	Riparian trees (*Macaranga tanarius* and *Melia azederach*) on northern perimeter of Project Area used as daytime roost by small numbers of waterbirds foraging on nearby fishponds.	Wetland habitats in Project Area used by small numbers of foraging ardeids; the habitats present on site are not optimal quality for ardeid species, however.	Other bird species of conservation importance recorded in Grassland, Seasonal Marsh and Freshwater Marsh/Reedbed.
Species	Species recorded roosting in the Project Area include Great Cormorant (maximum 5), Grey Heron (maximum 2), Great Egret (maximum 1), Black-crowned Night Heron (maximum 4). Also used by Little Egret, Cattle Egret and Chinese Pond Heron, including birds foraging on site.	Species recorded foraging in Project Area include Little Egret (maximum 48), Cattle Egret (maximum 14) and Chinese Pond Heron (maximum 7). Little Egret and Chinese Pond Heron also breed locally and some birds from these egretries probably forage in the Project Area.	Species recorded include Black Kite (maximum 5), Oriental Pratincole (maximum 11, only recorded during flight path surveys), Little Ringed Plover (maximum 1), Pacific Swift (maximum 22), Zitting Cisticola (maximum 1), Red-billed Starling (maximum 15) and White-shouldered Starling (maximum 2).

Criteria	**Impacts to Roosting Water birds**	**Impacts to Foraging Ardeids**	**Impacts to Other Bird Species of Conservation Importance**
Size/Abundance	Numbers present in Project Area very small in comparison to Deep Bay populations.	Numbers present within Project Area are small in comparison to Deep Bay populations, suggesting that habitat quality is not optimal.	Numbers of most species present in Project Area are small in comparison to Deep Bay populations. Reasonable numbers of Oriental Pratincole present on a single date. Numbers of Pacific Swift foraging over the Project Area are moderate. Numbers of Red-billed Starling are small compared to total Deep Bay population (peak count given in Carey *et al*. (2001) is 3000 birds).
Duration	Impacts would be permanent if trees are removed, otherwise temporary disturbance impacts during construction only.	Impacts resulting from habitat loss would be permanent.	Impacts resulting from habitat loss would be permanent.
Reversibility	Loss of trees would be easily reversed in the long-term by replacement planting, disturbance impacts would be temporary and reversible.	Habitat loss irreversible in absence of mitigation measures.	Habitat loss irreversible in absence of mitigation measures.
Magnitude	Magnitude would be low because alternative roost sites for these species are available around nearby fishponds.	Magnitude of impacts would be low due to relatively small numbers of individuals present and large area of suitable habitat nearby. Magnitude greater if the Project Area is also used for foraging by egrets breeding nearby (see section 8.8.23).	Magnitude of impacts would be low because number of individuals for all species is small relative to Deep Bay populations and a large amount of higher-quality habitat for all species remains nearby.

Criteria	Impacts to Roosting Water birds	Impacts to Foraging Ardeids	Impacts to Other Bird Species of Conservation Importance
Overall Impact Severity	Impacts are considered to be of **Low Significance** due to presence nearby of alternative roost sites and low number of individuals recorded roosting on site.	Impacts to foraging egrets, including birds from the nearby egretries, of **Low to Moderate Significance** given the small numbers of individuals present relative to the Deep Bay population. This includes impacts to three species: Little Egret, Cattle Egret and Chinese Pond Heron.	Impacts to Little Ringed Plover, Zitting Cisticola and White-shouldered Starling of **Low Significance** due to small numbers present within the Project Area. Impacts to Pacific Swift of **Low Significance** because this highly mobile, aerial species will not be significantly impacted by habitat changes within the Project Area, and there are no local breeding colonies (Carey *et al*. 2001). Impacts to Oriental Pratincole of **Low Significance** because, despite reasonable numbers present on a single date, this is a migratory species which is widespread in Deep Bay during the peak passage period and does not appear to be reliant on the habitats present in the Project Area. Impacts to Black Kite and Red-billed Starling of **Low Significance** because the numbers recorded within the Project Area are very small in comparison to the total Deep Bay population and these species are less disturbed by human activities.

8.8.6 The breeding population of Pacific Swift is of Local Concern (Fellowes *et al.* 2002), but there is no breeding population close to Wo Shang Wai and the individuals recorded within the Project Area are from the migrant population. It is unlikely that this highly mobile, aerial species would be significantly impacted by the development.

8.8.7 No other bird species are considered to be significantly impacted by the development of the Project Area. Large flocks of some species were recorded, with peak counts of 269 Little Swift, 85 Barn Swallow and 151 Yellow Wagtail recorded in the Project Area. These species are, however, widespread in Hong Kong and are very numerous in the Deep Bay wetlands during migration periods. Large numbers were present on only one date in each case (out of 17 surveys conducted), and it is not considered that the Project Area is of particular importance for any of these species, therefore impacts are not considered to be significant.

Herpetofauna

8.8.8 No species of conservation importance were recorded within the Project Area. There are very few records of Chinese Striped Terrapin in Hong Kong, but it is generally considered that the species is not native to Hong Kong and it is assumed that the individual present in the Project Area was of captive origin. No significant impacts to herpetofauna are predicted.

Dragonflies

8.8.9 Scarlet Basker was considered by Fellowes *et al.* (2002) to be of Local Concern, but has since increased in Hong Kong and is now widespread, especially in fishpond habitats (Wilson 2004). The species was recorded on two surveys in very low numbers (maximum two individuals) in drainage ditches within the Project Area. Impacts to this species are not considered to be significant due to the low numbers present and the current status of the species in Hong Kong. No other dragonfly species of conservation importance were recorded.

Butterflies

8.8.10 The only butterfly species of conservation importance recorded within the Project Area was Danaid Egg-fly, which is considered by Fellowes *et al.* (2002) to be of Local Concern. One individual of this species was recorded in the freshwater marsh. The larval foodplant for the species, *Portulaca oleracea*, was not recorded in the Project Area. Given the single record in unsuitable habitat and the absence of the larval foodplant it is not thought that Danaid Egg-fly breeds in the Project Area and no impacts to the species are predicted.

Table 8-22 Potential Ecological Impacts to Scarlet Basker and Danaid Egg-fly in Project Area, without mitigation measures.

Criteria	Impacts to Scarlet Basker	Impacts to Danaid Egg-fly
Habitat Quality	Scarlet Basker recorded in drainage ditches within Project Area. Species is considered by Wilson (2004) to favour weed-choked fishponds, suggesting that the species does not breed in these drainage ditches, although it may do so in the Freshwater Marsh.	Danaid Egg-fly recorded within Freshwater Marsh in Project Area; this is not typical habitat for the species, suggesting that it was not breeding locally. The larval foodplant (*Portulaca oleracea*) was not recorded in the Project Area.
Species	Scarlet Basker is listed by Fellowes *et al.* (2002) as being of Local Concern, but the species has since increased in Hong Kong (Wilson 2004).	Danaid Egg-fly is listed by Fellowes *et al.* (2002) as being of Local Concern.
Size/Abundance	Very small numbers recorded within the Project Area (totally 3 individuals recorded during nine surveys).	A single individual recorded within the Project Area during the surveys.
Duration	Loss of wetland habitat would be permanent without mitigation measures.	Impacts would be permanent if habitat is lost.

Criteria	Impacts to Scarlet Basker	Impacts to Danaid Egg-fly
Reversibility	Potential impacts easily reversed by provision of suitable habitat.	Impacts of habitat loss could be reversed by provision of suitable plant species for breeding.
Magnitude	Magnitude would be low because of small numbers present in relation to total Deep Bay population.	Species appears to be rare within the Project Area (single individual recorded), so impacts considered to be of very low magnitude.
Overall Impact Severity	Impacts are considered to be of **Low Significance** due to very small numbers of individuals present, suboptimal quality of habitats presence and current Hong Kong status.	Impacts considered to be of **No Significance** because a single individual was recorded in unusual habitat and the foodplant was not found, suggesting the sole record may be an individual passing through the Project Area.

Indirect Ecological Impacts

Habitat Loss

8.8.11 While there will be no direct habitat loss outside the Project Area, habitats in this area could potentially suffer from indirect impacts as a result of increased levels of human disturbance, pollution of downstream watercourses and increased changes in hydrology due to increased surface runoff. These are considered to potentially have an impact to only two habitats within the Assessment Area: active fishponds and drainage channels. Potential impacts to these two habitats are assessed in **Table 8-23**.

8.8.12 Other habitats in the Assessment Area (Freshwater Marsh/Reedbed, Seasonal Marsh, Developed Land, Wasteland, Woodland, Plantation, Grassland, Active and Inactive Dry Agricultural Land) are not considered to be impacted by the project because these are very small in area, of very low ecological value and/or show no ecological linkage to the Project Area (especially where isolated by residential developments and the San Tin Highway). Despite their high ecological value, impacts to inactive fishponds are also not considered to be significant because these are isolated from the Project Area by the existing Palm Springs residential estate.

Table 8-23 Potential Indirect Ecological Impacts to habitats in the Assessment Area without mitigation measures.

Criteria	Indirect Impacts to Fishponds	Indirect Impacts to Drainage Channels
Habitat Quality	Moderate to High.	Low to moderate.
Species	Used by a number of disturbance-sensitive waterbirds, including 26 species of conservation importance recorded during surveys.	27 bird species recorded, including 12 of conservation importance, but only Common Teal recorded downstream of site. Scarlet Basker (Local Concern) also recorded. Aquatic invertebrates low in diversity but high abundance of pollution-tolerant species.

Criteria	Indirect Impacts to Fishponds	Indirect Impacts to Drainage Channels
Size/Abundance	Drained fishponds attract large numbers of waterbirds, with fairly large numbers present on fishponds throughout the winter.	Drainage channels adjacent to the Project Area are fairly small and are used by relatively small numbers of wetland-dependent species. These channels feed into Deep Bay, which is of considerable importance to migratory waterbirds, fish and aquatic invertebrates.
Duration	Disturbance to nearby fishponds would be greatest during the construction phase of the project, especially while activities are being carried out on the northern part of the sites, closest to the fishpond area. After construction work finishes the presence of residents close to these ecologically-important fishponds would cause ongoing disturbance to sensitive waterbirds.	Pollution impacts will occur during the construction phase due to runoff of sediment and pollutants. In the absence of mitigation, pollution would continue during the operation phase due to surface runoff. Ongoing but short-term impacts to hydrology due to increased surface runoff from paved area during heavy rainfall.
Reversibility	Construction phase disturbance would be temporary, finishing when construction activities have ceased. Post-construction disturbance would be permanent and on-going.	Serious pollution events would be costly to clean up. Minor events would be more easily cleaned.
Magnitude	Degree of disturbance would be considerable during construction phase of project, especially while construction activities are being conducted at the northern edge of the Project Area, and during the period of presence of large waterbirds (dry season). In the absence of mitigation, post-construction disturbance would potentially also be quite high due to large numbers of residents close to disturbance-sensitive waterbirds.	Major pollution events, especially chemical pollution, would have a large impact on water quality in watercourses. Minor organic pollution and sediment runoff would have a lesser impact, especially in comparison to existing pollution levels. Increase in surface runoff would be small in comparison to existing water flow in Mai Po River.
Overall Impact Severity	In the absence of mitigation measures, disturbance to waterbirds in nearby fishponds during the construction and operation phases is considered to be of **Moderate to High Significance** due to the importance of these ponds to waterbirds and their proximity to the northern edge of the Project Area.	Impacts from pollution of watercourses downstream of the site are considered to be of **Moderate Significance** because the areas to be impacted are currently of low ecological value and are polluted from other sources. Changes in surface runoff of **Low Significance** because the increase in water flow would be small in comparison to existing flow in the channel.

Pollution of Watercourses and Deep Bay

8.8.13 Under current conditions the Project Area is drained by small drainage ditches around the perimeter, as well as a larger drainage channel at the northern boundary of the Project Area. These ditches and channels feed into the Deep Bay wetland ecosystem and ultimately feed into Deep Bay; areas downstream of the Project Area (and thus potentially impacted) include parts of the Mai Po Inner Deep Bay Ramsar Site, the Inner Deep Bay SSSI and fishponds within the WCA. Mai Po Nature Reserve is not directly downstream of the Project Area (and therefore not directly impacted), but is connected to Inner Deep Bay. The bay and surrounding wetlands are very important ecologically, with diverse habitats and a large number of threatened species, including some globally-threatened species. This importance is recognised internationally by the designation of Mai Po Inner Deep Bay Ramsar Site. Pollution of the wetland ecosystems would have a detrimental impact on the ecological value of the area.

8.8.14 Potential sources of pollution from the Project Area into surrounding watercourses include sediments released during site excavation, chemical waste from mechanical equipment, especially oils and lubricants, and domestic discharge, including sewerage. Further details of the possible sources of water pollution are included in Chapter 5. Details of potential ecological impacts are included in **Table 8-24**.

Table 8-24 Potential Ecological Impacts from pollution of watercourses and Deep Bay without mitigation measures.

Criteria	Pollution Impacts to Watercourses and Deep Bay
Habitat Quality	Watercourses downstream of the Project Area are of relatively low ecological value due to moderate levels of pollution. Deep Bay is of high ecological value.
Species	Watercourses in Project Area contain a low diversity of fish and invertebrates but a high abundance of pollution-tolerant species. Similar conditions are present in other watercourses nearby. Deep Bay contains a high diversity and abundance of faunal species, including many species of conservation interest. Mangrove and intertidal ecosystems in Deep Bay are important.
Size/Abundance	Watercourses draining the Project Area are small, only a few metres wide. Deep Bay itself is large.
Duration	Construction phase impacts potentially include sedimentation from soil runoff, release of contaminants during excavation, chemical waste and domestic effluent. Sources of water pollution during the operational phase would be from waste water discharge from residences.
Reversibility	Significant pollution events could be cleaned up to some degree but this would be costly and would have long-term impacts on ecosystems.
Magnitude	Pollution events would be large in watercourses draining the Project Area, although these watercourses already suffer from moderate levels of pollution. The small size of the Project Area relative to Deep Bay should ensure that impacts to the bay will be of small magnitude, especially if sources of pollution can be rapidly identified and contained.

Criteria	Pollution Impacts to Watercourses and Deep Bay
Overall Impact Severity	Impacts to watercourses adjacent to and downstream of the site are considered to be of **Moderate Significance** because the areas to be impacted are currently of low ecological value and are polluted from other sources. Impacts to Deep Bay are considered to be generally of **Low Significance** due to the small size of the site relative to the size of the bay, but serious pollution events (especially chemical pollution) into the bay would be of **Moderate to High Significance.**

Habitat Fragmentation

8.8.15 The Project Area is on the edge of the Deep Bay wetlands ecosystem and does not provide important ecological linkages between surrounding habitats. No fragmentation of habitats is predicted by development of the Project Area.

Cumulative Ecological Impacts of Habitat Loss

8.8.16 There will be cumulative ecological impacts resulting from the development, consisting of the loss of wetlands around the Deep Bay ecosystem; without appropriate action, this would lead to an overall reduction in wetland area around Deep Bay and an abrupt interface between the wetland ecosystem and adjacent human development. This issue has been addressed by the Town Planning Board by designation of the WBA, for which the planning intention 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' (TPB PG-No. 12B). Within the Project Area this planning intention is supported by zoning of the Project Area as OU(CDWRA), for which the planning intention is 'to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds through residential and/or recreational development to include wetland restoration area. It is also intended to phase out existing sporadic open storage and port back-up uses on degraded wetlands' (OZP No. S/YL-MP/6).

8.8.17 The overall ecological impact of the loss of the wetland fringe at Deep Bay would be of high significance, but the Project Area at Wo Shang Wai would have a small contribution towards this and the impact from the Project Area alone, in the absence of any mitigation, is considered to be of **Low Significance** in a Deep Bay context.

Indirect Impacts to Species of Conservation Importance in the Assessment Area

Vegetation

8.8.18 No plant species of conservation importance were recorded in the Assessment Area. Permanent impacts to nearby vegetation could arise as a result of hydrological changes, although it is considered that alterations to the Project Area, which is largely terrestrial habitat at the edge of and extensive wetland ecosystem, will not have significant impacts in this way.

8.8.19 Construction-phase impacts to nearby vegetation could also arise from the deposition of dust on leaf surfaces. As there are no species of conservation importance or woodland/shrubland habitats of high ecological value in the Assessment Area, and because the duration of this impact will be limited the construction period, these impacts are considered to be of **Low Significance**. Good site practice during the construction of the development will help to further reduce the severity of these impacts.

Mammals

8.8.20 Terrestrial mammal densities in the Assessment Area appear to be very low, and it is not considered that any significant disturbance impacts will occur to these populations. The Project Area is not considered to represent a significant link between any habitats of importance to mammal populations, therefore it is not considered that any fragmentation of mammal habitats will arise from the development. There will be no impacts to bat roosts outside the Assessment Area, and the only species recorded foraging in the Project Area is Japanese pipistrelle, which is very common and widespread.

Birds

Disturbance of Water birds

8.8.21 Fishponds to the north of the Project Area are used by comparatively large numbers of waterbirds; 26 species recorded during the transect surveys are listed by Fellowes *et al.* (2002) as species of conservation importance. Many of these species are prone to disturbance by human activity, especially visual and noise disturbance from the presence of humans and vehicles nearby and, to a lesser degree, from night-time glare and dust emissions. Disturbance impacts will be greatest during the winter period, when the largest number of disturbance-sensitive waterbirds (especially ardeids and spoonbills) are present in the area. The fishponds would be particularly impacted by disturbance during the construction phase, when there would be high levels of vehicle activity in the Project Area associated with land formation, piling and construction activities. The presence of dogs associated with the construction site would also provide a source of disturbance to waterbirds. Disturbance during the operation phase would be less, although this would still be significant if human activity was located at the northern perimeter of the Project Area. Light pollution at night would continue to provide a potential source of disturbance during the operation phase. Potential impacts of the development are considered in **Table 8-25**.

Table 8-25 Potential Disturbance Impacts to waterbirds of conservation importance in Assessment Area without mitigation measures.

Criteria	Disturbance Impacts to Water birds of Conservation Importance
Habitat Quality	A high diversity of disturbance-sensitive waterbirds of conservation importance use fishpond habitats to the north of the Project Area.
Species	22 bird species of conservation importance recorded on the fishponds, including (with maximum counts during transect surveys in parentheses): Little Grebe (3), Great Cormorant (503), Grey Heron (11), Great Egret (22), Intermediate Egret (4), Little Egret (123), Cattle Egret (60), Chinese Pond Heron (13), Black-crowned Night Heron (1), Striated Heron (not on transects), Black-faced Spoonbill (9), Northern Pintail (21), Common Teal (11), Eurasian Wigeon (27), Osprey (1), Black Kite (9), Little Ringed Plover (1), Pied Kingfisher (1), White-throated Kingfisher (2), Red-billed Starling (821), White-shouldered Starling (not on transects) and Collared Crow (2). Also White-bellied Sea Eagle, Oriental Pratincole, Black-headed Gull and Pacific Swift were recorded flying through the area.

Criteria	Disturbance Impacts to Water birds of Conservation Importance
Size/Abundance	High abundance of some species, notably Red-billed Starling, Great Cormorant and Little Egret.
Duration	Disturbance to nearby fishponds would be greatest during the construction phase of the project, especially while activities are being carried out on the northern part of the Project Area, closest to the fishpond area. Disturbance would be reduced after construction work finishes. Some permanent human disturbance may occur where residential blocks are closest to existing fishponds. Possibility of light disturbance impacts to roosting or night-time foraging waterbirds during the operational phase.
Reversibility	Construction phase disturbance would be temporary, finishing when construction activities have ceased. Post-construction disturbance would be permanent and on-going.
Magnitude	Degree of disturbance would be considerable during construction phase of project, especially while construction activities are being conducted at the northern edge of the Project Area, and during winter when greater numbers of large waterbirds are present. Post-construction disturbance would be small as human activity in the vicinity of the fishponds would be small, and existence of the wetland buffer would create a buffer between the existing fishponds and the source of human disturbance.
Overall Impact Severity	In the absence of mitigation measures, construction-phase disturbance to waterbirds in nearby fishponds is considered to be of **Moderate to High Significance** due to the importance of these ponds to waterbirds and their proximity to the northern edge of the Project Area. Post-construction disturbance impacts to fishponds are considered to be of **Moderate Significance** if human activity and night-time lighting are present close to fishpond areas.

Impacts to Egretries

8.8.22 The Project Area lies within the potential foraging distance of three egretries, at Mai Po Village (250 m from the Project Area), Mai Po Lung (1250 m from the Project Area) and Tam Kon Chau (650 m from the Project Area). Assessment of the potential impacts to these egretries is given in **Table 8-26**. Flight path data do not suggest that birds from any egretry pass over the Project Area in significant numbers on their way to foraging sites beyond the Project Area. Furthermore the presence of the Palm Springs and Royal Palms residential developments would already impact flight paths across the Wo Shang Wai Project Area.

8.8.23 Loss of foraging grounds would potentially impact breeding egrets by a reduction in foraging efficiency, especially if birds were forced to fly further to find food. Small numbers of ardeids were recorded foraging within the Project Area; during the egret breeding season (March – July) the peak count of Little Egret was of 20 birds, while the peak count of Chinese Pond Heron was of seven birds. Observations and flight path data do not confirm whether these individuals were breeding at the nearby egretries or whether these were non-breeding birds, but a precautionary approach has been adopted by considering that some or all of these individuals were breeding birds from either the Mai Po Village or Tam Kon Chau egretry. It is highly unlikely that birds from Mai Po Lung forage within the Project Area, due to the distance between the two sites and the presence of hills along the flight path, providing a significant obstacle that egrets would be required to avoid.

8.8.24 The other potential impact to egretries would be through obstruction of major flight paths between the egretry and important foraging grounds. Very small numbers of egrets were recorded flying over the Project Area on flight path surveys during the egret breeding season, and these did not appear to be following regular flight paths. Previously published data (Anon. 1997) also suggest that egrets do not fly over the Project Area in significant numbers, at least from the Mai Po Village egretry. There is little suitable foraging habitat beyond the Project Area (especially for birds from the Mai Po Lung and Tam Kon Chau egretries) which would require a route over the Project Area to be followed. Small numbers of individuals may fly over the Project Area infrequently, however, so there would be a small impact on flight paths from the egretries. This impact would be greater if buildings within the Project Area are tall, especially if these are significantly taller than the surrounding residential estates.

8.8.25 No direct impacts to the egretries will occur as a result of changes in the vegetation forming the structure of the egretries. Increased traffic along Castle Peak Road during construction and operation of the Project Area would pass the Mai Po Village egretry but egrets breeding at this Project Area are tolerant of high levels of disturbance from traffic on San Tin Highway and Castle Peak Road, and it is not considered that the increased disturbance from traffic will have a significant disturbance impact. Some disturbance may occur to nesting birds at Mai Po Village and Tam Kon Chau from noise generated during construction, but no disturbance impacts from the Project Area are anticipated during the operation phase.

Table 8-26 Potential Ecological Impacts to egretries in Assessment Area without mitigation measures.

Criteria	Impacts to Mai Po Village Egretry	Impacts to Other Egretries
Habitat Quality	Historically a high quality site, although Little Egrets did not breed at the main site during 2007.	Egretries at Mai Po Lung and Tam Kon Chau contain reasonable numbers of pairs of Little Egret and Chinese Pond Heron.
Species	Egretry used by Little Egret and Chinese Pond Heron. Formerly used by Cattle Egret (2004), Great Egret (2003) and Black-crowned Night Heron (2002).	Egretries used by Chinese Pond Heron and Little Egret.
Size/Abundance	35 pairs of Little Egret and 50 of Chinese Pond Heron in 2006 (Anon. 2006c).	Tam Kon Chau: 37 pairs of Chinese Pond Heron in 2006 Mai Po Lung: 12 pairs of Little Egret and 74 of Chinese Pond Heron in 2006 (Anon. 2006c).
Duration	Impacts would be restricted to the breeding season of egrets, between March and July. Significant impacts, if they were to occur, could cause permanent abandonment of the egretry. Noise disturbance at the egretry would be confined to the construction phase.	Impacts would be restricted to the breeding season of egrets, between March and July. Significant impacts, if they were to occur, could cause permanent abandonment of the egretry. Noise disturbance at the egretries would be confined to the construction phase.
Reversibility	Abandonment of the egretry would be difficult to reverse.	Abandonment of an egretry would be difficult to reverse.

Criteria	Impacts to Mai Po Village Egretry	Impacts to Other Egretries
Magnitude	Little Egrets forage in the Project Area during the breeding season (March-July), with a peak count of 20 during this period. Small numbers of Chinese Pond Heron also forage in the Project Area (peak count seven birds). Both counts may include birds from Mai Po Village egretry. Major flight paths from the egretry to forage grounds do not appear to pass through the Project Area, although small numbers of egrets do fly through the Project Area during the breeding season. Noise disturbance is not considered to be large as birds in the egretry are tolerant of high levels of disturbance from nearby San Tin highway.	Some Chinese Pond Heron foraging in the Project Area during the breeding season may come from the Tam Kon Chau egretry. Birds from Mai Po Lung are not thought to forage in the Project Area because of the distance from the egretry and the presence of hills on the flight path presenting an obstacle to egret movement. Noise disturbance may occur at Tam Kon Chau, but egrets elsewhere seem to be tolerant of moderate noise levels.
Overall Impact Severity	Impact considered to be of **Low to Moderate Significance**, mostly due to loss of foraging habitat. There appear to be no significant flight paths from the egretry over the Project Area, and impacts to these are considered to be of **Low Significance**. **No direct impact** to egretry due to habitat loss or disturbance. Noise disturbance considered to be of **Low Significance** because of distance between egretry and Project Area, and tolerance of egrets to moderate noise levels.	Potential impacts to Mai Po Lung egretry **Not Significant** because there is no evidence of impacts to either foraging birds or flight paths. Impacts to Tam Kon Chau egretry of **Low Significance** because small numbers of birds from this site may forage in the Project Area, due to the proximity of the egretry. **No Significant Impact** to flight paths from Tam Kon Chau egretry because there appear to be no important flight paths over the Project Area. Noise disturbance to Tam Kon Chau considered to be of **Low Significance** because of distance between egretry and Project Area, and tolerance of egrets to moderate noise levels.

Impacts to Flight Paths of Non-breeding and Migratory Birds

8.8.26 Impacts to flight paths of non-breeding birds (including non-breeding resident species and migratory bird species) would arise if buildings created a barrier across flight paths used by birds on a regular basis, when flying between foraging areas and/or roost sites. The flight path surveys did not suggest that the Project Area is located on any major flight paths, but the northern part of the Project Area appears to be reasonably important for local movement of waterbirds between fishpond areas to the north. Construction in the northern part of the Project Area would impact these waterbirds to some degree. Birds in the southern part of the Project Area are recorded flying at higher altitude to avoid buildings in the adjacent residential estates. Flight paths in this area would be impacted if buildings were significantly higher than those in the existing residential estates; this would be the case if buildings were constructed to six storeys, as permitted by the OZP (OZP No. S/YL-MP/6). High levels of noise during the construction phase may also cause low-level disturbance to important flight paths nearby.

8.8.27 Waterbirds and raptors can often be recorded flying over developed areas, including Palm Springs and Royal Palms, towards wetland habitats suitable for foraging. Certain raptor species are also observed soaring over developed land hunting for potential prey. The Project Area is surrounded on three sides by developed land, therefore it is not anticipated that there will be a significant cumulative impact to flight paths through loss of undeveloped land unless the new buildings are significantly taller than those already present in the adjacent residential estates.

8.8.28 Most other species recorded flying over the Project Area in reasonable numbers during the surveys are common species of open country and anthropogenic habitats. No regular flight paths for these species were recorded within the Project Area and it is not considered that they will be significantly impacted by development of the Project Area. Large numbers of swifts (Little and Pacific Swift) and swallows (Barn and Red-rumped Swallow) were recorded during the flight path surveys. These species forage in flight, are highly mobile and manoeuvrable while foraging and do not tend to follow particular flight paths. All four species are abundant in Deep Bay, especially during migration periods, and can sometimes be found foraging over developed land; Little Swift and Barn Swallow commonly breed on buildings in Hong Kong. Despite the large numbers recorded on flight path surveys, it is not considered that flight paths these species will be significantly impacted.

8.8.29 Apart from egrets, for which the impacts are covered in Section 8.8.24, no other colonies of birds breed close to the Project Area that would be significantly impacted by impedance of flight paths to and from the breeding sites.

Table 8-27 Potential Ecological Impacts to non-breeding bird flight paths without mitigation measures.

Criteria	Impacts to Non-breeding Bird Flight paths
Habitat Quality	Small numbers of birds were recorded flying over the Project Area during the dry season surveys but flight paths through the area are partly impeded by the presence of existing residential developments.
Species	42 bird species recorded during flight path surveys, including 15 species of conservation importance.
Size/Abundance	A few wetland-dependent species recorded flying over the northern part of the Project Area in reasonable numbers (e.g. total counts of 197 Great Cormorant, 128 Little Egret, 34 Chinese Pond Heron, 102 Black Kite); see **Figure 8.4**. Single large flocks of Black-headed Gull (70) and Red-billed Starling (50) also recorded, but these apparently not regular in Project Area.
Duration	Any obstruction to flight paths below the level of buildings would be permanent; this applies particularly to Flight path 1, where most birds were recorded below 20 m. All flight paths may be temporarily disrupted by noise disturbance during construction.
Reversibility	Obstruction of flight paths below the level of buildings would be permanent. Flight paths above the level of buildings may be temporarily impacted during the construction phase but this would subsequently be reversed.

Criteria	Impacts to Non-breeding Bird Flight paths
Magnitude	No clearly-defined and regular flight paths exist over the Project Area, suggesting that most birds passing over the Project Area do so opportunistically. Most individuals flying over the Project Area passed over the northern and west edge of the Project Area, along Flight paths 1, 2, 4 or 5 (**Figure 8.4**); impacts of development in this area would be of greater magnitude than elsewhere within the Project Area. Birds flying over the southern part of the Project Area are flying higher to pass over existing residential developments. Any development in this area will have no impact on flight paths, provided it does not significantly exceed the height of the existing developments.
Overall Impact Severity	Impacts considered of **Low to Moderate Significance** for development in the south of the Project Area, where few birds were recorded and these were usually relatively high. The magnitude of impacts in this area would be dependent on the height of the buildings relative to the surrounding residential estates. Impacts of **Moderate Significance** if development occurs on the northern or northwestern part of the Project Area, particularly along Flight paths 1, 2, 4 and 5, where more birds were recorded and these were often flying below 20 m above the ground. **No Significant Cumulative Impact** predicted to flight paths as a result of loss of undeveloped land adjacent to existing residential estates, because bird species are also recorded flying over existing developments.

Impacts to Other Fauna

8.8.30 Other fauna are less prone to disturbance impacts than birds, and are thus less likely to be affected by indirect impacts arising from the residential development. Species of conservation importance are present in very low numbers in the Assessment Area (single Scarlet Basker and Danaid Egg-fly recorded away from the Project Area) and indirect impacts to these species are not considered to be significant because, as in the Project Area, habitats present are not of optimal quality and a very small number of individuals were recorded, suggesting populations are small.

8.8.31 Aquatic fauna downstream of the Project Area are potentially impacted by soil runoff or pollution; these potential impacts are discussed in **Table 8-24**.

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

8.9.1 **Table 8-28** summarises the findings of the potential impacts identified in Section 8.8. Impacts identified with a Moderate or High Significance would require mitigation measures to be carried out in order to bring these impacts to acceptable levels.

Table 8-28 Summary of Potential Ecological Impacts in the absence of Mitigation Measures.

Description of Potential Impact	**Significance of Impact**
Direct loss of Habitats in Project Area	
Loss of Grassland Habitats	Loss of habitat of **Low Significance** due to low value of habitat and low abundance of species of conservation importance.
Loss of Seasonal Marsh	Impacts to habitat of **Low to Moderate Significance** due to small size, ephemeral nature and high fragmentation of habitat. Impacts to species utilising the habitat of **Low to Moderate Significance**, mostly due to impacts to moderately diverse dragonfly fauna.
Loss of Freshwater Marsh/Reedbed	Habitat loss of **Moderate Significance** because of importance of the habitat in a Hong Kong context and high potential value of the habitat.
Loss of Drainage Channels/ Ditches	Impacts of **Low Significance** due to low existing value of the ditches in the Project Area, and minimal impact to riparian trees used by roosting waterbirds.
Direct Impacts to Species of Conservation Importance	
Impacts to Vegetation	**No Significant Impact** because no species of conservation importance present in the Project Area.
Impacts to Mammals	**No Significant Impact** because no species of conservation importance present in the Project Area.
Impacts to Roosting Water birds	Impacts to waterbirds roosting at the northern edge of the Project Area of **Low Significance** due to small numbers of birds present and existence of other suitable roosting sites.
Impacts to Foraging Ardeids	Impacts from loss of foraging habitat of **Low to Moderate Significance** due to the relatively small number of individuals involved, the suboptimal quality of the habitat and the presence of other suitable foraging locations nearby.
Impacts to Other Bird Species	Impacts to other bird species of conservation importance (Black Kite, Oriental Pratincole, Little Ringed Plover, Pacific Swift, Zitting Cisticola, Red-billed Starling and White-shouldered Starling) of **Low Significance** because the Project Area does not provide habitat for locally-important populations of any of these species.
Impacts to Herpetofauna	**No Significant Impact** because no species of conservation importance present in the Project Area.
Impacts to Scarlet Basker	Impacts of **Low Significance** because of very small numbers present in Project Area and current status of the species in Hong Kong.
Impacts to Danaid Egg-fly	**No Significant Impact** because no evidence that the species breeds within the Project Area.

Description of Potential Impact	Significance of Impact
Indirect Impacts to Habitats in Assessment Area (outside Project Area)	
Disturbance Impacts to Adjacent Fishponds	Impacts of disturbance to waterbirds in nearby fishponds of **Moderate to High Significance** due to the importance of these ponds to waterbirds and their proximity to the northern edge of the Project Area.
Indirect Impacts to Off-site Drainage Channels	Impacts from pollution of watercourses downstream of the Project Area are considered to be of **Moderate Significance**. Changes in surface runoff of **Low Significance** because magnitude small in comparison to existing flow in the channel.
Indirect Impacts to Other Habitats in Assessment Area	**No Significant Impacts** to other habitats because these are small and/or show no ecological linkage to the Project Area.
Pollution Impacts to Watercourses and Deep Bay	Impacts to watercourses downstream of the Project Area are considered to be of **Moderate Significance**. Pollution impacts to Deep Bay generally of **Low Significance** due to the small size of the Project Area relative to the size of the bay, but serious pollution events (especially chemical pollution) into the bay would be of **Moderate to High Significance.**
Impacts from Habitat Fragmentation	**No Significant Impacts** because Project Area is on the edge of the wetland ecosystem and does not form a link between other habitats in the area.
Cumulative Impacts of Wetland Loss	Overall impacts would be of High Significance if Deep Bay ecosystem was compromised. Contribution from the Project Area would be of **Low Significance.**
Indirect Impacts to Species of Conservation Importance	
Indirect Impacts to Vegetation	**No impacts** to species of conservation importance because none present in Assessment Area. Impacts of **Low Significance** to other vegetation during construction phase due to dust deposition.
Indirect Impacts to Mammals	**No Significant Impact** because no species of conservation importance recorded in Assessment Area, and low density mammal populations present.
Disturbance to Water birds of Conservation Importance	Construction-phase disturbance of **Moderate to High Significance** due to the importance of fishponds to waterbirds and their proximity to the northern edge of the Project Area. Post-construction disturbance impacts of **Moderate Significance** if human activity is present close to fishpond areas.

Description of Potential Impact	Significance of Impact
Impacts to Mai Po Village Egretry	Impacts to Mai Po Village egretry of **Low to Moderate Significance.** Flight paths would be impacted by development in the north of the Project Area, in which case impacts would be of **Low to Moderate Significance.** Noise disturbance at egretry during construction considered to be of **Low Significance.**
Impacts to Other Egretries	Impacts **Not Significant** at the Mai Po Lung egretry, as there is no evidence that these birds forage in the Project Area or fly over to reach other foraging sites. **No Significant Impact** from noise disturbance. Impacts to Tam Kon Chau Egretry of **Low Significance** because some birds may forage within the Project Area and a few birds fly low over the north of the Project Area. Noise disturbance considered to be of **Low Significance.**
Impacts to Non-breeding Bird Flight paths	Impacts of **Low to Moderate Significance** for development in the south of the Project Area. Impacts of **Moderate Significance** in the northern or northwestern part of the Project Area, particularly along Flight paths 1, 2, 4 and 5.
Impacts to Other Fauna	Only species of conservation importance recorded were Scarlet Basker and Danaid Egg-fly, with only single individuals recorded of each. Overall **No Significant Impact** to herpetofauna, dragonflies, butterflies or aquatic invertebrates.

Mitigation for Loss of Habitats in Project Area

8.9.2 Development of the Project Area results in an unavoidable loss of 4.00 ha of freshwater marsh/reedbed and 0.69 ha of seasonal marsh. Loss of these wetlands habitats from the Deep Bay ecosystem would have a low to moderate ecological impact, and require mitigation. Impacts to other habitats are considered to be of low significance and do not require mitigation measures.

8.9.3 The freshwater marsh/reedbed and seasonal marsh within the Project Area are located away from adjacent wetland habitats; retention of these habitats in their existing locations would limit potential development of the site, and would lead to fragmentation of the wetland habitats, with a negative ecological impact. As such, it is considered that retention of these habitat patches is not feasible. Mitigation through restoration of an equivalent area of wetland habitat adjacent to existing wetland habitats (outside the Project Area) is more appropriate, as this would prevent the loss of wetland in the Project Area and would permit enhancement of this wetland through appropriate management and by increasing ecological linkages with adjacent wetland habitats contiguous with the Deep bay wetland ecosystem. Part of the proposed development involves the creation of wetland habitat in a Wetland Restoration Area (WRA). This restoration of wetland habitat is encouraged under Town Planning Board Guideline 12B (TPB PG-No. 12B) for sites within the WBA and is a requirement for developments on land zoned as OU(CDWRA), as is the case at Wo Shang

Wai (OZP No. S/YL-MP/6). The total area of land on Project Area designated to form the WRA is 4.74 ha; this accords with the "No-net-loss in Wetland" principle set out in Town Planning Board Guideline 12B. The design of wetland within the WRA is such that it is anticipated that the overall wetland function of the Project Area will be increased in comparison to existing conditions, especially for those species which are listed as targets in the WRA design (Little Egret, Cattle Egret and Chinese Pond Heron).

8.9.4 Full details of the habitats to be provided by the WRA and management approaches to create and maintain these habitats are given in the Wetland Restoration Plan (WRP) in Appendix H. Key features of the WRA include:

- Creation of 4.74 ha of wetland habitats, including reedbeds, large open water bodies (for wetland birds) and small fish-free open water bodies (for dragonflies).
- Location of WRA at northern edge of the Project Area will allow integration with adjacent wetland habitats (fishponds and drainage channels), allowing the free movement of organisms. Wetland habitats currently present in the Project Area are found in small patches with a degree of fragmentation from each other and from surrounding wetlands.
- Maximisation of the interface between the WRA and adjacent wetlands along most of the length of the northern boundary of the Project Area, to encourage free movement of organisms (especially waterbirds) between the WRA and surrounding wetlands.
- Inclusion of wetland-dependent bird species as targets to ensure that habitats provided will mitigate for the species significantly impacted by the project.
- Creation of small water bodies free from fish, suitable for colonisation by dragonflies and amphibians, to enhance the diversity of habitats present for dragonfly and amphibian communities.
- Planting of trees and shrubs to enhance the site by provision of roosting sites for large waterbirds (cormorants and ardeids) using the WRA and adjacent fishponds.
- Inclusion of short grass habitats on bunds to provide habitat for foraging Cattle Egrets.
- Creation of a diversity of habitats on bunds and islands, including short grass, tall grass/shrubs, trees/shrubs and non-vegetated islands.
- Prevention of public access into the WRA to avoid disturbance of birds using the WRA and adjacent fishponds.

8.9.5 The habitats created in the WRA are not directly equivalent to the habitats currently present in the Project Area (for example there is no open water currently present), but are considered to provide suitable conditions for a variety of species, including the target species. Reedbed habitats will be allowed to mature, making these habitats available for reedbed-dependent species which are currently not present in the Project Area and are localised in Hong Kong and Deep Bay. The overall wetland area is equivalent to that already present in the Project Area, while the wetland function is considered to represent an increase over current conditions through reduction in fragmentation, integration with adjacent wetland habitats, greater diversity of habitats (reedbed, open water of various depths, fish-free ponds, short grass, trees/shrubs and bare islands) and increased maturity of ecologically-important reedbed habitats.

8.9.6 Creation of the WRA would fully compensate for wetland habitat loss during the operational phase. However, temporary loss of wetland habitats would be unavoidable during the construction of the WRA. In order to minimise the duration and magnitude of the temporary wetland loss, construction of the WRA would be conducted at the start of the project, before the construction of the residential areas. Creation of the WRA habitats is expected to occur during the first year of construction. Establishment (including wetland planting) will take another year, during which time the WRA will be opened to surrounding wetland habitats to enhance integration with these other wetlands. During the construction of the residential areas, the WRA will be screened from the rest of the Project Area to prevent disturbance impacts from the ongoing construction work. Residual impacts from temporary loss of wetland are considered to be of low significance because of the short-term nature of the habitat loss (one wet season for construction of the WRA), the relatively small area of habitat involved and the proximity to other wetland habitats, allowing rapid recolonisation by wetland-dependent species.

Mitigation for Loss of Ardeid Foraging Habitat

8.9.7 Development of the Project Area would directly impact Little Egret, Cattle Egret and Chinese Pond Heron through loss of wetland habitats suitable for foraging. Loss of wetland foraging habitat for these three species will be compensated by the provision of suitable habitat in the WRA, for which these three species will be targets. Further details regarding the provision and management of suitable habitats can be found in **Appendix H**.

8.9.8 There will inevitably be some short-term impact to these species through loss of foraging habitat during the construction and establishment of the WRA. This will be minimised by creating the WRA at the start of the construction period (during the first year of site occupation), so that wetland habitat loss is limited to the first few months of site occupation. After creation (during establishment) the WRA will be opened to adjacent wetland habitats to allow integration between these and the WRA and to provide habitat for ardeids during the remainder of the construction period.

8.9.9 The newly-created WRA will be subject to disturbance from elsewhere within the Project Area. This disturbance will be greater than is currently present in the Project Area and will be greater during the construction period of the residential area. Methods will be adopted to minimise the potential disturbance impacts to the WRA, including prevention of public access into the WRA, the design and orientation of buildings, landscape planting and road layout. Disturbance during the construction period will be minimised by erection of a visual barrier between the WRA and the construction site. For further details see section 8.9.21. Techniques adopted to minimise disturbance to fishponds, including lack of public access into the WRA and aspects of the site layout, will also apply to the minimisation of disturbance within the WRA. For further details, see Sections 8.9.14-8.9.18.

Mitigation for Direct Impacts to Other Species

8.9.10 Apart from the loss of foraging habitats for ardeids, no other impacts to species of conservation importance are considered to be of moderate or high significance that would require mitigation. Loss of wetland habitats used by many of these species will be mitigated by the creation of the WRA.

8.9.11 Loss of trees for roosting waterbirds was identified as an impact of low significance, and therefore mitigation measures are not considered necessary. The site will be enhanced for roosting waterbirds, however, by the provision of trees and shrubs in the WRA. No residual impacts to roosting waterbirds are predicted during the operational phase, although there will be low impacts during the construction phase.

8.9.12 Loss of breeding habitat for Scarlet Basker was identified as an impact of low significance. In addition, habitat for a moderately diverse dragonfly community (albeit comprising common, widespread species) would be lost. These impacts do not require mitigation, but the provision of wetland habitats, especially small fish-free ponds, in the WRA will provide suitable habitat, and the residual impacts to the dragonfly community are predicted to be very low during operation and low during construction.

8.9.13 No significant impacts were predicted to Danaid Egg-fly, which is not thought to breed in the Project Area. Inclusion of the larval foodplant (*Portulaca oleracea*) in herbaceous displays in the landscape planting in the residential area will increase the value of the Project Area for this species.

Mitigation for disturbance to fishponds and disturbance-sensitive waterbirds

8.9.14 Fishpond habitats to the north of the project area will be indirectly impacted by disturbance to waterbirds of conservation importance, especially during the construction phase. Consideration of techniques to minimise the potential disturbance to these has been incorporated in the detailed design of the Master Layout Plan (MLP). This includes the zonation of the interface between wetland habitats and residential areas as a Sensitive Area, with a specific design rationale (considering building height, distribution and orientation, road layout, landscaping, public access, etc.). This design has taken into account ways to avoid and minimise potential disturbance impacts to waterbird species in surrounding fishpond habitats.

8.9.15 Land immediately adjacent to the existing fishpond habitats is considered as a Buffer Area. This land will have no residential development to avoid a direct interface between the residential areas and the ecologically-important fishponds to the north of the Project Area, thus distancing potential sources of disturbance resulting from the development (especially noise, night-time lighting and human activity) from waterbirds and minimising the potential impacts. This contrasts with conditions currently present on site, which include developed land used for container storage in the north-east corner of the Project Area, adjacent to fishpond habitats. Removal of this interface between human activity and fishponds will be beneficial to disturbance-sensitive waterbirds.

8.9.16 The Buffer Area will be used as the WRA to compensate for wetland habitat loss on site (see Section 8.9.3-8.9.4). There will be no public access into the WRA for residents from the development, to ensure that direct human disturbance to waterbirds in the adjacent fishponds will be avoided as far as possible (although minimal disturbance may occur for short periods during the maintenance activities in the WRA). The back of the WRA, at the boundary with the residential area, will comprise a perimeter wall and landscape screening to ensure that public access to the WRA is prevented, and to create a visual barrier between the WRA and the residential area, avoiding visual disturbance impacts during the operational phase.

8.9.17 Immediately adjacent to the WRA, the residential land has been zoned as a Sensitive Area. This will consist of low-density residential development, reducing the degree of human activity in the area and thus minimising the potential sources of disturbance. Buildings in this area will be the lowest in the development (2.5 – 3 storeys) and, through provision of private back yards, will be set back from the WRA to reduce the visual intrusion on nearby fishpond habitats. Orientation of buildings is such that all will face towards the residential area, eliminating the need for public access next to the WRA. As human activity will be greatest at the front of the buildings, the potential sources of impacts to waterbirds (including noise and night-time lighting) will be concentrated away from the WRA and impacts to waterbirds will be minimised.

8.9.18 The club house, situated in the extreme north-eastern corner of the Project Area, will provide the only direct interface between residential areas with public access and existing wetlands outside the Project Area. The significance of the impact will be minimised by screening from landscape planting to reduce visual and light disturbance to wetland habitats. Human activities associated with the club house (car parking and sports pitches) will be located on the landward side, away from the wetland habitats, to prevent potential sources of disturbance to the wetlands. The residual impact of the clubhouse on adjacent wetland habitats is predicted to be low.

8.9.19 Potential impacts from human activity will also be high during the construction period. This would be particularly the case for construction work carried out during the dry season (November - April), when numbers of disturbance-sensitive waterbirds are at a peak, and would be greater when construction work was being carried out in the north of the Project Area, adjacent to existing fishpond habitats. Sources of disturbance at this time include visual disturbance from human activity on site, noise disturbance from machinery and disturbance from dogs associated with the construction site.

8.9.20 In order to minimise the duration and magnitude of the construction-phase impacts the WRA will be created during the first year of the construction period. Construction work in this area, which is immediately adjacent to the fishponds, is scheduled to take place between 15 March and 15 November (**Appendix B.2**); this is in order to minimise the duration of this work during the dry season, when disturbance-sensitive waterbirds are present in the greatest numbers. Some construction work on the residential areas will be carried out during the dry season, however; this will not involve work adjacent to the fishponds, to minimise potential impacts to migratory waterbirds. Further details on measures to minimise disturbance at this time are given in Section 8.9.22. All construction work will be screened from adjacent fishponds by visual barriers of 2.4 m, with colour tone matched with the environment prior to the construction (site hoarding location see **Figure 4.6**) to minimise potential disturbance to waterbirds. Dogs will not be allowed on the construction site to ensure that these do not provide a source of disturbance to waterbirds. Noise impacts will be minimised during construction by good site practice and selection of quiet equipment, for example by avoiding the use of percussive piling (see Chapter 4). Night-time light disturbance will be minimised by limiting the amount of lighting in the construction site, and by situating this away from the WCA fishponds. Impacts of dust will be minimised by measures taken to reduce dust emissions from the construction site as detailed in Chapter 3.

8.9.21 All reprofiling work within the WRA (including all earth moving and site formation works) will be conducted during a single wet season. After the reprofiling work has been completed, the WRA will require replanting, watering and weeding to be conducted during the establishment of the vegetation; this work will cause considerably less disturbance to waterbirds than the construction work, as it does not require heavy machinery. Furthermore, replanting work would only be required during the wet season, when fewer waterbirds are present. Following the completion of construction works in the WRA, the visual barriers between the WCA fishponds and the WRA will be removed so that the WRA is able to integrate with the existing wetland habitats outside the Project Area and will be available for use by wetland-dependent species. During this time, human activity will be required for management of WRA habitats; the potential impacts of this will be reduced by minimising the time people are present on site and by avoiding human activity during the early morning (when larger numbers of birds are likely to be present in the WCA fishponds). The establishment period for the WRA is anticipated to take about two years after completion of WRA reprofiling.

8.9.22 Following the completion of reprofiling works in the WRA, the major potential source of disturbance will be from ongoing construction in the residential part of the Project Area. A 3 m site hoarding will be placed between the WRA and the construction works for residential areas so that a visual barrier is maintained between the construction work and wetland habitats. The wetland habitats in the WRA will be open to the WCA fishponds during establishment of the WRA; this will distance the ongoing construction work from the WCA and will provide a buffer between disturbance-sensitive waterbirds and ongoing construction works. Other methods to reduce potential sources of disturbance will continued to be employed, including good site practice within the construction site, selection of quiet equipment to minimise noise disturbance, minimisation of night-time lighting and location of this away from the wetlands and prevention of dogs from accessing the construction site.

Mitigation for Pollution Impacts to Watercourses and Deep Bay

8.9.23 Impacts to drainage channels and other watercourses outside the Project Area would arise from the increased risk of water pollution events. These watercourses feed into Deep Bay, an area of high ecological value, where pollution events would have a significant ecological impact. Potential sources of water pollution during the construction phase include sedimentation from soil excavation, release of contaminants during excavation, chemical waste from equipment and domestic waste water. During the operational phase, the primary source of pollution would arise from domestic waste.

8.9.24 Mitigation measures to be adopted in the construction phase relate to good site practice, so that all waste is contained on site and removed where necessary. These measures include the containment of silt runoff within the site boundary, the containment of contaminated soils for removal from the site, appropriate storage of chemicals and chemical waste and the provision of sanitary facilities for on-site workers. For further details, refer to Chapters 5 and 7.

8.9.25 During the operation phase, sewage from the residential estate would be conducted into the planned public sewer along Castle Peak Road to prevent discharge into surrounding wetlands (see Chapter 6). Surface runoff will be collected internally and will be diverted into the Mai Po River rather than the WRA (see Chapter 5).

8.9.26 Water from the residential areas will not be discharged into the WRA, which will be fully self-contained. No fertilisers or pesticides will be used in the WRA, which is designed in such a way as to be largely self-sustaining. Excess water in the WRA during periods of heavy rainfall will be discharged directly into the Mai Po River to the north of the Project Area. Since this water will come from wetland habitats with no source of contamination, this will have no downstream impacts on watercourses or Deep Bay.

Mitigation for Habitat Fragmentation

8.9.27 No habitat fragmentation is predicted as a result of the development of the Project Area which is on the edge of the Deep Bay wetland ecosystem and does not provide linkage between ecologically-important habitats. In its current state (prior to development), wetland habitats within the Project Area are relatively fragmented in discrete small areas. This fragmentation within the Project Area will be reduced by the provision of an equivalent area of wetland habitat in one contiguous area at the northern boundary; this will also increase the integration of these habitats into the surrounding Deep Bay wetland ecosystem.

Mitigation for Cumulative Impacts of Habitat Loss

8.9.28 Under existing conditions, the future ecological value of habitats within the Project Area is uncertain with respect to the further spread of human development, especially development associated with the existing container storage areas. Complete development of the Project Area would contribute to the loss of the wetland fringe around the Deep Bay ecosystem, which is considered to be of high significance (although the relatively small size of the Project Area compared to the rest of Deep Bay means the contribution of this Project Area to the total impact is of low significance). Under the OZP (OZP No. S/YL-MP/6) the Project Area is zoned as OU(CDWRA), which provides an opportunity to consolidate and enhance wetland habitats within the Project Area through wetland restoration in conjunction with development. This is the only planning related mechanism whereby the uncertainty surrounding the future ecological value of the Project Area can be removed. In accordance with this planning intention, the loss of wetland habitats within the Project Area will be fully compensated by creation of an equal area of wetland habitats within the WRA, thus there will be no permanent net loss of wetland area resulting from the project. Furthermore, the WRA will be provided on the northern edge of the Project Area, adjacent to the existing fishpond area to the north; this will provide a buffer between the proposed development and existing wetlands, thus reducing disturbance to existing wetlands.

Mitigation for Impacts to Egretries

8.9.29 The impact to the Mai Po Village egretry is predicted to be of Low to Moderate Significance due to the potential loss of foraging habitat for Little Egrets and, to a lesser extent, Chinese Pond Heron. Impacts to other egretries are predicted to be of Low Significance. The loss of foraging habitat will be compensated by creation of suitable foraging habitats as part of the WRA. Details regarding habitat creation in the WRA as compensation for habitat loss can be found in Sections 8.9.3-8.9.4, and full details of the habitats to be provided are included in Appendix H. There would be a temporary residual impact during the construction of the WRA; however, this would be minimised by timing the creation of the WRA for the first year of the construction period. Although establishment of the WRA is expected to take a further year, hoarding between this and surrounding wetlands would be removed during this time, making the WRA available as foraging habitat for egrets.

8.9.30 Birds breeding at the Mai Po Village and Tam Kon Chau egretries do not appear to fly over the Project Area in significant numbers on their way to or from more distant foraging locations. A small number of birds (totally ten birds during the survey of 12th June 2006) were, however, recorded flying low over the northern part of the Project Area during the egret breeding season, probably moving between foraging areas in fishponds to the north of the Project Area. It is not considered that impacts to these flight paths will have a significant impact on breeding success at the egretry, but these impacts will, in any case, be minimised by measures taken to reduce impacts to flight paths of other bird species, especially by concentrating residential development in the southern half of the Project Area. Full details of these measures can be found in Section 8.9.31-8.9.33. A small residual impact may remain during the construction phase, due to the visual barrier around the construction site; this will be temporary and impacts to the egretry will be low.

8.9.31 Although noise disturbance to egretries during construction is considered to be of low significance, measures taken to reduce noise levels during construction (including selection of appropriate machinery and methods, and erection of noise barriers) will ensure that these impacts are minimised. (Please refer to Section 4.8 for details)

Mitigation for Impacts to Flight paths of Non-breeding Birds

8.9.32 Impacts to flight paths would be most likely to occur in the northern part of the Project Area, where the greatest number of birds was recorded flying over the Project Area and birds were lower over the ground (especially along Flight path 1 (**Figure 8–4**)). This part of the Project Area will be used for the WRA and will not be used for residential buildings, with the consequence that bird flight paths over this area will not be impeded once wetland construction works are complete.

8.9.33 Under the OZP for the area (OZP No. S/YL-MP/6) the maximum permitted height for buildings within the Project Area is six storeys. This is considerably higher than the buildings at Palm Springs and Royal Palms, and would potentially impact the flight paths of birds over the Project Area. To minimise such impacts the maximum height of buildings within the Project Area will be four storeys; such buildings will be generally three metres higher than existing buildings in adjacent residential estates. Furthermore, the development has been zoned in such a way that the lowest buildings within the Project Area will be those closest to the WRA. This is the part of the Project Area most likely to be used by low-flying birds and the reduction in building height will minimise potential impacts to flight paths.

8.9.34 There will be some residual impact to flight paths in the northern part of the Project Area during the construction phase, resulting from the presence of construction machinery and from site fencing (required to avoid visual disturbance impacts to foraging waterbirds) and potentially also from noise disturbance. These impacts will be limited in duration to the construction period, and the timing of the WRA formation at the start of the construction period will ensure that the duration of these construction-phase impacts to flight paths will be minimised.

Mitigation for Indirect Impacts to Other Species outside the Project Area

8.9.35 No significant indirect impacts are predicted to any species outside the Project Area. Impacts of low significance are predicted to vegetation as a result of dust deposition during the construction period, although no species of conservation importance would be impacted. The impacts to vegetation will be minimised by reducing dust emissions from the construction site (see Chapter 3 for further details).

8.10 Post-mitigation Acceptability of the Project

8.10.1 **Table 8-29** provides details of potential impacts of the development without mitigation, proposed mitigation measures to reduce the significance of those impacts (where required) and significance of impact after those mitigation measures have been instigated.

Table 8-29 Summary of Potential Ecological Impacts before and after adoption of Mitigation Measures.

Description of Potential Impact	Significance of Impact without Mitigation	Proposed Mitigation	Significance of Impact after Adoption of Mitigation Measures
Direct Loss of Habitats in Project Area			
Loss of Grassland Habitats	Loss of habitat of **Low Significance** due to low value of habitat and low abundance of species of conservation importance.	No mitigation required because impacts of low significance but design of WRA includes 0.33 ha of grassland habitats on bunds which will provide habitat for grassland species.	Impact of **Low Significance.**
Loss of Seasonal Marsh and Freshwater Marsh/Reedbed	Impacts to habitat of **Low to Moderate Significance** due to small size, ephemeral nature and high fragmentation of habitat. Impacts to species utilising the habitat of **Low to Moderate Significance**, mostly due to impacts to moderately diverse dragonfly fauna. Habitat loss of **Moderate Significance** because of importance of the habitat in a Hong Kong context and high potential value of the habitat.	Loss of wetland habitats to be compensated by provision of 4.74 ha of wetland in the WRA (total area of seasonal marsh and freshwater marsh/reedbed currently 4.69 ha). This will include 1.12 ha of reedbed to compensate for reedbed loss on site, as well as a variety of other habitats (open water, short grass, trees and shrubs).	Loss of wetland area fully compensated, therefore **No Significant Impact** from wetland loss. **No Significant Impacts** to species using seasonal marsh and freshwater marsh/reedbed. Temporary wetland loss during construction of WRA of **Low Significance** but unavoidable and temporary. Management of WRA for wildlife presents opportunity to enhance value of Project Area for wildlife by habitat improvement, especially through provision of mature reedbed habitat.

Description of Potential Impact	**Significance of Impact without Mitigation**	**Proposed Mitigation**	**Significance of Impact after Adoption of Mitigation Measures**
Loss of Drainage Channels/ Ditches	Impacts of **Low Significance** due to low existing value of the ditches on site, and minimal impact to riparian trees used by roosting waterbirds.	Any loss of habitats for dragonflies and other fauna will be mitigated by provision of wetland habitats in WRA.	Impacts of **Low Significance**. Wetland habitat to be provided in WRA.
Direct Impacts to Species of Conservation Importance			
Impacts to Vegetation	**No Significant Impact** because no species of conservation importance present in the Project Area.	No mitigation required because no significant impacts predicted.	**No Significant Impact.**
Impacts to Mammals	**No Significant Impact** because no species of conservation importance present in the Project Area.	No mitigation required because no significant impacts predicted.	**No Significant Impact.**
Impacts to Roosting Waterbirds	Impacts to waterbirds roosting at the northern edge of the Project Area of **Low Significance** due to small numbers of birds present and existence of other suitable roosting sites.	Trees and tall shrubs included in design for WRA to provide roosting sites for waterbirds.	**No Residual Impact** because loss of trees fully compensated by tree planting in WRA.
Impacts to Foraging Ardeids	Impacts from loss of foraging habitat of **Low to Moderate Significance** due to the relatively small number of individuals involved, the suboptimal quality of the habitat and the presence of other suitable foraging locations nearby.	Habitat suitable for foraging ardeids will be compensated in WRA.	No net loss of habitat, therefore **No Residual Impact** during operation phase. Unavoidable **Low Impact** during construction phase but this will be temporary, restricted to the first year of construction.

Description of Potential Impact	Significance of Impact without Mitigation	Proposed Mitigation	Significance of Impact after Adoption of Mitigation Measures
Impacts to Other Bird Species	Impacts to other bird species of conservation importance (Black Kite, Oriental Pratincole, Little Ringed Plover, Pacific Swift, Zitting Cisticola, Red-billed Starling and White-shouldered Starling) of **Low Significance** because the Project Area does not provide habitat for locally-important populations of any of these species.	Impacts to these species considered to be of Low Significance due to low numbers of individuals present, therefore further mitigation measures not required. Design of the WRA will, however, provide habitat for these species which will compensate for habitat loss on site.	Impacts of **Low Significance** during construction of the WRA but **No Significant Impacts** to these bird species after construction completed.
Impacts to Herpetofauna	**No Significant Impact** because no species of conservation importance present in the Project Area.	None required but WRA will compensate for any habitat loss.	**No Significant Impact.**
Impacts to Scarlet Basker	Impacts of **Low Significance** because of very small numbers present in Project Area and current status of the species in Hong Kong.	Mitigation not required because impacts of Low Significance, but design of WRP should provide suitable habitat to compensate for any habitat loss.	Residual impacts of **Very Low Significance.**
Impacts to Danaid Egg-fly	**No Significant Impact** because no evidence that the species breeds within the Project Area.	Mitigation not required but inclusion of larval food plant (*Portulaca oleracea*) in landscape planting will enhance value of Project Area for the species.	**No Significant Impact**, planting of larval food plant may provide net ecological benefit.
Indirect Impacts to Habitats in Assessment Area (outside Project Area)			
Disturbance Impacts to Adjacent Fishponds	Impacts of disturbance to waterbirds in nearby fishponds of **Moderate to High Significance** due to the importance of these ponds to waterbirds and their proximity to the northern edge of the Project Area.	Site layout designed to prevent human disturbance at northern boundary and greatest human impacts furthest from wetlands. No public access to WRA and rest of Project Area to be screened from fishponds by landscape planting.	Operation phase impacts outside Project Area of **Very Low Significance** because presence of WRA will distance human activity from fishpond areas. Operation phase disturbance impacts to WRA of **Low Significance.**

Description of Potential Impact	Significance of Impact without Mitigation	Proposed Mitigation	Significance of Impact after Adoption of Mitigation Measures
		Barriers during construction phase to block noise and visual disturbance to fishponds. Timing of work in WRA during wet season at the start of construction period; after completion WRA will provide buffer from rest of construction work.	Impacts during construction of WRA of **Low Significance** but temporary. Other construction phase impacts of **Very Low Significance.**
Indirect Impacts to Off-site Drainage Channels	Impacts from pollution of watercourses downstream of the Project Area are considered to be of **Moderate Significance**. Changes in surface runoff of **Low Significance** because magnitude small in comparison to existing flow in the channel.	Good site practice during construction phase to avoid pollution of watercourses. Connection to trunk sewer during Operation phase to prevent discharge into watercourses and Deep Bay.	Pollution risks during construction and operation phase avoided, therefore **No Significant Impact.** Changes in surface runoff of **Low Significance** because magnitude small in comparison to existing flow in the channel.
Indirect Impacts to Other Habitats in Assessment Area	**No Significant Impacts** to other habitats because these are small and/or show no ecological linkage to the Project Area.	No mitigation measures necessary.	**No Significant Impacts.**
Pollution Impacts to Watercourses and Deep Bay	Impacts to watercourses downstream of the Project Area are considered to be of **Moderate Significance**. Pollution impacts to Deep Bay generally of **Low Significance** due to the small size of the Project Area relative to the size of the bay, but serious pollution events (especially chemical pollution) into the bay would be of **Moderate to High Significance.**	Good site practice during construction phase to avoid pollution of watercourses and Deep Bay. Connection to trunk sewer during Operation phase to prevent discharge into watercourses and Deep Bay.	Pollution risks during construction and operation phase avoided, therefore **No Significant Impact.**

Description of Potential Impact	**Significance of Impact without Mitigation**	**Proposed Mitigation**	**Significance of Impact after Adoption of Mitigation Measures**
Impacts from Habitat Fragmentation	**No Significant Impacts** because Project Area is on the edge of the wetland ecosystem and does not form a link between other habitats in the area.	Wetland habitats present in Project Area will be incorporated into single WRA, integrated with wetland habitats outside Project Area.	**No Significant Impacts** outside Project Area. Reduction in habitat fragmentation within Project Area of **Net Ecological Benefit.**
Cumulative Impacts of Wetland Loss	Overall impacts would be of High Significance if Deep Bay ecosystem was compromised. Contribution from the Project Area would be of **Low Significance.**	Loss of 4.69 ha of wetland habitats in Project Area mitigated by provision of 4.74 ha of wetland in WRA.	Loss of wetland habitat fully compensated, so **No Residual Impact.** Potentially a small net ecological gain due to protection of wetland habitats in WRA.
Indirect Impacts to Species of Conservation Importance			
Indirect Impacts to Vegetation	**No impacts** to species of conservation importance because none present in Assessment Area. Impacts of **Low Significance** to other vegetation during construction phase due to dust deposition.	Measures to control dust emissions during construction phase.	Impacts to vegetation outside Project Area of **Very Low Significance.**
Indirect Impacts to Mammals	**No Significant Impact** because no species of conservation importance recorded in Assessment Area, and low density mammal populations present.	No mitigation necessary.	**No Significant Impacts.**

Description of Potential Impact	**Significance of Impact without Mitigation**	**Proposed Mitigation**	**Significance of Impact after Adoption of Mitigation Measures**
Disturbance to Waterbirds of Conservation Importance	Construction-phase disturbance of **Moderate to High Significance** due to the importance of fishponds to waterbirds and their proximity to the northern edge of the Project Area. Post-construction disturbance impacts of **Moderate Significance** if human activity is present close to fishpond areas.	Site layout designed to prevent human disturbance at northern boundary and greatest human impacts furthest from wetlands. No public access to WRA and rest of the Project Area to be screened from fishponds by landscape planting. Removal of current potential disturbance from container storage adjacent to fishponds.	Operation phase impacts outside Project Area of **Very Low Significance** because presence of WRA will distance human activity from fishpond areas. Operation phase disturbance impacts to WRA of **Low Significance.** Impacts during construction of WRA of **Low Significance** but temporary. Other construction phase impacts of **Low Significance.**
		Barriers during construction phase to block noise and visual disturbance to fishponds. Timing of work in WRA during wet season at the start of construction period; after completion WRA will provide buffer from rest of construction work.	
Impacts to Mai Po Village Egretry	Impacts to Mai Po Village egretry of **Low to Moderate Significance.** Flight paths would be impacted by development in the north of the Project Area, in which case impacts would be of **Low to Moderate Significance.** Noise disturbance at egretry during construction considered to be of **Low Significance.**	Loss of wetland foraging habitat to be compensated by provision of equal area of suitable habitat in WRA. Impacts to flight paths to be minimised by location of residential area on southern side of Project Area and by MLP design involving building heights of 2.5/3 storeys and 4 storeys. Noise disturbance to be minimised by adoption of appropriate site management techniques.	**No Significant Impact** from loss of habitat in operation phase, but unavoidable **Low Impact** during construction of WRA. **Low Impact** to flight paths. **Very Low Impact** to egretry due to noise disturbance during construction phase.

Description of Potential Impact	**Significance of Impact without Mitigation**	**Proposed Mitigation**	**Significance of Impact after Adoption of Mitigation Measures**
Impacts to Other Egretries	Impacts of **Not Significant** at the Mai Po Lung egretry, as there is no evidence that these birds forage in the Project Area or fly over to reach other foraging sites. **No Significant Impact** from noise disturbance.	Loss of wetland foraging habitat to be compensated by provision of equal area of suitable habitat in WRA.	**No Impacts** to Mai Po Lung egretry. Impacts to Tam Kon Chau due to habitat loss of **Low Significance du**ring construction of WRA, but **No Net Impact** during operation phase.
	Impacts to Tam Kon Chau Egretry of **Low Significance** because some birds may forage within the Project Area and a few birds fly low over the north of the Project Area. Noise disturbance considered to be of **Low Significance.**	Impacts to flight paths to be minimised by location of residential area on southern side of Project Area and by MLP design involving building heights of 2.5/3 storeys and 4 storeys. Noise disturbance to be minimised by adoption of appropriate site management techniques.	**Low Impact** to flight paths from Tam Kon Chau. **Very Low Impact** to Tam Kon Chau due to noise disturbance during construction phase.
Impacts to Bird Flight Paths	Impacts of **Low Significance** for development in the south of the Project Area. Impacts of **Moderate Significance** in the northern or northwestern part of the Project Area, particularly along Flight paths 1, 2, 4 and 5.	Layout of the Project Area will restrict residential development to southern part of Project Area, with tallest buildings closest to existing residential estates. Building heights will be 2.5/3 storeys and 4 storeys and will therefore not be significantly higher than in surrounding residential estates.	Operation phase impacts of **Very Low Significance** because location and height of buildings will not obstruct existing flight paths. Impacts of **Low Significance** during construction of WRA on northern part of the Project Area, but this will be temporary at the start of construction phase.

Description of Potential Impact	Significance of Impact without Mitigation	Proposed Mitigation	Significance of Impact after Adoption of Mitigation Measures
Impacts to Other Fauna	Only species of conservation importance recorded were Scarlet Basker and Danaid Egg-fly, with only single individuals recorded of each. Overall **No Significant Impact** to herpetofauna, dragonflies, butterflies or aquatic invertebrates.	No mitigation measures required.	**No Significant Impacts.**

8.11 Conclusions

8.11.1 The main ecological impact of development of the Project Area would be the loss of 4.69 ha of wetland habitat (Seasonal Marsh and Freshwater Marsh/Reedbed) currently present within the Project Area. This habitat loss will be fully mitigated by the provision of 4.74 ha of wetland habitat within the WRA, in agreement with the "No-net-loss of Wetland" principle outlined in Town Planning Board Guideline 12B (TPB PG-No. 12B) for sites within the WBA. The design of the WRA provides suitable habitats for foraging and roosting waterbirds (including Little Egret, Cattle Egret and Chinese Pond Heron), dragonflies, amphibians and other fauna. Temporary impacts through habitat loss during the construction of the WRA are minimised by scheduling this construction work to be carried out early in the construction period, in order to reinstate wetland habitats within the Project Area within the first year of occupation.

8.11.2 Without mitigation measures, indirect impacts were predicted through disturbance of wetland bird species outside the Project Area, impedance of flight paths for non-breeding birds and reduction in breeding success at local egretries as a result of loss of foraging habitat. These issues have been addressed through adoption of appropriate mitigation measures.

8.11.3 The issue of disturbance to waterbirds was given serious consideration in the layout of the Project Area and had implications on the design of the MLP. The final site layout avoids direct interface between the residential areas and fishponds to the north of the Project Area, which are favoured by foraging waterbirds. Disturbance impacts are further avoided by prevention of public access into the WRA, landscape planting to screen the residential areas from wetlands and the concentration of human activity and buildings close to existing residential estates. Disturbance from noise and visual intrusion during the construction phase will be avoided by screening the construction site from fishponds, by timing works close to fishponds to take place during the wet season (when fewer disturbance-sensitive wetland birds are present) and by creation of the WRA at the start of the construction period to provide a buffer between ecologically-important fishponds and ongoing construction work. As a result of these mitigation measures, it is considered that residual impacts through disturbance of waterbirds have been minimised.

8.11.4 Impedance of flight paths affects not only non-breeding bird species but also local egretries. Although no important flight paths were recorded passing through the Project Area, consideration was given in the design to avoiding potential impacts to birds flying through the Project Area. Mitigation measures adopted include the avoidance of residential buildings in the north of the Project Area (where most bird activity was recorded) and design of buildings to include a maximum building height of four storeys (generally 3m higher than surrounding residential estates). These mitigation measures have minimised the potential impacts to bird flight paths so that it is now considered that impacts are low or very low.

8.11.5 Impacts to local egretries (especially Mai Po Village egretry) could have arisen through loss of foraging habitat and impedance of flight paths to foraging sites. These impacts have been mitigated through provision of foraging habitat in the WRA and design of buildings to avoid impacts to flight paths. Under the current design, impacts to egretries are forecast to be low, although some minor residual impacts will occur through loss of foraging habitat during the construction of the WRA.

8.11.6 Other potential sources of off-site impacts, including pollution events and impacts to other wildlife species, have been considered and appropriate mitigation measures have been put in place to ensure that such potential impacts will be avoided or minimised.

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9 FISHERIES IMPACTS ASSESSMENT

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

9.1 Summary

9.1.1 The section describes the aquaculture resources and activities in the area of influence of this development project. Particular attention was given to the fishponds located to the north of the Project Area which are within the Conservation Area. The Fisheries Impact Assessment has been undertaken in accordance with section 3.9.7 of the Study Brief, and the findings of the surveys have been used in the planning process. There are no fisheries resources lost as a result of this project, as the fishponds were infilled many years ago. The assessment thus focused on the indirect impacts in the fishery resources as a consequence of the development of the Project at Wo Shang Wai. The conclusion of this part of the EIA is that no direct impact is anticipated either during or following the implementation of this Project. Indirect impact on deterioration of water quality of the adjacent fishponds during construction will be insignificant.

9.2 Legislation and Standards

9.2.1 The following relevant legislation and associated guidance notes are applicable to the evaluation of fisheries impacts associated with the Project.

- Environmental Impact Assessment Ordinance (Cap. 499., S.16), Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM), Annexes 9 and 17;
- Hong Kong Planning Standards and Guidelines Chapter 10 (HKPSG);
- Town Planning Board Guidelines for Application for Developments within Deep Bay Area under Section 16 of the Town Planning Ordinance (TBP PG-NO.12B); and
- Fisheries Protection Ordinance (Cap. 171)

9.3 Assessment Methodology

9.3.1 The Fisheries Impact Assessment was undertaken following the criteria and guidelines as specified in Annexes 9 and 17 of the TM and the EIA Study Brief ESB-131/2005. The Assessment Areas for this study include areas within the boundary of the proposed development (including the access road) and the adjacent areas of potential impact (fishponds at the north and northwest boundary of the site) (**Figure 9.1**).

9.3.2 Literature of the existing information regarding the Assessment Area of both published and unpublished materials were reviewed. The fisheries information included in this Section are:

(i) The physical environmental background;
(ii) The existing level and pattern of pond culture activities and fisheries production;
(iii) The existing pond culture resources and composition of commercially important species;
(iv) Identification of parameters and area that are important to pond culture activities; and
(v) The status of the fishponds, the productivity and value of the fisheries resources of the actively used pond.

9.3.3 This information was obtained by interview with the fishermen and fishpond owners followed by ground truthing site investigation.

9.4 Baseline Conditions

Literature Review

9.4.1 According to Agriculture, Fisheries and Conservation Department latest information (2006)[1], aquaculture activities in Hong Kong include marine fish culture, pond fish culture and oyster culture. Pond fish culture activities with freshwater and brackish fishpond aquaculture are concentrated in the northwest New Territories. In 2006, the approximate size of local inland ponds was 1,024 ha, which produced around 1,943 tonnes of freshwater fish amounting to $29 million. 92 per cent of the fish farming is polyculture of bighead carp, silver carp, common carp and grass carp in combination with tilapia or grey mullet, while 8 per cent of the fishponds practice monoculture of carnivorous species like giant groupers, seabreams and spotted scat in brackish fishponds rearing near the coastline of the northwest New Territories. The sources of fish fry and fingerlings are imported from the Mainland and Taiwan and may be caught in local coastal waters, which are stocked in early spring. They are reared until they reach marketable size in about eight to twelve months.

9.4.2 Since the late 1970s, the fishpond area in the Deep Bay Area has been gradually declined under urban development pressure (Aspinwall & Co., 1997). Significant changes in land uses in the region included the construction of Fairview Park, Tin Shui Wai New Town, Yuen Long Industrial Estate and other low density residential projects such as Palm Springs within the Assessment Area of this Project. Between 1985 and 1994, the fishpond area dropped from over 2000ha to 1500ha, representing a 25% decrease. In **Table 9–1** AFCD's figures on pond culture fisheries show the declining trend of the fishpond area and also the annual fish production in the last ten years.

Table 9-1 AFCD Figures on HKSAR Pond Culture Fisheries

Year*	Fish Pond Area (ha)	Freshwater Fish Production (tonnes)
1997	1,125	5,000
1998	1,110	4,900
1999	1,100	4,500
2000	1,060	2,820
2001	1,059	2,550
2002	1,030	1,989
2003	1,030	2,110
2004	1,030	1,980
2005	1,030	1,900
2006	1,024	1,943

*Data from 1997 to 2000 are abstracted from Maunsell (2004).
Data from 2001 to 2006 are abstracted from AFCD Annual Reports 2001-2005[2] and AFCD website[1].

9.4.3 The local freshwater aquaculture industry has been declined in recent year, as a result of high costing and low return, as well as competition with imported marine fish and the increase awareness of food safety in rear fish products. In order to improve the quality of local aquaculture fisheries and to regain consumer confidence, the Government has launched an "Accredited Fish Farm Scheme" in 2005 to promote the sustainable development of the local aquaculture industry (AFCD, 2006)[2].

9.4.4 The "Accredited Fish Farm Scheme" is a voluntary scheme, which enhances the quality of local aquaculture products by introducing "Good Aquaculture Practices" to local fish farms. Aquaculture products from accredited fishponds have to undergo a series of water quality monitoring and random checking of fisheries products to ensure the quality is safe to consume before selling in the market. This scheme also makes local aquaculture products stand out by branding.

Field Investigation Findings

9.4.5 Site investigations have been conducted on 18 November 2005 and 9 January 2006 to ground truth the status of the fishponds and interview the fish farmers and workmen who are in charge of the maintenance work of the fishponds within the Assessment Area (**Plate 9.1** showing fishpond in maintenance stage). **Figure 9.1** shows the fishponds status around Wo Shang Wai recorded during the site investigation on 18 November 2005.

9.4.6 There are approximately 84 fishponds within the study boundary, which combine to a surface area of 79.9ha. Four of these have been divided into two to three sub-fishponds with bund walls and weirs constructed in between ponds.

9.4.7 The fishponds at the northern and northwest portion from the Project Area are mostly in active use. Ponds at the south-western corner are abandoned ponds or reed beds grow with Phragmites (**Figure 9.1** shows the location of the fishponds and **Plate 9.2** shows the abandoned fishpond with reeds growing).

9.4.8 One pond located at the south of Wo Shang Wai Village in the Conservation Area to the south of the Project Area, is used as a recreational fishing ground (**Plate 9.3**), while others are abandoned ponds with poor water quality. Five of the freshwater fishponds were observed to be undergoing routine maintenance (dredging or drying) on the 18 November

2005 visit, and were attracting wetland dependent birds foraging on the partially drained pond (**Plate 9.4**). By the next visits in December 2005 and January 2006 these ponds had been filled with water and fingerlings (**Plate 9.5**).

9.4.9 Fishponds at the northwest portion are brackish ponds while those at the northern portion are freshwater ponds. **Figure 9.1** and **Table 9–2** shows the status and activities of the fishponds recorded on 18 November 2005.

Table 9-2 Fishponds Status and Area in the Project Area

Status	Size	Activities
Active Freshwater Fishponds	37.9 ha	- Polyculture of Grass Carp, Tilapia, Big Head Carp and Grey Mullet. - Trash fish capturing for aquarium sell. - Accredited Fish Farm Scheme providing freshwater fish with quality assurance.
Fishponds in drying or maintenance stage	5.4 ha	- Draining around once a year for fish collection to the market. - Drying by direct sunlight to reduce the bacteria from fish faeces. - Maintenance every 4 – 10 years to dredge the pond bottom and adding lime to neutralize the acidity from long term rearing.
Inactive Fishponds	18.7 ha	- Abandoned from previous fishing ground. - Abandoned from previous aquaculture activities and forming reed bed.
Active Brackish Fishponds	17.9 ha	- Culture of higher value estuarine fish species: Spotted Scat, Giant Grouper and Grey Mullet. - Accredited Fish Farm Scheme providing brackish fishes with quality assurance.

9.4.10 Polyculture of Big Head Carp, Tilapia, Grey Mullet and Grass Carp are commonly reared species in the freshwater fishponds. Trash fish such as mosquito fish and freshwater shrimps are abundant in some of the fishponds to control mosquitoes and for selling to the aquarium fish market (**Plate 9.6** and **Plate 9.7**).

9.4.11 Around 23 fishponds in the Assessment Area are brackish and under the Accredited Fish Farm Scheme (as recorded during 18 November 2005 and 9 January 2006 site visits), and practice monoculture fish farming with Spotted Scat, Giant Grouper and other Groupers with higher economic values. These fish species have adapted to grow in brackish water with low salinity (**Plate 9.8** and **Plate 9.9**).

9.4.12 Based upon the above review and field investigation findings, the sensitive receivers for fisheries that may be affected by the proposed development are the active fishponds around the Wo Shang Wai Project Area, pond culture activities around Mai Po, and the inactive ponds that have potential for further development of pond culture within the Assessment Area.

9.5 Prediction of Impacts

9.5.1 The potential impacts on fisheries activities and resources at the sensitive receivers caused by the construction activities and operation of the proposed development may occur in the form of direct habitat loss or indirect disturbance impacts. The following sections identify the possible impacts caused by the proposed development during construction and operation phases. The nature and extent of impacts on aquaculture will be described and quantified as far as possible. The significance of the predicted impacts will then be evaluated in S.9.6 and mitigation measures will be recommended to avoid or minimize the potential impacts on the pond culture activities if necessary.

Construction Phase

9.5.2 The construction of the proposed development involves site formation works at the previously filled vacant land, wetland restoration work, preloading, substructure, superstructure work and landscaping activities. There are no fishponds located inside the footprint of the Project Area and thus there will be neither temporary occupation nor permanent loss of fishponds during construction. No blockage of access to the fishponds in vicinity and around Wo Shang Wai and Mai Po due to the project will occur, as the existing accesses to the ponds are not within the Project Area. However, four actively managed fishponds adjoin the Project Area along the northern site boundary will potentially be affected by site runoff, sediments released during site excavation, chemical waste from mechanical equipment or construction dust. Dust, silt and chemical waste arise from the construction activities especially during site formation at the Wetland Restoration Area (WRA) may affect the water quality of these active fishponds. According to the baseline water quality monitoring at one of the northern fishpond adjoining to the Project Area (S.5.3.16 Baseline Water Quality at WM13S and WM13B), the average suspended solids concentration was not compliance with the Water Quality Objective, further deterioration of water quality may affect the healthy growth of the fishes. The fisheries impacts from silt runoff and sediment release to the adjacent ponds and streams may not be recoverable/reversible after the suspended solids (SS) have settled. Elevated SS level may have acute or chronic adverse effect on fish, or even kill the fish, if it rises up to an intolerable level in the pond water. Also if the surrounding streams, which are the major water source of the fish ponds, are contaminated, it may cause a shortage of water for exchange or re-filling of fish pond, disrupting culture activities and potentially causing fish kill.

9.5.3 No construction impact on the pond culture activities and resources in the Mai Po brackish fishponds at northwest and freshwater fishponds (both active and inactive) further away from the Project Area is anticipated, due to the separation of the Project Area from the fishponds by the existing residential development at the west, southwest and the south, and the long distance away from the Project Area. The inactive pond at Wo Shang Wai Village close to the southern boundary of the Project Area will receive minor disturbance impacts during construction. Hoarding will be established to enclose the site prior to the construction works, and with good site practices, indirect disturbance of increase sedimentation to this inactive pond is anticipated to be low. This pond is currently receiving domestic and sewage discharges from the village houses and only pollution tolerant fishes (Mosquito fish and Tilapia) observed in this pond. The potential for further development of this pond for aquaculture will unlikely to be high.

Operational Phase

9.5.4 The activities of the proposed development during operation phase include the maintenance of the WRA and management of the residential area. No sewage treatment plant will be in place within the proposed development. Sewage will be discharged through the sewerage system on-site which will connect to the future public trunk sewer to be in place by 2012 (proposed sewer see **Figure 6.2**). Impacts on pond culture activities due to sewer bursting and emergency discharge from sewage pumping stations on-site are not anticipated, as the sewer and sewage pumping stations are designed to be enclosed with concrete, no direct discharge to the adjacent wetland system and the fishponds will be occurred.

9.5.5 The WRA adjoining to the fishponds at the north will not have direct water contact in normal circumstances. The proposed wetland will also perform the function of acting as a buffer for flood protection. Excessive flood water will discharge to the adjacent stream channel by controlling the outflow structures. There will be no impact on the fisheries resources and activities within the Assessment Area due to the operation of the proposed development.

9.5.6 No operational impact is anticipated after the completion of the proposed project.

9.6 Evaluation of Impacts

9.6.1 The evaluation of fisheries impact of the proposed development is based on the criteria set in Annex 9 of the EIAO-TM and is shown in the following **Table 9–3**.

Construction Phase

9.6.2 The proposed development will be formed on a filled vacant land with no fishponds within the Project Area. There will be no temporary occupation and permanent loss of fishponds due to the proposed development. Indirect off-site impacts on the adjacent fishponds water quality will be temporary, short term and negligible with good site practices during construction. For significant pollution events, the impacts on loss of fisheries resources and aquaculture activity will be of moderate-low significant, due to the existing poor water quality of the fishponds and the relatively low proportion of total fisheries resources and small portion of fishponds (the adjoining 4 fishponds) will be affected in the Deep Bay context. No direct and indirect fisheries impact on the brackish active fishponds and inactive ponds around Mai Po is anticipated due to the distant and separation by the existing residential development.

9.6.3 The construction impacts on the pond culture activities in areas around Wo Shang Wai and Mai Po are anticipated to be moderate-low to negligible.

Table 9-3 Evaluation of Fisheries Impact

Criteria	Increase suspended solids concentration in the adjacent fishponds water column due to dust arises from the construction, water pollution due to chemical waste release from mechanical equipment, silt runoff and sediment release.
Nature of impact	The impacts of silt runoff, sediment release and construction dust will be temporary, localised and short term during the construction period. However, the fisheries impacts may not be recoverable/ reversible after the suspended solids have settled. The impacts of high dose of chemical waste pollution will be irreversible and long term.
Size of affected area	The adjoining fishponds will be potentially affected by water pollution from chemicals as well as suspended solids arising from the works.

Loss of fisheries resources/production	Insignificant for impacts of silt runoff, minor sediment release and construction dust. Low proportion of total fisheries resources will be affected by high dose of chemical waste pollution. Low impact from loss of culture fisheries resources due to both SS and chemical
Destruction and disturbance of nursery and spawning grounds	Not applicable.
Impact on fishing activity	Not applicable.
Impact on aquaculture activity	No aquaculture farms are affected by the insignificant impacts of silt runoff, minor sediment release and construction dust. Low impacts for the effect of both SS and chemical waste pollution on the aquaculture acitivity in the adjoining 4 fishponds with good site practice and proper mitigation measures, as few aquaculturists will be affected.

Operation Phase

9.6.4 No operational phase impacts are expected to pond culture activities due to operation of the sewerage system, pumping stations and Wetland Restoration Area of the proposed development, as all these systems are either enclosed with concrete or separated by bund wall.

Cumulative Impacts

9.6.5 The concurrent construction activities within the Assessment Area include the Yuen Long and Kam Tin Sewerage and Sewage Disposal Project along the Castle Peak Road section, which is separated from the fishponds by the Mai Po Village. Water runoff or silt deposition to fishponds is anticipated to be unlikely, as the sewage alignment will mostly follow existing roads or drainage channels, potential impacts on aquatic fauna are ranked as minimal (Ove, 2004). No cumulative impacts to fisheries due to water quality deterioration at the construction stage will be resulted. The proposed development involve no fishpond loss in the North West New Territories, therefore no cumulative impacts on aquaculture activities will be resulted for this project.

9.7 Mitigation Measures

9.7.1 With good site practices and implementation of dust and water quality control measures addressed in S.3.6 and S.5.6 of this EIA report (including site confinement with scaffolding erection around the perimeter of the construction site, covering of stockpile by impervious sheeting to avoid spread of dusty materials and proper storage and disposal of chemical waste to avoid discharge to the existing water system, etc.), the dust and water quality impacts on the adjacent fishponds are expected be controlled to within acceptable levels, which will also protect the fisheries resources from being impacted. The moderate-low impacts for the event of high dose chemical waste pollution would also be avoided by the proper handling and disposal of chemical waste released from mechanical equipment during construction phase. All indirect off-site impacts on pond culture activities are expected to be negligible. Thus, no specific mitigation measure for fisheries impacts is required during the construction and operation phases.

9.8 Environmental Monitoring and Audit Programme

9.8.1 The implementation of the dust control and water quality mitigation measures stated in Chapter 3 and 5 of this EIA report should be checked as part of the environmental monitoring and audit procedures during the construction phase. No specific Environmental Monitoring and Audit Programme for fisheries resources are required during construction and operation phases, as the potential impacts arised from the development are anticipated to be insignificant and avoidable with good site practices and implementation of air and water quality monitoring.

9.9 Conclusion

9.9.1 For the avoidance of doubt it should be noted that there will be no infilling of fishponds as a result of this proposed development. The proposed project will have no direct impact on the pond culture activities. Indirect impacts on the existing aquaculture resources or activities as a result of water quality deterioration due to construction dust, sediment release, silt runoff and chemical waste pollution will be insignificant with good site practices and implementation of dust and water quality control measures. No direct and indirect impacts on the pond culture activities in the brackish fishponds and inactive ponds around Mai Po are anticipated during both the construction and operation phases due to the distant and separation by the existing residential development.

9.10 References

[1]http://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu_mpo/fish_aqu_mpo.html (downloaded on 13 August 2007)

[2]http://www.afcd.gov.hk/english/publications/publications_dep/publications_dep.html (downloaded on 13 August 2007)

[3]http://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu_good/fish_aqu_good.html (downloaded on 13 August 2007)

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10 CULTURAL HERITAGE

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

10.1 Summary

10.1.1 As part of the cultural heritage assessments two villages were identified within the Assessment Area, Mai Po village and Wo Shang Wai village. There are no graded historical buildings or declared moments in the area of influence of this project, the two villages within the Assessment Area and the assessments of the impacts of the implementation of the development at Wo Shang Wai concluded there (as per the requirements of Section 3.9.8 of the Study Brief) will be neither direct nor indirect effects on cultural heritage resources.

10.2 Relevant Legislation & Guidelines

10.2.1 The following legislation and guidelines are relevant to the cultural heritage impact assessment (CHIA) in Hong Kong:

- Antiquities and Monuments Ordinance (Cap. 53);
- Environmental Impact Assessment Ordinance (Cap. 499);
- Technical Memorandum on EIA Process (Annex 10 and 19, EIAO-TM); and
- Hong Kong Planning Standards and Guidelines (HKPSG).

Antiquities and Monuments Ordinance (AM Ordinance)

10.2.2 It provides statutory protection against threat of development on declared monuments, historical buildings and archaeological sites to enable their preservation for posterity. The Ordinance also establishes statutory procedures to be followed in marking such a declaration.

10.2.3 In practices, the Antiquities and Monuments Office (AMO) would identify deemed monuments and agreement would be reached with the owners of the monuments to provide advice for specific measures to ensure preservation. Deemed monuments have the potential to be upgraded to statutory declared monuments under the AM Ordinance.

Environmental Impact Assessment Ordinance (EIAO) **and** ***Technical Memorandum on EIA Process (EIAO-TM)***

10.2.4 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.

Hong Kong Planning Standards and Guidelines (HKPSG)

10.2.5 Chapter 10 of the HKPSG covers planning considerations relevant to general guidelines and measures for conservation of historical buildings, archaeological sites and other antiquities.

10.3 Assessment Methodology

Assessment Scope

10.3.1 The assessment followed the criteria and guidelines for CHIA as set out in Annexes 10 and 19 of the TM. The Assessment Area covered an area defined by within a distance of 500m from the boundary of the proposed site limit.

Identification of Baseline Cultural Heritage Conditions

10.3.2 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:

- List of declared monuments protected by the AM Ordinance (Cap. 53);
- Deemed monuments, graded buildings and list of heritage sites identified by the AMO; and
- Published and unpublished papers, records, archival and historical documents through public libraries, archives and tertiary institutions.

10.3.3 If the results of the desktop search indicated that there are potential sites of cultural heritage, field survey would be conducted for detail evaluation.

10.4 Baseline Conditions and Sensitive Receivers

Declared Monuments

10.4.1 No declared monuments are located within the Assessment Area.

Graded Historical Buildings

10.4.2 No graded historical buildings are located within the Assessment Area.

Historical Villages

10.4.3 Two old villages were located within the Assessment Area: Mai Po village and Wo Shang Wai village.

10.4.4 *Mai Po village* is located west of the Mai Po Village SSSI (**Figure 10.1)** and approximately 250m away from the Site. The Wong clan is the predominant clan of the village, whose members arrived in the area several hundred years ago (Ove, 2004). Most of the buildings inside the village were modern. Their ancestral hall (Tse Tong), also named as Hing Hing Tong is a modern building (**Plate 10.1**) which is located over 300m away from the site limit of the Site.

10.4.5 *Wo Shang Wai village* is located south of the Project Area. It is a multi-clan village with a common ancestral hall (**Plate 10.2**). The hall is modified with some modern structures. All other buildings are modern residential houses. The ancestral hall is located about 100m away from the Project site limit.

Other Cultural Elements

10.4.6 Groups of managed fishponds were located north of the Project Area. They were identified as landscape resources LR56 and LR62 in Chapter 11 (Landscape and Visual Impact Assessment LVIA). One abandoned fishpond was located in the Wo Shang Wai village and identified as landscape resource LR90 in the LVIA section.

10.5 Impact Assessment

Construction Phase

10.5.1 Neither declared / deemed monuments nor graded historical buildings were identified within the Assessment Area. Only two historical villages Mai Po village and Wo Shang Wai village were found within the Assessment Area. No works was proposed to be carried out within the villages and their 300m and 100m areas around the ancestral halls of Wo Shang Wai and Mai Po Village respectively. No impact on the villages was therefore anticipated due to the large separation distance.

10.5.2 In the Study Brief it is stated that fishponds are a type of landscape feature. However, it should be stressed that no fishponds are located with the Project Area or impacted by the proposed project. Fishponds adjacent to the Project Area were evaluated in the LVIA section i.e. Chapter 11 as landscape resources of low sensitivity and no adverse impact was anticipated.

Operational Phase

10.5.3 The Mai Po village is located 250m away from the proposed Project. Although the Wo Shang Wai Village is located adjacent to the Project, no cultural heritage impact on its modern residential buildings was identified. The fishponds were identified as landscape resources of low sensitivity. No operational impact is therefore anticipated.

10.6 Mitigation Measures

10.6.1 As there were no associated impacts identified, no mitigation measure was required.

10.7 Residual Impacts

10.7.1 No residual impact was identified.

10.8 Conclusion

10.8.1 From the surveys and examination of the records it was identified that no declared or deemed monuments or graded historical buildings were identified in the Assessment Area. Most houses within the Mai Po Village and Wo Shang Wai Village are modern houses and their ancestral halls are located at least 100m from the development site. Fishpond features adjacent to the site are of low landscape sensitivity. No construction activity which could result in vibration effects are planned for this Project. Given the distance between the development site and the Villages there is no anticipated effect on cultural heritage resources.

10.9 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.

11 LANDSCAPE AND VISUAL IMPACT

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

11.1 Summary

11.1.1 This chapter of the report outlines the landscape and visual impacts associated with the proposed development at Wo Shang Wai 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.

11.1.2 The assessment included:

- 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, before and after the mitigation measures; and
- recommendation of appropriate mitigation measures and associated implementation programmes.

11.1.3 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, and 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 after completion without mitigation; on day 1 after mitigation, and in year 10 after mitigation.

11.1.4 Not unexpectedly during construction the impacts on the adjacent sensitive receivers in Palm Springs, Royal Palms, etc. are defined as moderate to negative. However once operational there will be a net gain in landscape resources and there will be a slight positive impact on the landscape character of the Tsing Lung Tsuen Plan (LCA2) due to the coherent residential and wetland development. The overall conclusion is that the landscape and visual impacts are acceptable with mitigation measures.

11.2 Environmental Legislation and Guidelines

11.2.1 The following legislation, standards and guidelines are applicable to the evaluation of landscape and visual impacts associated with the construction and operation of the Wo Shang Wai Comprehensive 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;
- EIAO Guidance Note (GN) 8/2002;
- Outline Zoning Plan No.S/YL-MP/6;
- Town Planning Board Guidelines for Application for Developments Within Deep Bay Area under Section 16 of the Town Planning Ordinance (PRB PG-NO. 12B);
- Hong Kong Planning Standards and Guidelines;
- Town Planning Ordinance (Cap 131);
- Forests and Countryside Ordinance (Cap 96) and its subsidiary legislation the Forestry Regulations;
- Country Parks Ordinance (Cap 208);
- Marine Parks Ordinance (Cap 476) and associated subsidiary legislation;
- Animals And Plants (Protection of Endangered Species) Ordinance (Cap 187);
- WBTC No. 23/93 - Control of Visual Impact of Slopes;
- SILTech Publication (1991) – Tree Planting and Maintenance in Hong Kong (Standing Interdepartmental Landscape Technical Group) [11-23]; and
- WBTC No. 12/2000 – Improvement to the Appearance of slopes in connection with WBTC 23/93;
- WBTC No. 30/2001 – Capital Works or Maintenance Works (including Tree Planting) Within or Adjacent to the Kowloon Canton Railway (Hong Kong) Section
- WBTC No. 7/2002 – Tree Planting in Public Works
- ETWBTC No. 3/2006 - Tree Preservation;
- Land Administration Office Instruction (LAOI) Section D-12 – Tree Preservation
- GEO publication (1999) – Use of Vegetation as Surface Protection on Slopes;
- GEO 1/2000 – Technical Guidelines on Landscape Treatment and Bio-engineering of Man-made Slopes and Retaining Walls; and
- Urban Council Publication (1998) - Champion Trees in Urban Hong Kong (Chinese Language Edition)

11.3 Scope and Content of the Study

Limits of the Assessment Area

11.3.1 The limit of the landscape impact study is 500m beyond the limit of the Works (**Figure 11.1A**). The limits of the visual impact study is the Zones of Visual Influence of the works during the construction and operation phases, which is illustrated in **Figure 11.1B**.

Assessment Methodology

11.3.2 Landscape and visual impacts have been assessed separately for the construction and operational phases.

11.3.3 The assessment of landscape impacts has involved the following procedures.

- ***Identification of the baseline landscape resources (physical and cultural) and landscape character 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 to change of the landscape resources.*** 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 landscape or landscape resource of particularly distinctive character or high importance, sensitive to relatively small changes
Medium:	Landscape or landscape resource of moderately valued landscape characteristics reasonably tolerant to change
Low:	Landscape or landscape resource, 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 landscape impacts.*** 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 landscape or landscape resource would suffer a major change
Intermediate:	The landscape or landscape resource would suffer a moderate change
Small:	The landscape or landscape resource would suffer slight or barely perceptible changes
Negligible:	The landscape or landscape resource would suffer no discernible change.

- ***Identification of potential landscape mitigation measures.*** These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise 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 and their approval-in-principle has been sought.
- ***Prediction of the significance of landscape impacts before and after 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 11–1** 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 impact and a low-medium-high degree of sensitivity of landscape resource/character. The significant thresholds are defined as follows:

Substantial:	Negative / positive impact where the proposal would cause significant deterioration or improvement in existing landscape quality
Moderate:	Negative / positive impact where the proposal would cause a noticeable deterioration or improvement in existing landscape quality
Slight:	Negative / 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

- ***Prediction of Acceptability of Impacts.*** An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the EIAO-TM.

Table 11-1 Relationship between Receptor Sensitivity and Impact Magnitude in Defining Impact Significance

Magnitude of Impact		Low	Medium	High
	Large	**Moderate**	**Moderate / Substantial**	**Substantial**
	Intermediate	**Slight / Moderate**	**Moderate**	**Moderate / Substantial**
	Small	**Slight**	**Slight / Moderate**	**Moderate**
	Negligible	**Insubstantial**	**Insubstantial**	**Insubstantial**

Receptor Sensitivity
(of Landscape Resource, Landscape Character Area or VSR)

11.3.4 The assessment of **visual impacts** has involved the following procedures.

- ***Identification of the Zones of Visual Influence during the construction and operational phases of the*** Wo Shang Wai Comprehensive Development project. 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 Wo Shang Wai Comprehensive Development project from various locations.
- ***Identification of the Visually Sensitive Receivers (VSRs) within the ZVIs at construction and operational phases.*** These are the people who would reside within, work within, play within, or travel through, the ZVIs.
- ***Assessment of the degree of sensitivity to change of the VSRs and assessment of the potential magnitude of visual impacts***. This includes consideration of the following factors:
  - the type of VSRs, which 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. 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 approximate numbers of affected VSRs (very few, few, many, very many);
  - the value and quality of existing views,
  - the availability and amenity of alternative views;

- the duration or frequency of view;

  the degree of visibility*;*
- 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.
- the change / blockage to the character of existing views.

11.3.5 The sensitivity of VSRs 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

11.3.6 The magnitude of visual impacts are classified as follows:

Large:	The VSRs would suffer a major change in the character of their viewing experience;
Intermediate:	The VSRs would suffer a moderate change in the character of their viewing experience;
Small:	The VSRs would suffer a small change in the character of their viewing experience;
Negligible:	The VSRs would suffer 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.*** These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise 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 and their approval-in-principle has been sought.

- ***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 and 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 impact 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 11–1.** The significance of the visual impacts is categorised as follows:

  Substantial: Negative / positive impact where the proposal would cause significant deterioration or improvement in existing visual character;

  Moderate: Negative / positive impact where the proposal would cause a noticeable deterioration or improvement in existing visual character;

  Slight: Negative / 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.

- ***Prediction of Acceptability of Impacts.*** An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the EIAOTM.

11.3.7 In addition, the following assumptions have been made in the assessment:

- 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 indicated in **Table 11–3** and **Table 11–4**.

11.4 Planning and Development Control Framework

11.4.1 A review has been undertaken of the current planning goals and objectives, statutory land-use and landscape planning designations for the Assessment Area.

11.4.2 The relevant OZP is the **Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/6** which is shown in **Figure 11.1A**. Under this Plan the site is principally zoned as "OU" Other Uses. The Explanatory Statements states at Para 9.9.1 that:

"The planning intention of this zone is to provide incentive for the restoration of degraded wetlands adjoining existing fishponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration

area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fishponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay….

"To be in line with the rural setting which is mainly village houses, to minimize visual impact and to take into account the capacities of local road network and infrastructure in this area, development or redevelopment shall not result in a total development or redevelopment intensity in excess of a total plot ratio of 0.4 and a maximum building height of 6 storeys including car park. To provide flexibility for innovative design adapted to the characteristics of particular sites, minor relaxation of the above restrictions may be considered by the Board through the planning permission system. Each proposal will be considered on its individual planning merits. Full justifications and illustration materials should be submitted to the Board for consideration…

"An area at Wo Shang Wai to the north of Royal Palms and Palm Springs is also zoned "OU(CDWRA)". This area comprises formed land, fishponds filled prior to the publication of the Mai Po and Fairview Park IDPA Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks."

11.4.3 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 (PRB PG-N).12B)). At Para 6.4, these state that:

"The intention of the WBA is to protect the ecological integrity of the fishponds and wetland within the WCA and prevent development that would have a negative off-site disturbance impact on the ecological value of fishponds. 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 fishponds 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 fishponds lost.

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 minimise its impact on the wetland and to restore some of the lost fishponds 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

Development proposals to restore lost fishponds or to replace existing undesirable uses by wetland habitats are encouraged…

Residential
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"

11.4.4 It is considered that the Wo Shang Wai Comprehensive 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 buffer area adjacent to existing fishponds and low-rise development south of this. The Wo Shang Wai Comprehensive Development Project would also be in accordance with the Town Planning Board Guidelines for Application for Developments Within Deep Bay Area under Section 16 of the Town Planning Ordinance (PRB PG-N).12B)) in that the Project provides a wetland and visual buffer to separate the development from the WCA, replacing in part, undesirable uses with wetland creation.

11.4.5 Nevertheless, the Project must be very carefully designed to minimise any potentially adverse impacts on the environment.

11.5 Baseline Study

Physical, Human and Cultural Landscape Resources

11.5.1 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 11.2**. Photo-views illustrating the landscape resources are illustrated in **Figures 11.3** to **11.14** inclusive. For ease of reference and co-ordination between text, tables and figures each landscape resource is given an identity number.

On-Site Landscape Resources

LR29 – Drainage Channel at East of Site – A drainage channel 5m wide and around 120m long, flowing from the housing area towards a storage area and along the boundary fence. The water is clear and the embankment is covered with grass. The sensitivity of this landscape resource is Low.

LR30 – Freshwater Marsh – Approximately 4 ha area of marsh with patches of *Phragmites sp* reeds in wet depression near the centre of the Site. The sensitivity of this landscape resource is Medium.

LR32 – Grassland with Seasonal Marsh Patches and Soils on Site – 11.74ha (11.05ha of grassland and 0.69ha of seasonal marsh patches) of muddy grassland comprising common grass species. The sensitivity of this landscape resource is Low.

LR33 – Tree Group on Site – There are 4 nos. of semi-mature trees comprising *Dimocarpus longan* and *Aleurites moluccana* with a typical high of 5m. The sensitivity of this landscape resource is Medium.

LR34 – Banana Trees on Site – A group of approximately 10 nos. of 4m high banana trees (*Musa* spp.). The sensitivity of this landscape resource is Low.

LR36 – Trees in Open Storage Area – There are approximately 74 semi-mature trees and about 119 young trees (less than 95mm dbh) with an average height of 5m comprising mainly *Macaranga tanarius, Hibiscus tiliaceus, Bauhinia blakeana, Albizia lebbeck.* The sensitivity of this landscape resource is Medium.

LR39 – Trees along Castle Peak Road (Mai Po) – Along Castle Peak Road, there are approximately 200 roadside trees with a typical height of 7m comprising mainly *Melaleuca quinquenervia, Leucaena leucocephala, Ficus microcarp, Acacia confusa, Bombax ceiba, Casuarina equisetifolia, Melia azedarach.* These range from young trees (less than 95mmdbh) to semi-mature and mature trees. A small number of these are within the Site boundary. The sensitivity of this landscape resource is Medium.

Off-Site Landscape Resources

LR1 – Trees Along East Side of San Tin Highway – There are about 100 mature trees comprising mainly *Celtis sinensis*, *Acacia confusa*, *Cinnamomum camphora*, *Macaranga tanarius*, *Melia azedarach*, *Schefflera heptaphylla* and *Albizia lebbeck*. They have a typical height of 6m. The sensitivity of this landscape resource is Medium.

LR2 – Roadside Trees Surrounding Mai Po Substation – There are in this location, about 200 mature *Eucalyptus citriodora* with an average height of 10m. The sensitivity of this landscape resource is Medium.

LR3 – Trees Opposite Mai Po San Tsuen – There are about 40 mature trees in this location comprising mainly *Dimocarpus longan*, *Celtis sinensis*, *Microcos paniculata* generally approximately 6m high. The sensitivity of this landscape resource is Medium.

LR4 – Field East of San Tam Road – This consists of an agricultural field with common agricultural species. There are about 60 semi-mature *Musa* spp.(Banana trees) with an average height of about 4m. The sensitivity of this landscape resource is Low.

LR5 – Ponds in Field East of San Tam Road – This resource consists of two irrigation ponds in an agricultural field east of Sam Tam Road. The ponds are approximate 2m wide, 2m long and 2 m deep, full of clear water. The sensitivity of this landscape resource is Low.

LR6 – Trees Behind Field east of San Tam Road – There are in this location about 30 semi-mature trees comprising mainly *Dimocarpus longan and Celtis sinensis*. They have a typical height of 7m. The sensitivity of this landscape resource is Medium.

LR7 – Stream Next to Field east of San Tam Road – This comprises a 220m long and 1m wide natural stream flowing from agricultural fields to a drainage channel along the east side of San Tam Road. Stream water is clear and the stream is about 100mm deep. Common riparian vegetation species are present along the natural embankment. The sensitivity of this landscape resource is Medium.

LR8 – Pond East of San Tam Road– A small pond approximately $3m^2$ besides village buildings. The water surface is covered with green algae. The sensitivity of this landscape resource is Low.

LR9 – Trees along East Side of San Tam Road – There are about 200 mature trees with an average height of about 10m, comprising mainly *Hibiscus tiliaceus*, *Ficus microcarpa*, *Bombax ceiba*, *Casuarina equisetifolia*, *Acacia confusa*, *Eucalyptus robusta*. The sensitivity of this landscape resource is Medium.

LR10 – Drainage Channel East of San Tam Road – This is a man made channel approximately 2m wide and 700m in length. The channel is made of concrete and common riparian vegetation species are present along the bank. The sensitivity of this landscape resource is Low.

LR11 – Grassland East of San Tam Road – An area of grassland approximately 360m x 60m, comprising grasses and weedy creeping species (*Ipomoea cairica).* The sensitivity of this landscape resource is Medium.

LR12 – Trees around Cottage Area east of San Tam Road – About 30 semi-mature trees with an average height of 6m comprising mostly fruit trees, (*Dimocarpus longan*, *Mangifera indica*, *Eriobotrya japonica*, *Celtis sinensis).* The sensitivity of this landscape resource is Medium.

LR13 – Slope adjoining San Tam Road – There are about 250 semi-mature to mature trees comprising common woodland species (*Macaranga tanarius*, *Melia azedarach*, *Leucaena leucocephala*, *Acacia confusa).* They have a typical height of 7m. The sensitivity of this landscape resource is Medium.

LR14 – Trees North of Scenic Heights – There are about 50 semi-mature trees with an average height of 7m comprising common woodland species (*Dimocarpus longan*, *Sapium sebiferum).* The sensitivity of this landscape resource is Medium.

LR15 – Trees inside Scenic Heights – There are about 100 semi-mature trees comprising mainly ornamental species (*Roystonea regia*, *Archontophoenix alexandrae*, *Michelia x alba*, *Casuarina equisetifolia).* They have an average height of 6m. The sensitivity of this landscape resource is Medium.

LR16 – Fruit Trees North of Ki Lung Shan Foothills I – There are about 100 semi-mature fruit trees with an average height of 5m. They are mainly *Dimocarpus longan*, *Litchi chinensis*, *Musa* spp., *Mangifera indica.* The sensitivity of this landscape resource is Medium.

LR17 – Woodland North of Ki Lung Shan Foothills II – There are about 100 mature trees comprising mainly common woodland species with an average height of 5m (*Microcos paniculata*, *Sapium sebiferum*, *Macaranga tanarius).* The sensitivity of this landscape resource is Medium.

LR18 – Trees on Ki Lung Shan Foothills II – There are about 50 semi-mature trees comprising mainly *Hibiscus tiliaceus, Michelia x alba, Acacia confuse.* They have an average height of 4m. The sensitivity of this landscape resource is Medium.

LR19 – Trees on Ki Lung Shan Foothills I – There are about 50 ornamental trees with an average height of 5m comprising mainly *Delonix regia*, *Michelia x alba, Juniperus chinensis var. kaizuca, Araucaria heterophylla*, *Mangifera indica.* The sensitivity of this landscape resource is Medium.

LR20 – Trees in Maple Gardens – There are about 100 trees with an average height of 6m comprising mainly *Delonix regia*, *Michelia x alba*, *Araucaria heterophylla*, *Mangifera indica*, *Macaranga tanarius*, *Terminalia catappa*, *Chrysalidocarpus lutescens.* The sensitivity of this landscape resource is Medium.

LR21 – Grassland on Ki Lung Shan Foothills – An area of grassland and small shrubs on hillsides. The sensitivity of this landscape resource is Low.

LR22 – Trees between San Tin Highway and Maple Gardens – There are about 40 mature trees with an average height of 7m comprising mainly *Eucalyptus robusta, Melia azedarach, Ficus elastica, Bauhinia variegata, Leucaena leucocephala, Mangifera indica.* The sensitivity of this landscape resource is Medium.

LR23 – Chunk Kai Horticultural Nursery – There are approximately 10 semi-mature trees - about 5m high - comprising *Mangifera indica, Ficus microcarpa.* The Nursery also contains some young trees. The sensitivity of this landscape resource is Low.

LR24 – Trees along San Tin Highway – There are about 1000 mature *Eucalyptus citriodora* (approximately 12m high) planted along the San Tin Highway forming lines of roadside tree. The sensitivity of this landscape resource is Medium.

LR25 – Pond east of Royal Palms – A small pond of 2m x 10m full of water. The sensitivity of this landscape resource is Low.

LR26 – Field east of Royal Palms – Agricultural field with common crop species. The sensitivity of this landscape resource is Medium.

LR27 – Trees east of Royal Palms – There are approximately 10 semi-mature trees with an average height of 5m, comprising mainly *Musa spp*, *Dimocarpus longan, Clausena lansium.* The sensitivity of this landscape resource is Medium.

LR28 – Trees outside Royal Palms near Palm Canyon Drive – There are about 100 semi-mature trees with a typical height of 6m, comprising mainly *Celtis sinensis*, *Acacia confusa*, *Bridelia tomentosa, Ficus rumphii, Leucaena leucocephala*. The sensitivity of this landscape resource is Medium.

LR31 – Trees on northern Boundary of Royal Palms – There are approximately 300 semi-mature trees of a typical height of 5-10m. Most are ornamental species comprising mainly *Mangifera indica, Ficus microcarpa, Livistona chinensis, Aleurites moluccana.* The sensitivity of this landscape resource is Medium.

LR35 – Stream on northern Boundary of Site – A clear, slow running stream of approximately 10m wide, 2m deep and around 3000m long flowing from Tam Kon Chau through the fishponds to the site. Common riparian vegetations are present along the embankment. The sensitivity of this landscape resource is Medium.

LR37 – Not Used

LR38 – Trees inside Open Storage Area – There are approximately 200 nos. of wild grown semi-mature trees with a typical height of 5m comprising mainly *Macaranga tanarius, Leucaena leucocephala.* The sensitivity of this landscape resource is Medium.

LR40 – Trees in Cottage Area east of Castle Peak Road – There are approximately 20 nos. of young trees with a typical height of 3m comprising mainly *Macaranga tanarius, Michelia x alba, Dimocarpus longan, Mangifera indica, Litchi chinensis.* The sensitivity of this landscape resource is Medium.

LR41 – Pond behind Mai Po San Tsuen – A small pond with an area of 60m x 80m contains fully of water. The sensitivity of this landscape resource is Low.

LR42 – Grassland besides DSD building – Artificial grassland besides a Drainage Services Department's building. The sensitivity of this landscape resource is Low.

LR43 – Trees in Mai Po San Tsuen – There are approximately 40 nos. of semi-mature trees of typical height of 5m comprising mainly *Macaranga tanarius, Michelia x alba, Dimocarpus longan, Mangifera indic, Roystonea regia*, *Archontophoenix alexandrae, Juniperus chinensis var. kaizuca, Livistona chinensis.* The sensitivity of this landscape resource is Medium.

LR44 – Trees behind Mai Po San Tsuen – There are about 30 nos. of wild grown semi-mature trees comprising mainly *Leucaena leucocephala, Melia azedarach.* They have an average height of 6m. The sensitivity of this landscape resource is Medium.

LR45 – Trees in Mai Po Lo Wai – There are approximately 10 nos. of semi-mature trees with a typical height of 5m comprising *Celtis sinensis, Juniperus chinensis var. kaizuca, Clausena lansium, Aglaia odorata.* The sensitivity of this landscape resource is Medium.

LR46 – Field west of Mai Po Lo Wai – Agricultural field with an approximate area of 2000m^2 with a few common crop species cultivated. The sensitivity of this landscape resource is Low.

LR47 – Pond west of Mai Po San Tsuen – A large pond of approximately 150m x 100m fully covered with fresh water plant *Eichhornia crassipes*. The sensitivity of this landscape resource is Low.

LR48 – Channel west of Mai Po San Tsuen – A man-made channel of 2m wide and 100m long with concert bank. Water is running slow and sallow. The sensitivity of this landscape resource is Low.

LR49 – Channel beside DSD building – A man-made channel of 2 m wide and 300m long with concert bank. The sensitivity of this landscape resource is Low.

LR50 – Woodland along Castle Peak Road (Mai Po) – There are approximately 500 semi-mature to mature trees, comprising *Macaranga tanarius, Musa spp, Bambusa spp, Eucalyptus citriodora, Ficus microcarpa.* Their typical height is of 7m. The sensitivity of this landscape resource is Medium.

LR51 – Fishponds along Tam Kon Chau Road – Two fishponds full of water with an area of approximately 18000m^2. The embankment is covered with grass and some trees. The sensitivity of this landscape resource is Low.

LR52 – Trees north of Tam Kon Chau Road –There are approximately 10 trees - about 4m high - comprising mainly *Macaranga tanarius.* The sensitivity of this landscape resource is Medium.

LR53 – Dry Pond north of Tam Kan Chau Road – A dry fish pond with an area of 100m x 100m. The sensitivity of this landscape resource is Low.

LR54 – Fishponds south of Tam Kon Chau Road – A group of fishponds full of water with an area of approximately 96000m^2. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR55 – Trees beside Fishponds south of Tam Kon Chau Road – There are approximately 30 semi-mature trees with a typical height of 5m, comprising *Musa spp, Dimocarpus longan, Litchi chinensis.* The sensitivity of this landscape resource is Medium.

LR56 – Fishponds north-east of Site – A group of fishponds full of water, approximately 300m x 300m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR57 – Trees beside fishponds north-east of Site –There are about 2 semi-mature trees with a typical height of 5m, comprising mainly *Melia azedarach.* The sensitivity of this landscape resource is Medium.

LR58 – Stream north of Tam Kon Chau Road – Slow running stream 400m long and 10m wide with rubbish present. Reed and grass present on the embankment. The sensitivity of this landscape resource is Medium.

LR59 – Trees beside Stream north of Tam Kon Chau Road – There are about 40 semi-mature trees comprising *Melia azedarach, Musa spp, Macaranga tanarius, Leucaena leucocephala, Mangifera indica*, *Syzygium jambos, Averrhoa carambola.* They have an average height of 5m. The sensitivity of this landscape resource is Medium.

LR60 – Fishponds north of Tam Kon Chau Road – A group of fishponds full of water, about 1000m^2. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR61 – Trees beside Fishponds north of Tam Kon Chau Road – Approximately 5m high mature *Ficus microcarpa* tree. The sensitivity of this landscape resource is Medium.

LR62 – Fishponds north-west of Site – A group of fishponds full of water, approximately 400m x 400m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR63 – Trees beside Fishponds north-west of Site –There are about 60 4m high semi-mature banana trees (*Musa spp).* The sensitivity of this landscape resource is Medium.

LR64 – Fishponds north of Tam Kon Chau – A group of fishponds full of water, approximately 200m x 100m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR65 – Trees beside Fishponds north of Tam Kon Chau – There are about 30 nos. of 5m high semi-mature *Dimocarpus longan* trees. The sensitivity of this landscape resource is Medium.

LR66 – Trees in Tam Kon Chau – There are about 40 semi-mature to mature trees with a typical height of 6m, comprising mainly *Dimocarpus longan, Ficus microcarpa***,** *Casuarina equisetifolia.* The sensitivity of this landscape resource is Medium.

LR67 – Pond south of Tam Kon Chau – A pond full of water, about 40m x 40m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR68 – Fishponds south of Tam Kon Chau – A group of fishponds full of water, approximately 200m x 300m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR69 – Fishponds south-west of Tam Kon Chau – A group of fishponds full of water extending an area of 100m x 300m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR70 – Fish Pond west of Palm Springs – A group of fishponds full of water, about 240m x 300m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR71–Trees beside Fish Pond west of Palm Springs – There are about 10 semi-mature trees with a typical height of 5m, comprising mainly *Dimocarpus longan, Melia azedarach, Eucalyptus citriodora*. The sensitivity of this landscape resource is Medium.

LR72 – Fishponds north-west of Palm Springs – A group of fishponds full of water, about 500m x 140m. Grass is present on the embankment. The sensitivity of this landscape resource is Low.

LR73 – Fishponds west of Palm Springs – A group of fishponds full of water, about 360m x 300m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR74 – Trees beside Fishponds west of Palm Springs – There are approximately 10 mature trees comprising mainly *Macaranga tanarius, Melia azedarach* of about 5m high. The sensitivity of this landscape resource is Medium.

LR75 – Fishponds west of Palm Springs – A group of fishponds full of water, approximately 300m x 100m. Grass is present on the embankment. The sensitivity of this landscape resource is Low.

LR76 – Fish Pond west of Palm Springs – A long rectangular fish pond covered with reeds, about 2000 m^2. Grass is present on the embankment. The sensitivity of this landscape resource is Low.

LR77 – Fishponds west of Palm Springs – A group of fish pond covered with reed extending to an area of about $720m^2$. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR78 – Trees beside Fishponds west of Palm Springs – There are about 10 nos. of semi-mature trees with an average height of 5m comprising mainly *Macaranga tanarius, Melia azedarach, Musa spp.* The sensitivity of this landscape resource is Medium.

LR79 – Fishponds west of Palm Springs – A group of fishponds full of water, about 100m x 200m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR80 – Trees beside Fishponds west of Palm Springs – There are about 10 mature trees with an average height of 5m comprising mainly *Macaranga tanarius, Melia azedarach.* The sensitivity of this landscape resource is Medium.

LR81 – Fishponds west of Palm Springs – A group of fishponds full of water, approximately 400m x 80m. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR82 – Trees beside Fishponds west of Palm Springs – There are about 10 semi-mature trees comprising mainly *Macaranga tanarius, Leucaena leucocephala* approximately 5m high. The sensitivity of this landscape resource is Medium.

LR83 – Stream west of Palm Springs – A natural stream, approximately 3m wide and 80m long. Common riparian vegetation is present along the embankment. The sensitivity of this landscape resource is Medium.

LR84 – Fishponds west of Palm Springs – A fish pond covered with reed about 400 m^2. The embankment is covered with grass and a few trees. The sensitivity of this landscape resource is Low.

LR85 – Trees beside Fishponds west of Palm Springs – There are approximately 10 semi-mature trees, about 5m high, comprising *Macaranga tanarius, Celtis sinensis*. The sensitivity of this landscape resource is Medium.

LR86 – Trees in northern Palm Springs – There are about 200 mature trees bordering the Site, comprising *Michelia x alba, Hibiscus tiliaceus, Mangifera indica, Casuarina equisetifoli, Araucaria heterophylla*. They have an average height of 6-10m. The sensitivity of this landscape resource is Medium.

LR87 – Trees in western Palm Springs – There are about 200 mature trees bordering the Site, with an average height of 6-10m comprising *Hibiscus tiliaceus, Casuarina equisetifoli, Roystonea regia.* The sensitivity of this landscape resource is Medium.

LR88 – Trees in southern Palm Springs – There are about 200 mature trees with an average height of 6-10m, comprising mainly *Hibiscus tiliaceus, Ficus microcarpa, Melaleuca quinquenervia.* The sensitivity of this landscape resource is Medium.

LR89 – Trees in Car Park in Palm Springs – There are about 40 mature trees with an average height of 7m comprising mainly *Hibiscus tiliaceus, Ficus microcarpa, Livistona chinensis, Roystonea regia*. The sensitivity of this landscape resource is Medium.

LR90 – Pond in Wo Shang Wai Village – A pond - approximately 400m^2 - full of water. The natural embankment is lined with common riparian vegetation. The sensitivity of this landscape resource is Low.

LR91 – Trees in northern Palm Springs – There are about 30 planted semi-mature trees comprising mainly *Hibiscus tiliaceus*, typically 6m high. The sensitivity of this landscape resource is Medium.

LR92 – Trees at Shopping Mall in Palm Springs – There are about 10 mature palms (*Roystonea regia)* typically 12m high. The sensitivity of this landscape resource is Medium.

LR93 – Ponds in Palm Springs – A pond full of water, approximately 140m x 200m. There are grasses and a few trees on the embankment. The sensitivity of this landscape resource is Medium.

LR94 – Trees beside Ponds in Palm Springs – There are about 50 semi-mature trees, comprising mainly *Macaranga tanarius, Musa spp.* They have an average height of 5m. The sensitivity of this landscape resource is Medium.

LR95 – Trees in southern Royal Palms – There are about 200 semi-mature trees comprising *Livistona chinensis, Aleurites moluccana. Michelia x alba, Araucaria heterophylla*. They have an average height of 6m. The sensitivity of this landscape resource is Medium.

LR96 – Trees around Sports Facilities in Royal Palms – There are about 50 semi-mature trees with an average height of 6m, comprising *Ficus mircocarpa, Livistona chinensis.* The sensitivity of this landscape resource is Medium.

LR97 – Trees east of Royal Palms – There are about 200 semi-mature trees, comprising *Eucalyptus robusta, Macaranga tanarius*, *Bombax ceiba*, *Cinnamomum camphora*, *Casuarina equisetifoli.* They have an average height of 6m. The sensitivity of this landscape resource is Medium.

LR98 – Pond south of Palm Springs Boulevard Entrance – A small pond, approximately. 24000m^2, full of water with banks covered with wild grasses and shrubs. The sensitivity of this landscape resource is Low.

LR99 – Ponds south of Palm Springs – Fishponds with an area of 60m x 40m. The ponds are full of water and grass with some trees present on the embankments. The sensitivity of this landscape resource is Low.

LR100 – Trees surrounding Ponds south of Palm Springs – There are about 10 semi-mature trees, typically 4m high, comprising mainly *Citrus spp. Macaranga tanarius*. The sensitivity of this landscape resource is Medium.

Landscape Character Areas

11.5.2 Several landscape character areas (LCAs) have been identified within the Assessment Area. These areas, and their sensitivity to change, are described below. The locations of the character areas are indicated on **Figure 11.15**. Photographs showing the character of the LCAs are provided in **Figure 11.16** and **Figure 11.17**. For ease of reference and co-ordination between text, tables and figures each landscape character area is given an identity number.

LCA1 - Palm Springs Development

11.5.3 This low-lying landscape comprises several clusters of self-contained residential development, such as Palm Springs, Maple Garden and Royal Palms, each comprising numerous low-rise residences developed to a single co-ordinated master plan. The areas of housing are separated by the San Tin Highway which runs through the LCA. Housing is set within a network of roads and amenity space with a centralised club house and community facilities. The peripheral areas of these residential developments are characterised by scattered village houses, occasional tree clumps, ponds and disused arable fields. Vegetation is typically street tree planting and amenity planting. Other features in this landscape include several ponds around the housing areas. Generally, this is a varied landscape of small scale domestic features which is both enclosed and intensively maintained. It has a low sensitivity to change.

LCA2 - Tsing Lung Tsuen Plain

11.5.4 Much of this flat, low-lying landscape is undeveloped and retains its predominantly rural characteristics. Most of the landscape lies below 40mPD. Occasional densely clustered villages, such as Wing Ping Tsuen, Fan Tin Tsuen, Mai Po San Tsuen, Mai Po Lo Wai and On Lung Tsuen are situated across the plain. Around villages lie areas of active and disused agricultural land and there are a number of open storage areas, giving the landscape a slightly incoherent and degraded quality. Castle Peak Road and the San Tin Highway run through the Landscape Character Area (LCA). Vegetation comprises primarily scattered trees and occasional blocks of woodland. A number of streams flow across the plain, fed from higher ground. Other features in this landscape include footpaths, roads, and ponds. Generally, this is a varied landscape of small scale elements which is both fairly open and tranquil. It has a medium sensitivity to change.

11.5.5 Within this LCA, landscape features of note include:

- Tai Fu Tai Mansion is considered as one of the most beautifully embellished traditional Chinese buildings in Hong Kong and is renowned for its fine architectural decorations
- Man Lun Fung Ancestral Hall is noted for the commemoration of one of the 'Five Major Clans' in Hong Kong
- Man Ancestral Hall
- Mai Po Village egretry is registered SSSI

LCA3 - San Tin Plain

11.5.6 Much of this flat, low-lying landscape is undeveloped and retains its predominantly rural characteristics, typified by extensive areas of fishponds and gei wai. Most of the landscape lies below 40mPD. Much of this area was probably formerly coastal and has been reclaimed from Deep Bay. Other land use includes remnant and active agriculture. Occasional villages, such as Mai Po San Tsuen and Lin Barn Tsuen are located across the plain. Vegetation comprises primarily scattered trees and mangrove. A number of streams flow across the plain, fed by streams such as the Sham Chun River, running off higher ground. Other features in this landscape include freshwater wetland, footpaths, roads, and the security fence of the Closed Area. Today, relic prehistoric sea cliffs can be found inland. Generally, this is a fairly simple landscape of moderate scale elements which is both fairly open and tranquil. It has a high sensitivity to change.

LCA4 - Ki Lung Shan Uplands

11.5.7 This rolling upland landscape rises to a height of 337mPD and falls to valleys and low-lying plains on all sides. The landscape is almost entirely undeveloped and the only human features in it include powerlines, footpaths, a lane / access road leading up to the summit from the western side, and a small reservoir and dam in a valley at the northern end of the uplands. Vegetation comprises scrub and woodland on lower slopes with grassland on the craggy upland area. Woodland lines stream courses in sheltered gullies. The landscape offers expansive panoramic views towards San Tin and Kwu Tung to the north and Ngau Tam Mei to the south. The result is a simple rural landscape of large scale elements which has a character that is open and tranquil. It has a high sensitivity to change.

Zone of Visual Influence (ZVI)

11.5.8 The ZVI for the Works will be largely similar during the construction phase and operational phase, as there will be no especially tall temporary machinery or structures associated with construction works. The ZVI is described below.

11.5.9 To the south of the Site, the ZVI is defined by the 2 and 3 storey buildings of the Palm Springs and Royal Palms developments and also the village of Wo Shang Wai.

11.5.10 To the west, the edge of the ZVI is not well-defined. Land west of the site is flat and low lying and fishponds extend from the western edge of the Site, westwards towards Deep Bay. The landscape is largely open, though broken by occasional trees and huts around fishponds. However, the full extent of the ZVI is not very clear.

11.5.11 To the north, the ZVI is defined largely by the Tam Kon Chau Road, which is slightly elevated above surrounding fishponds and by the village of Tam Kon Chau itself.

11.5.12 To the east, the ZVI is contained by development in Royal Palms and by dense, tall roadside tree planting along Castle Peak Road and the San Tin Highway. This means that there are no significant views of the Project Area from the San Tin Highway or from the Maple Gardens development east of the San Tin Highway.

11.5.13 To the north-east, the ZVI is defined by village buildings at Mai Po Lo Wai and Mai Po San Tsuen and cottage areas, though views to the Site are very broken by intervening industrial and storage areas.

Visually Sensitive Receivers (VSRs)

11.5.14 Within the ZVI for the construction and operation phases as well as key Visually Sensitive Receivers (VSRs) have been identified. These VSRs are mapped in **Figure 11.1B** while the section showing the derivation of ZVI is illustrated in **Figure 11-18**. They are listed below, and also, together with their sensitivity, in **Table 11–6.** The views currently experienced by VSRs are shown in **Figures 11.19** to **11.23**. For ease of reference, each VSR is given an identity number, which is used in the text tables and figures.

Residential Visually Sensitive Receivers

11.5.15 Residential VSRs are as follows:

- R1 Residents in Royal Palms (those most affected are approximately 21 properties on Ventura Avenue and approximately 8 properties on Santa Monica Avenue which are the only properties which directly face the site)
- R2 Residents in Palm Springs (those most affected are approximately 17properties in Camelia Path and approximately 32 properties on Narcissus Path which are the only properties which directly face the site)
- R3 Residents in Wo Shang Wai
- R4 Residents in Cottage Area South of Mai Po San Tsuen
- R5 Residents in Mai Po San Tsuen and Mai Po Lo Wai
- R6 Residents in Tam Kon Chau

Occupational Visually Sensitive Receivers

11.5.16 Occupational VSRs are as follows:

- O1 Workers in Fishponds in and around Mai Po
- O2 Workers in Industrial / Storage Areas north of Royal Palms
- O3 Workers in Industrial / Storage Areas east of Royal Palms

Travelling Visually Sensitive Receivers

11.5.17 Travelling VSRs are as follows:

- T1 Motorists on San Tin Highway
- T2 Motorists on Castle Peak Road
- T3 Motorists on Tam Kon Chau Road
- T4 Pedestrians on San Tin Highway Footbridge

Recreational Visually Sensitive Receivers

RE1 Visitors to Mai Po Nature Reserve

Potential Sources of Landscape and Visual Impact

11.5.18 The proposed project will involve the following sources of construction impacts:

- Site clearance works;
- Earth moving and regrading;
- Filling of existing marshes and channels;
- Removal of existing grass on Site;
- Removal of existing reeds on Site;
- Removal of existing trees on Site;
- Construction works on residential units, highways and club house;
- Presence of incomplete structures;
- Haulage off-site of excavated materials;
- Storage of existing topsoil for reinstatement works;
- Materials stockpiling;
- Importation and storage of construction equipment and plant;
- Laying down of utilities, including water, drainage and power;
- Construction of temporary parking areas, on site accommodation and working areas;
- Construction of temporary site hoarding (to entire site perimeter) and temporary noise barriers (9 and 10m high) to western and southern boundary of the site; and
- Night lighting.

11.5.19 Sources of operational phase landscape impact will be:

- Presence of new residential structures in the landscape;
- Night-time domestic and street lighting; and
- Presence of associated features in the landscape (e.g. highways, club house, etc).

11.6 Landscape Impact Assessment

Nature and Magnitude of Landscape Impacts Before Mitigation in Construction Phase

Impacts on Landscape Resources

11.6.1 The magnitude of the key impacts, before implementation of mitigation measures, on the landscape resources and landscape character areas that will occur in the construction phase are described below and tabulated in **Table 11–5**.

Landscape Resources

11.6.2 **Drainage Channel at East of Site (LR29) -** Before implementation of mitigation measures, there could be a permanent and reversible impact on the channel currently found on the site due to site clearance to allow for construction of the Project. It is estimated that as much as 120m length of the channel could be affected. The **unmitigated** magnitude of the impact is considered negligible. (The magnitude of mitigated impacts is shown in **Table 11–5**).

11.6.3 **Freshwater Marsh (LR30)** – Prior to implementation of mitigation measures, there could be an impact on the freshwater marsh with patches of reeds (*Phragmites sp*) currently found on the site due to site clearance to allow for construction of the Project. This impact would be a permanent and reversible. It is estimated that 40,000 sq.m. of marsh and patches of reeds could be affected. The **unmitigated** magnitude of the impact is considered medium. (The magnitude of mitigated impacts is shown in **Table 11–5**).

11.6.4 **Grassland with Seasonal Marsh Patches and Soils on Site (LR32)** - There could be a permanent and reversible impact on the grassland with few seasonal marsh patches currently found in the Project Area before implementation of mitigation measures. This would be due to site clearance to allow for construction of the Project. It is estimated that as much as 110,500 sq.m. of grassland and several seasonal marsh patches of very small in size (around 6,900 sq.m.) could be affected. Given the size of this resource and the fact that it is reasonably common in Hong Kong, the **unmitigated** magnitude of the impact is considered large. (The magnitude of mitigated impacts is shown in **Table 11–5**).

11.6.5 **Tree Group (LR33)** - It is estimated that about 4 trees (*Dimocarpus longan* and *Aleurites moluccana)* could be affected by a permanent but reversible before implementation of mitigation measures. This would be due to site clearance to allow for construction of the Project. The **unmitigated** magnitude of the impact is considered small. (The magnitude of mitigated impacts is shown in **Table 11–5**).

11.6.6 **Banana Trees on Site (LR34)** – Before implementation of mitigation measures, there could be a permanent and reversible impact on the group of banana trees currently found on the site due to site clearance to allow for construction of the Project. It is estimated that about 10 trees could be affected. The **unmitigated** magnitude of the impact is considered small. (The magnitude of mitigated impacts is shown in **Table 11–5**).

11.6.7 **Trees in Open Storage Area (LR36)** – Prior to implementation of mitigation measures, there could be a permanent and reversible impact on around 28 young trees (less than 95mm dbh) and around 21 semi-mature trees in the area of the Site used for open storage (*Macaranga tanarius, Hibiscus tiliaceus, Bauhinia blakeana, Albizia lebbeck).* The **unmitigated** magnitude of the impact is considered intermediate. (The magnitude of mitigated impacts is shown in **Table 11–5**).

11.6.8 **Trees along Castle Peak Road (Mai Po) (LR39) -** Around 9 young roadside trees (less than 95mm dbh) and around 14 semi-mature trees which may need to be removed to create the Site entrance (mainly *Melaleuca quinquenervia, Leucaena leucocephala, Ficus microcarp, Acacia confusa, Bombax ceiba, Casuarina equisetifolia, Melia azedarach).* Before implementation of mitigation measures, this would result in a permanent and reversible impact on this resource. The **unmitigated** magnitude of the impact is considered small. (The magnitude of mitigated impacts is shown in **Table 11–5**).

Landscape Character

11.6.9 **Tsing Lung Tsuen Plain (LCA2)** – The Project Area lies wholly within this LCA. Before implementation of mitigation measures, there could be a temporary and reversible impact on the character of the LCA resulting from the disturbance to the Site itself and the presence of construction machinery, stockpiles and partially constructed structures in the landscape. Due to the slightly degraded character and size of the LCA (which covers 479 ha), the **unmitigated** magnitude of this impact (i.e. just over 20ha) is considered small. (The magnitude of mitigated impacts is shown in **Table 11–5**).

Nature and Magnitude of Landscape Impacts Before Mitigation in Operation Phase

11.6.10 The magnitude of the impacts, before implementation of mitigation measures, on the landscape resources and landscape character areas that will occur in the operation phase are the same as the impacts described above for the construction phase. They are tabulated in **Table 11–5**.

Landscape and Visual Mitigation Measures in Construction and Operation Phases

Review of Comments on Landscape and Visual Issues During Continuous Public Involvement (CPI)

11.6.11 During the CPI process, a number of comments relevant to the design of the project and to landscape and visual aspects were received. There was a wide-spread consensus that 6-storey development was undesirable and some respondents stated that developments higher than existing buildings at Palm Springs and Royal Palms might also be undesirable. Some mentioned that the width of the Wetland Restoration Area should be as wide as possible whereas some nearby residents suggested otherwise. Conflicting opinions were expressed respecting fingers of water interconnecting with and linking the Wetland Restoration Area and the development.

Alternative Layout Options Considered During the Design Process

11.6.12 A large number of alternative layout options have been evaluated in terms of their effects on landscape character, landscape resources (particularly their mitigation effects) and on the views of VSRs. These are presented in Section 2 of the Report. These include the Initial Option (refer to Figure 2.3b) and the Transitional Options C, D, E and F (refer to Figures 2.7 – 2.10).

11.6.13 As certain options proved not to be viable in ecological terms, the landscape and visual implications of only those alternatives that proved to be viable in ecological terms were the considered. The performance of these options expressed as performance (Good/Medium/Poor) against a series of criteria, as follows:

- Reprovision of Landscape Area;
- Building Height Variation;
- Building Height;

- Spacing Between Units;
- Distance between Buildings and VSRs;
- Consistency with CPI Comments; and
- Compliance with OZP Layout Requirements vis-à-vis WRA.

11.6.14 It should be noted that this evaluation considers only landscape and visual issues and not other factors such as ecological mitigation (which is considered vis-à-vis the different options elsewhere in this Report).

Alternative Layouts

11.6.15 During the generation of the preferred site layout, a number of different layout options were , considered. These are described in detail in Section 2. Those options considered viable in ecological terms are discussed below in terms of their landscape and visual performance. A tabulation of their performance is provided in **Table 11–2.**

Compatible Development Option

11.6.16 The first option considered, was a compatible development pattern to that at Royal Palms and Palm Springs, onto the site. This would involve typical suburban type development with limited landscape space. Many units would typically be terraced (see **Chapter 2**). This option achieved a high consistency with the existing landscape in terms of the scale of development, but was viewed poorly in terms of compliance with the Study Brief and planning intention stated in the OZP; spacing between units and building height variation. It was therefore not selected to go forward.

Transitional Wetland Concept Options

11.6.17 Based strictly on the requirements of the Statutory Plan (i.e. max 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 explored (see **Chapter 2**). A number of these were not selected to go forward to more detailed assessment, either because they did not fulfil statutory plan requirements or because of other reasons.

11.6.18 Option C (mixed height development) (see **Chapter 2)** was similarly not selected to go forward, because although this option has advantages of variation in development profile and slightly greater visual permeability than other options, it has adverse visual effects resulting from the small number of 6-storey structures on visual receivers (especially on residents in Royal Palms and Palm Springs - 6-storey buildings were not supported by them during the CPI) and on the landscape character of the Tsing Lung Tsuen Plain (LCA2), where buildings of 6 storeys are not characteristic.

11.6.19 Option D (2.5/3-storey and 4-storey) (see **Chapter 2)** has the advantage that it contains no 6-storey structures and so offers potential for lower visual effects than Options B and C and at the same time achieves some limited variation in profile. It also has a layout that accords with OZP requirements (unlike Option A). Whilst visual effects are likely to be slightly higher than under the 2/2.5/3-storey Option E, the less dense layout of Option D may offer slightly reduced effects on landscape character whilst offering greater area for landscape mitigation. However, the visual effects of the proposed 4-storey buildings along parts of the southern boundary on adjoining residents were perceived as being undesirable by the residents of Palm Springs and Royal Palms during CPI.

11.6.20 Option E (2.5/3-storeys) (see **Chapter 2**) offers relatively low built structures which will conform closely to the existing scale of structures in the landscape, as well as a layout that accords with OZP requirements. There is limited height profile variation and interest. Option E was not preferred however, due to its relatively dense arrangement which results in potentially more significant effects on landscape character and visual amenity and reduced areas for landscape mitigation.

Refined Preferred Option

11.6.21 A further option was prepared in response to preferences established during the CPI exercise. Lower buildings were introduced at the most sensitive locations to minimise the interface concerns with adjoining resident communities. The fingers of water entering the residential parts of the Site were redesigned to become landscape area. The area of wetland restoration was widened and a loop road established at the western end of the Site.

11.6.22 Option F (2.5/3-storey and 4-storey) (see **Chapter 2**) offers a balanced alternative with regard to landscape / visual criteria as well as fulfilment of OZP requirements with regard to WRA location; reduced visual effects on adjoining VSRs in Palm Springs and Royal Palms as well as some variation in building profile. 4-storey development along the southern boundary under other options is re-located in this option at the centre of the site. The fingers of water (wetland streams) between the areas of housing are removed and replaced by landscape areas, resulting in an overall area of landscape mitigation, greater than any other Option.

11.6.23 Generally therefore, as can be seen from **Table 11–2,** Option F was considered the most preferable option due to the fact that:

- it scored as many ‘Good’ performances as any other option
- it did not score ‘Poor’ against any criterion and achieved at least a Moderate performance against every criterion. It was therefore preferable in this regard to Option C and E;
- it scored more ‘Good’ performances than Option D and was therefore preferable to Option D in this regard.

Table 11-2 Assessment of Layout Options against Landscape / Visual Criteria

Landscape / Visual Factor	**Metrics (Good / Medium / Poor)**				
	Compatible Development Option (refer to Fig. 2.3b)	***Transitional Wetland Concept Options (refer to Figs. 2.7 – 2.10)***			
		Option C	*Option D*	*Option E*	*Option F*
Reprovision of Landscape Area	M	M	M	P	G

Landscape / Visual Factor	**Metrics (Good / Medium / Poor)**				
	Compatible Development Option (refer to Fig. 2.3b)	***Transitional Wetland Concept Options (refer to Figs. 2.7 – 2.10)***			
		Option C	*Option D*	*Option E*	*Option F*
Building Height Variation	P	G	M	P	M
Building Height	G	M	M	G	M
Spacing Between Units	P	G	M	P	M
Distance between Buildings and VSRs	M	M	M	M	M
Consistency with CPI Comments	M	P	M	M	M
Compliance with OZP Layout Requirements vis-à-vis WRA	G	G	G	G	G

11.6.24 The proposed landscape and visual mitigation measures for potential impacts generated during the construction and operation phases are described below in **Table 11–3** and **Table 11–4**, together with the associated funding, implementation, management and maintenance agencies. The mitigation measures are illustrated in **Figure 11.24A** to **Figure 11.26.**

<u>Other Mitigation Measures</u>

11.6.25 Para 9.9.1 of Explanatory Statement of the Mai Po and Fairview Park Outline Zoning Plan No. S/YL-MP/6 allows development up to 6 storeys in height.

11.6.26 In addition to the important ecological considerations mentioned elsewhere in this report, the broad buildscape as recommended has taken a more sympathetic approach relative to the existing built environment. Residents have indicated that medium rise 6-storey structures should be avoided. As CPI is anticipated to be an on-going process, until project implementation, further fine tuning of the layout is anticipated especially in the immediate area interfacing with existing residential neighbourhoods. In particular, the ‘over-looking’ concerns from neighbouring residents will be further investigated at S16 application and at detailed design stage.

11.6.27 Whilst the preferred Option F was the result of a comprehensive assessment of different landscape and visual effects, as a measure to avoid landscape and visual effects, a decision was made to develop a scheme which has primarily 2.5/3-storey houses with some 4 storey buildings, significantly less than the height permitted under the OZP.

11.6.28 Other mitigation measures including strategies for reducing, offsetting and compensating for impacts have been designed into the Project, during construction and operation phases. These are identified in **Table 11–3** and **Table 11–4** below and are illustrated in **Figure 11.24A** to **Figure 11.26**.

Table 11-3 Proposed Construction Phase Landscape and Visual Mitigation Measures

ID No.	Landscape and Visual Mitigation Measure	Funding Agency	Implementation Agency
CM1	The construction area and contractor's temporary works areas should be minimised to avoid impacts on adjacent landscape.	Developer	Developer (via Contractor)
CM2	Screening of construction works by hoardings/noise barriers around Works area in visually unobtrusive colours, to screen Works.	Developer	Developer (via Contractor)
CM3	Reduction of construction period to practical minimum.	Developer	Developer (via Contractor)
CM4	Topsoil, where identified, should be stripped and stored for re-use in the construction of the soft landscape works, where the soil material meets acceptable criteria and where practical. The Contract Specification shall include storage and reuse of topsoil as appropriate.	Developer	Developer (via Contractor)
CM5	Hydroseeding or sheeting of soil stockpiles with visually unobtrusive material (in earth tone).	Developer	Developer (via Contractor)
CM6	Advance screen planting to noise barriers.	Developer	Developer (via Contractor)
CM7	Control night-time lighting and glare by hooding all lights.	Developer	Developer (via Contractor)
CM8	Ensure no run-off into streams adjacent to the Project Area.	Developer	Developer (via Contractor)
CM9	Protection of existing trees on boundary of the Project Area shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this specification, the Contractor shall be required to submit, for approval, a detailed working method statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas. (Tree protection measures will be detailed at S16 and Tree Removal Application stage).	Developer	Developer (via Contractor)
CM10	Trees unavoidably affected by the works shall be transplanted where practical. Trees should be transplanted straight to their destinations and not held in a nursery. A detailed Tree Transplanting Specification shall be provided in the Contract Specification, if applicable. Sufficient time for necessary tree root and crown preparation periods shall be allowed in the project programme.	Developer	Developer (via Contractor)

Table 11-4 Proposed Operation Phase Landscape and Visual Mitigation Measures

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency	Manage-ment Agency	Mainten-ance Agency
OM1	Compensatory Tree Planting for all felled trees shall be provided to the satisfaction of relevant Government departments. 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.	Developer	Developer	Incorporated Owners	Management Co.
OM2	A continuous belt of screen planting along southern perimeter of site with fast growing tree species. At least 450 trees capable of reaching a height > 10m within 10 years should be planted. Planting of the belt of trees shall be carried out as advance works ahead of other site formation and building works. These 450 trees are in addition to the 750 trees proposed under OM3.	Developer	Developer	Incorporated Owners	Management Co.
OM3	Maximise soft landscape and amenity water bodies in residential areas of the development. Approximately 750 of trees (of Heavy Standard size) should be planted. Where space permits, roadside berms should be created. Street trees should be of species that reach a mature height of no less than 15m.	Developer	Developer	Incorporated Owners	Management Co.
OM4	Maximise freshwater habitat wetland creation consistent with achieving other parameters. Min 4.74 ha to be provided. Wetlands must have natural edge profiles with >1m wide emergent zone. No access to the wetland by residents and all wetlands must be screened from residential development by a continuous tree screen at interface with residential development or earth mounding such that disturbance is minimised. Implementation of the wetland shall be carried out as advance works.	Developer	Developer	Wetland Management Trust / Project Proponent / Incorporated Owners	Wetland Management Trust / Project Proponent / Incorporated Owners
OM5	Use appropriate (visually unobtrusive and non-reflective) building materials and colours in built structures.	Developer	Developer	Private Owners	Private Owners

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency	Management Agency	Maintenance Agency
OM6	During detailed design, refine building layout to create a min 10m wide gap between buildings north of Wo Shang Wai pond and also two min 10m wide gaps in the row of buildings adjacent to Royal Palms.	Developer	Developer	Incorporated Owners	Management Co.
OM7	Streetscape elements (e.g. paving, signage, street furniture, lighting etc.) shall be sensitively designed in a manner that responds to the local context, and minimises potential negative landscape and visual impacts. Lighting units should be directional and minimise unnecessary light spill.	Developer	Developer	Incorporated Owners	Management Co.

11.6.29 An indicative list of species appropriate for mitigation planting is provided below:

Indicative Mitigation Planting Species for Different Areas

Screen/Buffer Planting (Southern Boundary)	**Street Trees**
Trees *Acacia auriculiformis* *Casuarina equisetifolia* *Eucalyptus citriodora* Palms / Bamboos *Chrysalidocarpus lutescens* *Bambusa textilis* *Bambusa vulgaris* 'Striata' Shrubs *Schefflera octophylla* *Ligustrum sinense* *Ficus microcarpa* 'Golden Leaves' *Murraya paniculata*	*Aleurites moluccana* *Bauhinia variegata* *Bischofia javanica* *Cassia siamea* *Grevillea robusta* *Melaleuca quinquenervia* *Peltophorum pterocarpum*

Garden and Park	**Riparian Plants (Including Screen Planting Along Residential Boundaries)**
Trees *Crataeva unilocularis* *Delonix regia* *Elaeocarpus hainanensis* *Michelia alba* *Melia azedarach* *Plumeria rubra var. acutifolia* *Bombax ceiba* *Magnolia grandiflora*	Riparian Trees and Shrubs *Bambusa tuldoides* *Cleistocalyx operculatum* *Diaspyros vaccinoides* *Eurya chinensis* *Glyptostrobus pencilis* *Ficus superba*

Spathodea campanulata *Vernicia Montana* Shrubs *Prunus mume* *Prunus persica* *Breynia nivosa* *Buddleia asiatica* *Camellia japonica* *Camellia sasanqua* *Clerodendrum thomsonae* *Cuphea hyssopifolia* *Delphinium ajacis* *Gardenia jasminoides* *Hedychium coronarium* *Hibisus rosa-sinensis* *Hydrangea macrophylla* *Hypericum chinense* *Iris tectorum* *Ixora stricta* *Jasminum sambac* *Lagerstroemia indica* *Osmanthus fragrans* *Russelia equisetriformis* *Rhapis excelsa* *Rhododendron simsii* *Rhododendron purpurea* *Scheffloera aboricola* *Spathiphyllum* sp. Groundcover *Asclepias curassavica* *Hymenocallis americana* *Asparagus sprengeri* *Lantana montevidensis* *Liriope spicata* *Nephrolepis exaltata* *Portulaca oleracea* *Rhoeo discolor* *Setcreasea purpurea* *Syngonium* sp. *Tracheloepermum jasminioides* *Zephyranthus grandiflora*	*Ficus virens* *Hibiscus tiliaceus* *Litsea glutinosa* *Litsea rotundifolia* *Macaranga atanarius* *Morus alba* *Glochidion hirsutum* *Saurarus chinensis* *Sapium sebiferum* *Symplocos laurina* *Viburnum oderatissimum* *Melicope pteleifolia* *Zanthoxylum nitidum* **Planting Within Wetland Restoration Area** Reedbed species *Phragmites* spp. (e.g. *Phragmites australis*) Tree/tall shrub mix *Ficus hispida* *Ficus microcarpus* *Ficus variegata* var. *chlorocarpa* *Macaranga tanarius* *Melia azedarach* *Syzygium jambos* *Bridelia tomentosa* *Trema orientalis* *Viburnum odoratissimum* Grass and shrub mix *Bridelia tomentosa* *Gardenia jasminoides* *Melastoma candidum* *Rhaphiolepis indica* *Cynodon dactylon* *Panicum maximum* *Paspalum paspaloides* Short grass mix *Commelina diffusa* *Cynodon dactylon* *Eleusine indica* Marginal vegetation mix *Polygonum barbatum* *Polygonum glabra* *Ludwigia octovalvis* *Ludwigia perennis* *Cyperus malaccensis* *Eleocharis spiralis*

Programme of Implementation of Landscape and Visual Mitigation Measures

11.6.30 The Construction Phase measures listed above shall be adopted from the commencement of construction and shall be in place throughout the entire construction period. The Operation Phase measures listed above 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.

Prediction of Significance of Landscape Impacts

11.6.31 The potential significance of the landscape impacts during the construction and operation phases, before and after mitigation, are provided below in **Table 11–5** and mapped in **Figure 11.27** to **Figure 11.30**. This assessment follows the methodology outlined above and assumes that the appropriate mitigation measures identified in **Table 11–3** and **Table 11–4** above 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 11.33** to **11.39** inclusive.

Construction Phase

11.6.32 In the Construction Phase, after the implementation of the proposed mitigation measures, there will still be some negative residual landscape impacts as described below.

11.6.33 No substantial negative significant residual landscape impacts will be experienced by landscape resources or LCAs.

11.6.34 Negative residual landscape impacts of moderate significance will be experienced by the following landscape resources:

- **Freshwater Marsh (LR30)** – During construction, there will be a loss of around 4ha of grassy marsh and reed marsh (*Phragmites* sp.). This is a relatively sensitive resource (medium) in Hong Kong and of significance to the locality. Resulting impacts will be Moderate negative (The significance of impacts reflects the fact that this areas is a combination of a shallow water marsh of short vegetation and reed marsh rather than a ‘reedbed’).

11.6.35 Negative residual landscape impacts of Slight significance will be experienced by the following landscape resources and character areas:

- **Grassland with Seasonal Marsh Patches and Soils on Site (LR32)** – During construction approximately 11.7 ha of grassland with seasonal marsh patches and soil will be temporarily removed to allow for earthworks and construction. This kind of grassland is not a very sensitive resource and provided soils are stockpiled for re-use, resulting impacts on the resource will be Slight negative.
- **Tree Group on Site (LR33)** - During construction, around 4 trees will have to be removed from the Site to make way for site formation. This is a relatively sensitive resource (medium) in Hong Kong and of significance to the locality, but given the limited numbers of trees involved, resulting impacts will be Slight negative.

- **Banana Trees on Site (LR34)** - During construction, around 10 banana trees will have to be removed from the Site to make way for site formation. This is a low sensitivity resource in Hong Kong and so resulting impacts will be Slight negative.

- **Trees in Open Storage Area (LR36)** - During construction, around 28 young trees (less than 95mm dbh) and around 21 semi mature trees will have to be removed from the Site to make way for site formation. This is a relatively sensitive resource (medium) in Hong Kong, and of significance to the locality, but given the limited numbers of trees involved, resulting impacts will be Slight negative.

- **Trees along Castle Peak Road (Mai Po) (LR39) -** During construction, around 9 young trees (less than 95mm dbh) and around 14 semi mature trees will have to be removed from the Site to make way for site formation. This is a relatively sensitive resource (medium) in Hong Kong, and of significance to the locality, but given the limited numbers of trees involved, resulting impacts will be Slight negative.

- **Tsing Lung Tsuen Plain (LCA2)** – Construction works will introduce a variety of incoherent textures and colours into the landscape of the Tsing Lung Plain. An open site that is currently used as part open storage / parking and part vacant / vegetated will be temporarily replaced by construction machinery, stockpiles and partially completed structures which will contrast with the existing character of the wider landscape of the LCA . However, given that the LCA covers many square kilometres, only part of it will be affected and resulting impacts will be Slight negative.

11.6.36 All other impacts on landscape resources and character will be of negligible significance.

Operation Phase

11.6.37 In the Operation Phase, after the implementation of the proposed mitigation measures, there will be no negative residual landscape impacts on the landscape resources. Moreover, there will be some slight positive landscape impacts on the landscape resources, as described below. On-site landscape resources will experience a change of impact from moderate and slight negative during construction to slight positive and insubstantial after mitigation. This is a result of the significant, effective mitigation measures that will be employed to enhance these resources.

11.6.38 Slight positive landscape impacts will be experienced by the following landscape resources and character areas:

- **Freshwater Marsh (LR30)** – As part of mitigation, wet grassland and reeds removed from site will be compensated for by the creation of a new wetland. This will result in a slight increase in wetland area (around 0.05ha) and therefore in Slight positive landscape impacts.

- **Trees on northern Boundary of Royal Palms (LR31)** - As part of mitigation, this belt of trees will be augmented by additional planting of approximately 120 trees across the Site as a whole. This will result in a significant net gain of trees (+120) and therefore in Slight positive landscape impacts.

- **Tree Group on Site (LR33)** – As part of mitigation, trees removed from site will either be transplanted back to site or will be compensated for by additional planting of approximately 150 trees across the Site as a whole. This will result in a significant net gain of trees (+146) and therefore in Slight positive landscape impacts.

- **Banana Trees on Site (LR34)** - As part of mitigation, trees removed from site will be compensated for by additional planting of approximately 150 trees across the Site as a whole. This will result in a significant net gain of trees (+140) and therefore in Slight positive landscape impacts.

- **Trees in Open Storage Area (LR36)** - As part of mitigation, trees removed from site will be compensated for by additional planting of approximately 250 trees across the Site as a whole and they may be transplanted elsewhere on site. This will result in a significant net gain of trees (+201) and therefore in Slight positive landscape impacts.

- **Trees along Castle Peak Road (Mai Po) (LR39) -** As part of mitigation, trees removed from the area at the entrance of the Site will either be compensated for by additional planting of approximately 200 trees across the Site as a whole and may be transplanted elsewhere on site. This will result in a significant net gain of trees (+177) and therefore in Slight positive landscape impacts.

- **Trees in northern Palm Springs (LR86)** - As part of mitigation, this belt of trees will be augmented by additional planting of approximately 110 trees across the Site as a whole. This will result in a significant net gain of trees (+110) and therefore in Slight positive landscape impacts.

- **Trees in western Palm Springs (LR87)** - As part of mitigation, this belt of trees will be augmented by additional planting of approximately 110 trees across the Site as a whole. This will result in a significant net gain of trees (+110) and therefore in Slight positive landscape impacts.

- **Trees in northern Palm Springs (LR91)** - As part of mitigation, this belt of trees will be augmented by additional planting of approximately 110 trees across the Site as a whole. This will result in a significant net gain of trees (+110) and therefore in Slight positive landscape impacts.

11.6.39 After implementation of the proposed mitigation measures there will be no negative residual landscape impacts on the Landscape Resources. Moreover, there will be some slight positive landscape impacts. Additionally, after Year 10 of operation the landscape impacts upon Landscape Character Areas will be insubstantial.

Table 11-5 Significance of Landscape Impacts in Construction and Operation Phases (Negative Impacts unless otherwise stated)

Table 11.5 Id. No.	**Landscape Resource / Landscape Character**	**Sensitivity to Change (Low, Medium, High)**		**Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)**		**Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)**		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)**		
									Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation			**DAY 1**	**YEAR 10**
Part 1 – Physical Landscape Resources (Topography, Vegetation, Soil, Open Space, Special Features, etc)											
On-Site Landscape Resources											
LR29	Drainage channel at East of Site	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	CM8 / OM4	Insubstantial	Insubstantial	Insubstantial
LR30	Freshwater Marsh	Medium	Medium	Intermediate	Intermediate	Moderate Negative	Moderate Negative	CM4 / OM4	Moderate Negative	Slight Positive	Slight Positive
LR32	Grassland with Seasonal Marsh Patches and Soils on Site	Low	Low	Large	Large	Moderate Negative	Moderate Negative	CM4 / OM3	Slight Negative	Insubstantial	Insubstantial
LR33	Tree Group on Site	Medium	Medium	Small	Small	Slight Negative	Slight Negative	CM10 / OM1	Slight Negative	Slight Positive	Slight Positive
LR34	Banana trees on Site	Low	Low	Small	Small	Slight Negative	Slight Negative	CM10 / OM1	Slight Negative	Slight Positive	Slight Positive
LR36	Trees in Open Storage Area	Medium	Medium	Intermediate	Intermediate	Slight Negative	Slight Negative	CM10 / OM1	Slight Negative	Slight Positive	Slight Positive
LR39	Trees along Castle Peak Road	Medium	Medium	Small	Small	Slight Negative	Slight Negative	CM10 / OM1	Slight Negative	Slight Positive	Slight Positive
Off-Site Landscape Resources											
LR1	Trees Along East Side of San Tin Highway	Medium	Medium	None	None	None	None	None	None	None	None
LR2	Roadside Trees Surrounding Mei Po Substation	Medium	Medium	None	None	None	None	None	None	None	None
LR3	Trees Opposite Mai Po San Tsuen	Medium	Medium	None	None	None	None	None	None	None	None

Table 11.5 Id. No.	**Landscape Resource / Landscape Character**	**Sensitivity to Change (Low, Medium, High)**		**Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)**		**Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)**		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)**		
									Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation			**DAY 1**	**YEAR 10**
LR4	Field East of San Tam Road	Low	Low	None	None	None	None	None	None	None	None
LR5	Ponds in Field East of San Tam Road	Low	Low	None	None	None	None	None	None	None	None
LR6	Trees Behind Field east of San Tam Road	Medium	Medium	None	None	None	None	None	None	None	None
LR7	Stream Next to Field east of San Tam Road	Medium	Medium	None	None	None	None	None	None	None	None
LR8	Pond East of San Tam Road	Low	Low	None	None	None	None	None	None	None	None
LR9	Trees along East Side of San Tam Road	Medium	Medium	None	None	None	None	None	None	None	None
LR10	Drainage Channel East of San Tam Road	Low	Low	None	None	None	None	None	None	None	None
LR11	Grassland East of San Tam Road	Medium	Medium	None	None	None	None	None	None	None	None
LR12	Trees around Cottage Area east of San Tam Road	Medium	Medium	None	None	None	None	None	None	None	None
LR13	Slope adjoining San Tam Road	Medium	Medium	None	None	None	None	None	None	None	None
LR14	Trees North of Scenic Heights	Medium	Medium	None	None	None	None	None	None	None	None
LR15	Trees inside Scenic Heights	Medium	Medium	None	None	None	None	None	None	None	None

Table 11.5 Id. No.	**Landscape Resource / Landscape Character**	**Sensitivity to Change (Low, Medium, High)**		**Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)**		**Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)**		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)**		
									Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation			**DAY 1**	**YEAR 10**
LR16	Fruit Trees North of Ki Lung Shan Foothills I	Medium	Medium	None	None	None	None	None	None	None	None
LR17	Woodland North of Ki Lung Shan Foothills II	Medium	Medium	None	None	None	None	None	None	None	None
LR18	Trees on Ki Lung Shan Foothills II	Medium	Medium	None	None	None	None	None	None	None	None
LR19	Trees on Ki Lung Shan Foothills I	Medium	Medium	None	None	None	None	None	None	None	None
LR20	Trees in Maple Gardens	Medium	Medium	None	None	None	None	None	None	None	None
LR21	Grassland on Ki Lung Shan Foothills	Low	Low	None	None	None	None	None	None	None	None
LR22	Trees between San Tin Highway and Maple Gardens	Medium	Medium	None	None	None	None	None	None	None	None
LR23	Chunk Kai Horticultural Nursery	Low	Low	None	None	None	None	None	None	None	None
LR24	Trees along San Tin Highway	Medium	Medium	None	None	None	None	None	None	None	None
LR25	Pond east of Royal Palms	Low	Low	None	None	None	None	None	None	None	None
LR26	Field east of Royal Palms	Medium	Medium	None	None	None	None	None	None	None	None
LR27	Trees east of Royal Palms	Medium	Medium	None	None	None	None	None	None	None	None

Table 11.5 Id. No.	**Landscape Resource / Landscape Character**	**Sensitivity to Change (Low, Medium, High)**		**Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)**		**Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)**		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)**		
		Construction	Operation	Construction	Operation	Construction	Operation		Construction	Operation **DAY 1**	Operation **YEAR 10**
LR28	Trees outside Royal Palms near Palm Canyon Drive	Medium	Medium	None	None	None	None	None	None	None	None
LR31	Trees on northern Boundary of Royal Palms	Medium	Medium	Small	Small	Slight	Slight	CM9/ OM2	Insubstantial	Slight Positive	Slight Positive
LR35	Stream flowing from Tam Kon Chau to the site	Medium	Medium	Small	Small	Slight Negative	Slight Negative	CM8/OM4	Insubstantial	Insubstantial	Insubstantial
LR37	NOT USED										
LR38	Trees inside Open Storage Area	Medium	Medium	None	None	None	None	None	None	None	None
LR40	Trees in Cottage Area east of Castle Peak Road	Medium	Medium	None	None	None	None	None	None	None	None
LR41	Pond behind Mai Po San Tsuen	Low	Low	None	None	None	None	None	None	None	None
LR42	Grassland besides DSD building	Low	Low	None	None	None	None	None	None	None	None
LR43	Trees in Mai Po San Tsuen	Medium	Medium	None	None	None	None	None	None	None	None
LR44	Trees behind Mai Po San Tsuen	Medium	Medium	None	None	None	None	None	None	None	None
LR45	Trees in Mai Po Lo Wai	Medium	Medium	None	None	None	None	None	None	None	None
LR46	Field west of Mai Po Lo Wai	Low	Low	None	None	None	None	None	None	None	None
LR47	Pond west of Mai Po San Tsuen	Low	Low	None	None	None	None	None	None	None	None
LR48	Channel west of Mai Po San Tsuen	Low	Low	None	None	None	None	None	None	None	None

Table 11.5	**Landscape Resource / Landscape Character**	**Sensitivity to Change (Low, Medium, High)**		**Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)**		**Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)**		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)**		
Id. No.									Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation			**DAY 1**	**YEAR 10**
LR49	Channel beside DSD building	Low	Low	None	None	None	None	None	None	None	None
LR50	Woodland along Castle Peak Road (Mai Po)	Medium	Medium	None	None	None	None	None	None	None	None
LR51	Fishponds along Tam Kon Chau Road	Low	Low	None	None	None	None	None	None	None	None
LR52	Trees north of Tam Kon Chau Road	Medium	Medium	None	None	None	None	None	None	None	None
LR53	Dry Pond north of Tam Kan Chau Road	Low	Low	None	None	None	None	None	None	None	None
LR54	Fishponds south of Tam Kon Chau Road	Low	Low	None	None	None	None	None	None	None	None
LR55	Trees beside Fishponds south of Tam Kon Chau Road	Medium	Medium	None	None	None	None	None	None	None	None
LR56	Fishponds north-east of Site	Low	Low	None	None	None	None	None	None	None	None
LR57	Trees beside fishponds north-east of Site	Medium	Medium	None	None	None	None	None	None	None	None
LR58	Stream north of Tam Kon Chau Road	Medium	Medium	None	None	None	None	None	None	None	None

Table 11.5 Id. No.	**Landscape Resource / Landscape Character**	**Sensitivity to Change (Low, Medium, High)**		**Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)**		**Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)**		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)**		
									Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation			**DAY 1**	**YEAR 10**
LR59	Trees beside Stream north of Tam Kon Chau Road	Medium	Medium	None	None	None	None	None	None	None	None
LR60	Fishponds north of Tam Kon Chau Road	Low	Low	None	None	None	None	None	None	None	None
LR61	Trees beside Fishponds north of Tam Kon Chau Road	Medium	Medium	None	None	None	None	None	None	None	None
LR62	Fishponds north-west of Site	Low	Low	None	None	None	None	None	None	None	None
LR63	Trees beside Fishponds north-west of Site	Medium	Medium	None	None	None	None	None	None	None	None
LR64	Fishponds north of Tam Kon Chau	Low	Low	None	None	None	None	None	None	None	None
LR65	Trees beside Fishponds north of Tam Kon Chau	Medium	Medium	None	None	None	None	None	None	None	None
LR66	Trees in Tam Kon Chau	Medium	Medium	None	None	None	None	None	None	None	None
LR67	Pond south of Tam Kon Chau	Low	Low	None	None	None	None	None	None	None	None
LR68	Fishponds south of Tam Kon Chau	Low	Low	None	None	None	None	None	None	None	None
LR69	Fishponds south-west of Tam Kon Chau	Low	Low	None	None	None	None	None	None	None	None
LR70	Fish Pond west of Palm Springs	Low	Low	None	None	None	None	None	None	None	None

Table 11.5 Id. No.	**Landscape Resource / Landscape Character**	**Sensitivity to Change (Low, Medium, High)**		**Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)**		**Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)**		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)**		
									Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation			**DAY 1**	**YEAR 10**
LR71	Trees beside Fish Pond west of Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR72	Fishponds north-west of Palm Springs	Low	Low	None	None	None	None	None	None	None	None
LR73	Fishponds west of Palm Springs	Low	Low	None	None	None	None	None	None	None	None
LR74	Trees beside Fishponds west of Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR75	Fishponds west of Palm Springs	Low	Low	None	None	None	None	None	None	None	None
LR76	Fish Pond west of Palm Springs	Low	Low	None	None	None	None	None	None	None	None
LR77	Fishponds west of Palm Springs	Low	Low	None	None	None	None	None	None	None	None
LR78	Trees beside Fishponds west of Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR79	Fishponds west of Palm Springs	Low	Low	None	None	None	None	None	None	None	None
LR80	Trees beside Fishponds west of Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR81	Fishponds west of Palm Springs	Low	Low	None	None	None	None	None	None	None	None
LR82	Trees beside Fishponds west of Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR83	Stream west of Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None

Table 11.5 Id. No.	**Landscape Resource / Landscape Character**	**Sensitivity to Change (Low, Medium, High)**		**Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)**		**Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)**		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)**		
									Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation			**DAY 1**	**YEAR 10**
LR84	Fishponds west of Palm Springs	Low	Low	None	None	None	None	None	None	None	None
LR85	Trees beside Fishponds west of Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR86	Trees in northern Palm Springs	Medium	Medium	Small	Small	Slight	Slight	CM9 / OM2	Insubstantial	Slight Positive	Slight Positive
LR87	Trees in western Palm Springs	Medium	Medium	Small	Small	Slight	Slight	CM9 / OM2	Insubstantial	Slight Positive	Slight Positive
LR88	Trees in southern Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR89	Trees in Car Park in Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR90	Pond in Wo Shang Wai Village	Low	Low	None	None	None	None	None	None	None	None
LR91	Trees in northern Palm Springs	Medium	Medium	Small	Small	Slight	Slight	CM9 / OM2	Insubstantial	Slight Positive	Slight Positive
LR92	Trees at Shopping Mall in Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR93	Ponds in Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR94	Trees beside Ponds in Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
LR95	Trees in southern Royal Palms	Medium	Medium	None	None	None	None	None	None	None	None
LR96	Trees around Sports Facilities in Royal Palms	Medium	Medium	None	None	None	None	None	None	None	None

Table 11.5 Id. No.	**Landscape Resource / Landscape Character**	**Sensitivity to Change (Low, Medium, High)**		**Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)**		**Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)**		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)**		
									Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation			**DAY 1**	**YEAR 10**
LR97	Trees east of Royal Palms	Medium	Medium	None	None	None	None	None	None	None	None
LR98	Pond south of Palm Springs Boulevard Entrance	Low	Low	None	None	None	None	None	None	None	None
LR99	Ponds south of Palm Springs	Low	Low	None	None	None	None	None	None	None	None
LR100	Trees surrounding Ponds south of Palm Springs	Medium	Medium	None	None	None	None	None	None	None	None
Part 2 – Landscape Character Areas											
LCA1	Palm Springs Development	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial
LCA2	Tsing Lung Tsuen Plain	Medium	Medium	Small Negative	Small Negative	Moderate Negative	Moderate Negative	CM1 / CM3 / CM5-7 OM3-8	Slight Negative	Slight Negative	Insubstantial
LCA3	San Tin Plain	High	High	Negligible	Negligible	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial
LCA4	Ki Lung Shan Uplands	High	High	Negligible	Negligible	Insubstantial	Insubstantial	None	Insubstantial	Insubstantial	Insubstantial

11.7 Visual Impact Assessment

Landscape and Visual Mitigation Measures

11.7.1 The proposed landscape and visual mitigation measures for impacts caused during the construction and operation phases are described previously in **Table 11–3** and **Table 11–4,** together with the associated funding, implementation, management and maintenance agencies, and the proposed implementation programme. The mitigation measures are illustrated in **Figure 11.24A** to **11.26.**

Prediction of Significance of Visual Impacts

11.7.2 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 11–6**. This follows the methodology outlined above and assumes that the appropriate mitigation measures identified in **Table 11–3** and **Table 11–4** will be implemented, and that the full effect of the soft landscape mitigation measures will be realised after ten years.

11.7.3 Photomontages of the proposed development before and after mitigation are illustrated in **Figures 11.33** to **11.39** inclusive.

Construction Phase

11.7.4 Residual visual impacts in the Construction Phase are mapped in **Figure 11.31** After all visual mitigation measures are implemented, there will be no negative residual visual impacts of substantial significance.

11.7.5 The proposed temporary noise barrier that will be provided along the western and southern boundaries of the project area (during construction phase only) will be 9 and 10m in height. It will be designed to have a solid barrier to the bottom 3m of this barrier with the remaining height constructed of a transparent acrylic material. Whilst there will be structural steel supports for this barrier, the barrier itself will be 'see-through' and the structural supports will be viewed associated with the construction works beyond and within the Project Area.

11.7.6 Negative residual visual impacts of moderate negative significance will be experienced by:

- **Residents in Royal Palms, Palm Springs and Wo Shang Wai (R1, R2 and R3)** – Residents in Palm Springs (approx 17 properties at the northern end of Camelia Path and approx 32 properties on Narcissus Path) and Royal Palms (approx 21 properties on Ventura Avenue and approx 8 properties on Santa Monica Avenue) will potentially experience views from short distances of site formation works, noise barrier, construction machinery and partially completed 2.5/3-storey structures. Other residents on the northern sides of these developments may experience more distant, oblique views of work on 2.5/3 and 4-storey structures. Other affected residents will include users of peripheral roads in Royal Palms and Palm Springs; as well as residents using the footpath along the boundary of Royal Palms, although these VSRs are more transitory in nature. The views of many of these VSRs will be partly screened by the existing belt of tall trees (many around 10m high) which runs along most of the boundary (a double row on an embankment in the case of Royal Palms). The upper portion of the noise barriers will be transparent while the remaining part will be of unobtrusive colours with design graphics. Key issues determining the magnitude of change to these VSRs will be the relative proximity of some of these VSRs, the broken or interrupted nature of the views of many VSRs 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 village houses, residential development, utilities, tree clumps etc. Construction work will constitute an intermediate 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 urban fringe open landscape of derelict land, fishponds, storage yards and the distant urban skyline of Shenzhen, to views which include earthworks, partially completed structures and construction machinery. To the extent that the site is currently visible through exiting trees, resulting impacts on this VSR group will be Moderate negative, during the construction period. Most residents of Royal Palms and Palm Springs do not live close to the boundary with the site and will experience little or no impact on their views, due to the effects of distance, intervening buildings and existing tree planting.

Residents on the northern side of Wo Shang Wai will experience what are in some cases, uninterrupted views of site formation works, noise barrier, construction machinery and partially completed 2.5/3 and 4-storey structures. The upper portion of the noise barriers will be transparent while the remaining part will be of unobtrusive colours with design graphics. The views of these VSRs will be only partly screened by the existing belt of tall trees and some views are unscreened. Key issues determining the magnitude of change to these VSRs will be the relative proximity of some of these VSRs, the broken or interrupted nature of the views of many VSRs 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 village houses, residential development, utilities, tree clumps etc. This will constitute a small magnitude of impact to the existing views by introducing artificial construction features into them. Resulting impacts on this VSR group will be Moderate negative, during the construction period. Residents, who do not live on the northern edge of the village, will experience little or no impact on their views, due to the effects of intervening buildings.

11.7.7 Residual visual impacts of slight negative significance will be experienced by:

- **Residents in Mai Po San Tsuen and Mai Po Lo Wai (R5)** – Residents in properties on the western edges of these villages which face directly towards the site, will experience distant views of site formation works, site hoardings, noise barrier, construction machinery and partially completed 2.5/3 and 4-storey structures across low-lying open land with a backdrop of trees. Key issues determining the magnitude of impact to these VSRs will be their moderate 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 Area 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 lower parts of the works will be hidden behind approx 4m high screen hoardings, this will nonetheless constitute a small magnitude of impact to the existing views, by introducing artificial and incoherent features into them. Resulting impacts on this small VSR group will be Slight negative.

- **Residents in Tam Kon Chau (R6)** – Residents in properties on the southern and eastern side of Tam Kon Chau which face directly towards the site, will experience distant views across fishponds of site formation works, site hoardings, noise barrier, construction machinery and partially completed 2.5/3 and 4-storey structures. Key issues determining the magnitude of impact to these VSRs will be their moderate 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 Area 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 works will be in part hidden behind approx 4m high screen hoardings, but this will nonetheless constitute a small magnitude of impact to the existing views, by introducing construction machinery and incoherent construction-related features into the middle distance of them. The existing developments of Palm Springs and Royal Palms are already visible in these views and this will tend to reduce the magnitude of impacts slightly. Resulting impacts on this very small VSR group will be Slight negative.
- **Pedestrians on San Tin Highway Footbridge (T4)** – Pedestrians crossing the footbridge across the San Tin Highway, south east of the Site will experience elevated broken and distant views across industrial / storage areas of site hoardings, noise barrier, construction machinery and traffic as well as partially completed 4-storey structures. Key issues determining the magnitude of impact to these VSRs will be their moderate distance from the source of impacts and limited changes to the indifferent character of existing views. This will constitute a small magnitude of impact to the existing views, by introducing brightly coloured construction machinery, and artificial features into the middle distance of views that are already fairly incoherent due to the presence of industrial and storage features. Resulting impacts on this very small VSR group will be Slight negative.
- **Workers in Fishponds in and Around Mai Po (O1)** – Those working at fishponds north and north-west of the Site will experience views across fishponds of site formation works, site hoardings, construction machinery and partially completed structures. Key issues determining the magnitude of impact 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 Area 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 lower parts of the works will be hidden behind approx 4m high screen hoardings, this will nonetheless constitute an intermediate magnitude of impact to the existing views, by introducing construction machinery and incoherent construction-related features into the middle distance of them. The existing developments of Palm Springs and Royal Palms are already visible in these views and this will tend to reduce the magnitude of impacts slightly. Resulting impacts on this very small VSR group will be Slight negative.

- **Workers in Industrial / Storage Areas north of Royal Palms (O2)** – Those working in industrial / storage areas north-east of the Site (especially those in elevated machinery), may experience broken, close views across intervening fencing of site hoardings, construction machinery and partially completed structures. Additionally, the jumbled mass of incoherent elements (machinery, containers and equipment) within and surrounding these workers results in views of the site being significant interrupted. Key issues determining the magnitude of impact to these VSRs will be their relative proximity to the source of impacts and limited changes to the indifferent character of existing views. This will constitute a small magnitude of impact to the existing views, by introducing brightly coloured construction machinery and incoherent construction-related features into the foreground of them. Impacts will be partly offset by the fairly incoherent visual quality of existing views and resulting impacts on this very small VSR group will be Slight negative.
- **Workers in Industrial / Storage Areas east of Royal Palms (O3)** – Those working in industrial / storage areas east of the Site (especially those in elevated machinery), may experience close views across intervening fencing of construction traffic and partially complete structures close to the entrance of the site. Key issues determining the magnitude of impact to these VSRs will be their relative proximity to the source of impacts, limited changes to the indifferent character of existing views and the fact that many views are broken by storage yard features. This will constitute a small magnitude of impact to the existing views, by introducing brightly coloured construction machinery and incoherent construction-related features into the foreground of them. Impacts will be partly offset by the fairly incoherent visual quality of existing views and resulting impacts on this very small VSR group will be Slight negative.

- **Visitors to Mai Po Nature Reserve (RE1)** – Visitors to the eastern edge of the WWF Mai Po Nature Reserve to the north west of the Site may have long distance (620m) views across fish ponds towards the Site itself. They will experience distant views of site hoardings, site formation works, construction machinery and partially completed 2.5/3 and 4-storey structures across low-lying open land with a backdrop of trees and low hills, providing a contrast with these natural features. Part of the Site and the works will be hidden by existing development and trees on the north-western edge of Palm Springs. Key issues determining the magnitude of impact to these VSRs will be their relatively great 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 Area 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 elsewhere, lower parts of the works will be hidden behind approx 4m high screen hoardings, this will nonetheless constitute a small magnitude of impact to the existing views, by introducing artificial and incoherent features into them. Resulting impacts during the construction period on this small but very sensitive VSR group will be Slight negative.
- **Motorists on Tam Kon Chau Road (T3)** – Motorists on Tam Kon Chau Road will experience visual impacts of an intermediate magnitude due to their moderate distance from the source of impacts, the panoramic quality of views (a broad, expansive view within which several, distant features are observed and where the Project Area is only one element); and the fact that for the most part, motorists are travelling perpendicular

to or away from the Site (rather than towards it). These factors, combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, and the transient nature of views will mean that visual impacts on this VSR group will be slight.

11.7.8 Residual visual impacts of Insubstantial significance will be experienced by:

- **Residents in Cottage Area South of Mai Po San Tsuen (R4) –** These residents will not experience visual impacts of significant magnitude due to the fact that their views are largely or entirely broken by intervening storage yard features, parked lorries or other structures such that views of the Project Area are not readily available. Even where glimpsed views might be possible, the visual character of the foreground is already so degraded by the features mentioned, that the relative effects of new features in these views would not be significant. This will mean that visual impacts on this VSR group will be Insubstantial.

- **Motorists on San Tin Highway (T1) –** Motorists on San Tin Highway will not experience visual impacts of significant magnitude due to their moderate distance from the source of impacts, the panoramic quality of views (a broad, expansive view within which several, distant features are observed and where the Project Area is only one element); and the fact that for the most part, motorists are travelling perpendicular to the Project Area entry. These factors, combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, and the transient nature of views will mean that visual impacts on this VSR group will be Insubstantial.

- **Motorists on Castle Peak Road (T2) –** Motorists on Castle Peak Road will not experience visual impacts of significant magnitude due to their moderate distance from the source of impacts, the panoramic quality of views (a broad, expansive view within which several, distant features are observed and where the Project Area is only one element); and the fact that for the most part, motorists are travelling perpendicular to the Project Area entry. These factors, combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, and the transient nature of views will mean that visual impacts on this VSR group will be Insubstantial.

Operation Phase

11.7.9 Residual visual impacts in the Operation Phase are mapped in **Figure 11.32**.

11.7.10 **At Day 1 of opening**, mitigation planting will still be relatively small and there will be visual impacts on a number of VSRs which, with the maturing of screen planting will tend to diminish over time.

11.7.11 At Day 1 of opening, Residual visual impacts of Moderate Negative significance will be experienced by:

- **Residents in Royal Palms, Palm Springs (R1 and R2) -** Residents in Palm Springs (approx 17 properties in Camelia Path and approx 32 properties on Narcissus Path) and

Royal Palms (approx 21 properties on Ventura Avenue and approx 8 properties on Santa Monica Avenue) will potentially experience views of completed 2.5/3 storey dwellings. Other residents on the northern sides of these developments may experience more distant, oblique views. Residents using peripheral roads in Royal Palms and Palm Springs; as well as residents using the footpath along the boundary of Royal Palms will also have potential views of the Project. All the views above may be partly obscured by the tall belts of existing trees (many around 10m high) along the boundary of the Site with Royal Palms (two rows on an embankment) and Palm Springs (see **Figures 11.25A; 11.25B; 11.25C; 11.26; 11.33** and **11.34**). Views at low-level will be partly screened by a row of circa 4m high (when first planted) tree screen mitigation planting. For viewers from higher elevations, to the extent that the site may be currently visible at present through the existing belts of tall trees, views of new 2.5/3-storey buildings will replace views across the site. These effects will be mitigated in part by the fact that only 2.5/3 story buildings will be seen where residents look directly onto the site; by the staggering of 4-storey buildings elsewhere on the boundary of the site and by the visual variety of a varied height profile along the boundary. At night, residential lighting and street lighting may also be partly visible. Key issues determining the magnitude of impact to these VSRs will be the relative proximity of some of the VSRs, the broken or interrupted nature of the views of many VSRs, the screening effect of existing and proposed trees 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 village houses, residential development, utilities, tree clumps etc. The result will be an impact in the visual character of these views from views across a mixed urban fringe open landscape of derelict land, storage yards, fishponds and the distant urban skyline of Shenzhen, to views with a more consistent residential character (see **Figure 11.33** and **Figure 11.34**). Impacts on those living on the north-eastern boundary of Royal Palms and those using the footpath at that location will to a certain extent be offset by the benefits of the removal of the existing open storage yard. Resulting visual impacts will be Moderate in the worst cases and Slight in others, but will tend to diminish over time as proposed screen planting around the development matures.

- **Residents in Wo Shang Wai (R3) -** New 2.5/3 and 4-storey buildings will be clearly visible in the middle distance to a small number of **Residents in Wo Shang Wai (R3)** living on the northern sides of the village, across the fishpond. Key issues determining the magnitude of impact to these VSRs will be the relative proximity of some of the VSRs, the broken or interrupted nature of the views of many VSRs, the screening effect of proposed trees 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 village houses, residential development, utilities, tree clumps etc. Views of new 2.5/3 and 4-storey buildings will appear in views northward and will represent a further developed feature in these views (which already feature views of houses in Palm Springs), in which some development at Palm Springs is already visible. Newly planted approx 4m high (when first planted) mitigation planting will screen the lower part of the buildings. At night, residential lighting and street lighting may also be partly visible. Resulting visual impacts will be Moderate for those living closest to the Project Area (though less for others in this

VSR group) but will tend to diminish over time as screen planting around the development matures (**Figure 11.35**).

11.7.12 At Day 1 of opening, Residual visual impacts of slight Negative significance will be experienced by:

- **Residents in Tam Kon Chau (R6)** - Residents in properties on the southern and eastern side of Tam Kon Chau (R6) which face directly towards the site, will experience distant views across fishponds of the new development with 2.5/3 storey buildings at the front and 4-storey buildings to the rear. Key issues determining the magnitude of impact to these VSRs will be their moderate 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 Area 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. This will constitute a small magnitude of impact to the existing views, by introducing new development features into the middle distance of them, although the existing developments of Palm Springs and Royal Palms are already visible in these views. At night, residential lighting and street lighting may also be partly visible, but will not significantly change views which are already characterised by residential lighting at Palm Springs and Royal Palms. Resulting impacts on this very small VSR group will be Slight negative but will tend to diminish over time as planting in and around the development matures (see **Figure 11.36**).

- **Pedestrians on San Tin Highway Footbridge (T4)** – Pedestrians crossing the footbridge across the San Tin Highway, south east of the Site may experience elevated broken and distant views of completed 4-storey structures in front of 2.5/3 storey structures, broken by storage yards, buildings and trees. Key issues determining the magnitude of impact to these VSRs will be their moderate distance from the source of impacts and limited changes to the indifferent character of existing views. This will introduce new development features into the middle distance of views. At night, residential lighting and street lighting may also be partly visible, but will not significantly change views which are already characterised by residential lighting at Palm Springs and Royal Palms. Given the fairly incoherent visual quality of existing views, resulting impacts on this very small VSR group will be Slight negative but will tend to diminish over time as planting in and around the development matures.

- **Residents in Mai Po San Tsuen and Mai Po Lo Wai (R5)** – Residents in properties on the northern and western edges of thee villages which face directly towards the site, will experience views of completed 2.5/3 and 4-storey structures against a backdrop of trees. Key issues determining the magnitude of impact to these VSRs will be their moderate 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 Area 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. This will introduce new development features into the distance of views. At night, residential lighting and street lighting may also be partly visible, but will not significantly change views which are already characterised by residential lighting at Palm Springs and Royal Palms. Given the contrast these built features will provide with natural features in the landscape, (although at some distance) resulting impacts on this very small VSR group will be Slight negative but will tend to diminish over time as planting in and around the development matures (see **Figure 11.38**).

- **Workers in Fishponds in and Around Mai Po (O1)** – Those working at fishponds north and north-west of the Site, will experience views across fishponds of the new development with 2.5/3 storey buildings at the front and 4-storey buildings to the rear. Key issues determining the magnitude of impact 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 Area 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. This will constitute an intermediate magnitude of impact to the existing views, by introducing new development features into them although the existing developments of Palm Springs and Royal Palms are already visible in these views. At night, residential lighting and street lighting may also be partly visible, but will not significantly change views which are already characterised by residential lighting at Palm Springs and Royal Palms. Resulting impacts on this very small VSR group will be Slight negative (particularly on those working closer to the development) but will tend to diminish over time as planting in and around the development matures (see **Figure 11.37**).

- **Workers in Industrial / Storage Areas north of Royal Palms (O2)** – Those working in industrial / storage areas north-east of the Site (especially those in elevated machinery), may experience broken, close views across intervening fencing of construction machinery and of the completed development. Additionally, the jumbled mass of incoherent elements (machinery, containers and equipment) within and surrounding these workers results in views of the site being significant interrupted. Key issues determining the magnitude of impact to these VSRs will be their relative proximity to the source of impacts and limited changes to the indifferent character of existing views. This will constitute a small magnitude of impact to the existing views, by introducing new development features (2.5 / 3 and 4 storey buildings) into them. At night, residential lighting and street lighting may also be partly visible, but will not significantly change views of the general surroundings which are already characterised by residential and road lighting. Given the fairly incoherent visual quality of existing views, resulting impacts on this very small VSR group will be Slight negative (particularly on those working closer to the development) but will tend to diminish over time as planting in and around the development matures.

- **Workers in Industrial / Storage Areas east of Royal Palms (O3)** – Those working in industrial / storage areas east of the Site (especially those in elevated machinery), may experience close views across intervening fencing and storage areas of completed Project buildings. Key issues determining the magnitude of impact to these VSRs will be their relative proximity to the source of impacts, limited changes to the indifferent character of existing views and the fact that many views are broken by storage yard features. This will constitute a small magnitude of impact to the existing views, by introducing new development features (2.5 / 3 and 4 storey buildings) into them. At night, residential lighting and street lighting may also be partly visible, but will not significantly change views of the general surroundings which are already characterised by residential and road lighting. Given the fairly incoherent visual quality of existing views, resulting impacts on this very small VSR group will be Slight negative (particularly on those working closer to the development) but will tend to diminish over time as planting in and around the development matures.

- **Visitors to Mai Po Nature Reserve (RE1)** – Visitors to the eastern edge of the WWF Mai Po Nature Reserve to the north west of the Site may have long distance (620m) views across fishponds towards the Site itself. They will experience distant views of completed 2.5/3 buildings with 4-storey structures to the rear. The buildings will be seen across low-lying open land with a backdrop of trees and low hills. Part of the Project will be hidden by existing development and trees on the north-western edge of Palm Springs. Lower parts of the works will be screened by approx 4m high screen planting. Key issues determining the magnitude of impact to these VSRs will be their relatively great 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 Area 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. The effect of the Project will be to appear largely as an extension to existing development at Palm Springs and Royal Palms which already form part of these views. At night, residential lighting and street lighting may also be very slightly visible, but will not significantly change views which are already characterised by residential lighting at Palm Springs and Royal Palms. To this extent, the Project will not appear wholly out of place and resulting impacts on this small but very sensitive VSR group will be Slight negative. Impacts will tend to diminish over time as planting in and around the development matures (see **Figure 11.39**).
- **Motorists on Tam Kon Chau Road (T3)** – Motorists on Tam Kon Chau Road will experience visual impacts of an intermediate magnitude due to their moderate distance from the source of impacts, the panoramic quality of views (a broad, expansive view within which several, distant features are observed and where the Project Area is only one element); and the fact that for the most part, motorists are travelling perpendicular to or away from the Site (rather than towards it). The Project will appear largely as an extension of existing housing at Royal Palms and Palms Springs and will therefore not appear out of place or incongruous in these views of the landscape. Mitigation planting will also help in blending buildings into the landscape. These factors, combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, and the transient nature of views will mean that visual impacts on this VSR group will be slight.

11.7.13 At Day 1 of opening, Residual visual impacts of Insubstantial significance will be experienced by:

- **Residents in Cottage Area South of Mai Po San Tsuen (R4) –** These residents will not experience visual impacts of significant magnitude due to the fact that their views are largely or entirely broken by intervening storage yard features, parked lorries or other structures such that views of the Project Area are not readily available. Even where glimpsed views might be possible, the visual character of the foreground is already so degraded by the features mentioned, that the relative effects of new features in these views would not be significant. This will mean that visual impacts on this VSR group will be Insubstantial.

- **Motorists on San Tin Highway (T1) –** Motorists on San Tin Highway will not experience visual impacts of significant magnitude due to their moderate distance from the source of impacts, the panoramic quality of views (a broad, expansive view within which several, distant features are observed and where the Project Area is only one element); and the fact that for the most part, motorists are travelling perpendicular to the Project Area entry. These factors, combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, and the transient nature of views will mean that visual impacts on this VSR group will be Insubstantial.

- **Motorists on Castle Peak Road (T2) –** Motorists on Castle Peak Road will not experience visual impacts of significant magnitude due to their moderate distance from the source of impacts, the panoramic quality of views (a broad, expansive view within which several, distant features are observed and where the Project Area is only one element); and the fact that for the most part, motorists are travelling perpendicular to the Project Area entry. These factors, combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, and the transient nature of views will mean that visual impacts on this VSR group will be Insubstantial.

11.7.14 **At Year 10 after opening**, after all visual mitigation measures are implemented and have matured over 10 years, residual visual impacts of slight Negative significance will be experienced by:

- **Residents in Royal Palms, Palm Springs (R1 and R2) –** Residents in Palm Springs (approx 17 properties at the northern end of Camelia Path and approx 32 properties on Narcissus Path) and Royal Palms (approx 21 properties on Ventura Avenue and approx 8 properties on Santa Monica Avenue) will potentially experience views of new 2.5/3 storey dwellings. Other residents on the northern sides of these developments may experience more distant, oblique views. Residents using peripheral roads in Royal Palms and Palm Springs; as well as residents using the footpath along the boundary of Royal Palms will also have potential views of the Project. It is likely that almost all views of the Project will be obscured either in large part, or totally, by the tall belts of existing trees (many of which will have grown to around 15m high) along the boundary of the Site with Royal Palms (two rows on an embankment) and Palm Springs. Screening will be augmented by further mitigation screen planting along the boundary of the development which will have grown to around 10m high (see **Figures 11.25A; 11.25B; 11.25C; 11.26; 11.33** and **11.34**). For all viewers, to the extent that the site may be currently visible at present through the existing belts of tall trees, views of trees will replace views across the previously derelict site. These effects will be mitigated in part by the fact that only 2.5/3 story buildings will be seen where residents look directly onto the site; by the staggering of 4-storey buildings elsewhere on the boundary of the site and by the visual variety of a varied height profile along the boundary. 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). Key issues determining the magnitude of change to these VSRs will be the relative proximity of some of the VSRs, the broken or interrupted nature of the views of many VSRs, the screening effect of existing and proposed trees 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 village houses, residential development, utilities, tree clumps etc. The result will be a change in the visual character of these views from partially interrupted views across a mixed urban fringe open landscape of derelict land, fishponds, storage yards and the distant urban skyline of Shenzhen to more consistent short-range views of natural vegetation (see **Figure 11.33** and **Figure 11.34**). Resulting visual impacts will be Slight in the worst cases (mentioned above) and Insubstantial in others. Most residents in Palm Springs and Royal Palms do not live close to the boundary with the site and will experience little or no impact on their views, due to the effects of distance, intervening buildings and existing tree planting.

11.7.15 Insubstantial residual visual impacts will be experienced by:

- **Residents in Wo Shang Wai (R3) –** The effect of circa 10m high mitigation screen planting will mean that to the small number of **Residents in Wo Shang Wai (R3)** living on the northern sides of the village, views of new buildings will be entirely, or almost entirely obscured. Key issues determining the magnitude of impact to these VSRs will be the relative proximity of some of the VSRs, the broken or interrupted nature of the views of many VSRs, the screening effect of proposed trees 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 village houses, residential development, utilities, tree clumps etc. In particular, the row of mitigation planting will have matured by Year 10 and will at this time have a fairly dramatic mitigation effect (as opposed to Day 1 when its effect will be more limited), appearing in views northwards and will represent a further natural feature in these views. At night, residential lighting and street lighting is unlikely to be very visible through belts of trees. 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 existing houses in Palm Springs. Resulting visual impacts will therefore be Insubstantial (**Figure 11.35**).

- **Residents in Cottage Area South of Mai Po San Tsuen (R4) –** These residents will not experience visual impacts of significant magnitude due to the fact that their views are largely or entirely broken by intervening storage yard features, parked lorries or other structures such that views of the Project Area are not readily available. Even where glimpsed views might be possible, the visual character of the foreground is already so degraded by the features mentioned, that the relative effects of new features in these views would not be significant. This will mean that visual impacts on this VSR group will be Insubstantial.

- **Residents in Mai Po San Tsuen and Mai Po Lo Wai (R5) -** where the Project is visible, it will appear largely as an extension of existing housing at Royal Palms and Palms Springs and will not appear out of place or incongruous in these views of the landscape. Key issues determining the magnitude of impact to these VSRs will be their moderate distance from the source of impacts, the panoramic quality of many views, the screening effects of mitigation planting 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. The maturing of mitigation planting at the edges of the Site can be expected to have a significant effect on reducing visual impacts at Year 10. At night, residential lighting and street lighting is unlikely to be very visible. 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). For this reason, residual visual impacts will be Insubstantial in all cases (see **Figure 11.38).**

- **Motorists on San Tin Highway (T1) –** Motorists on San Tin Highway will not experience visual impacts of significant magnitude due to their moderate distance from the source of impacts, the panoramic quality of views (a broad, expansive view within which several, distant features are observed and where the Project Area is only one element); and the fact that for the most part, motorists are travelling perpendicular to the Project Area entry. These factors, combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, and the transient nature of views will mean that visual impacts on this VSR group will be Insubstantial.

- **Motorists on Castle Peak Road (T2) –** Motorists on Castle Peak Road will not experience visual impacts of significant magnitude due to their moderate distance from the source of impacts, the panoramic quality of views (a broad, expansive view within which several, distant features are observed and where the Project Area is only one element); and the fact that for the most part, motorists are travelling perpendicular to the Project Area entry. These factors, combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, and the transient nature of views will mean that visual impacts on this VSR group will be Insubstantial.

- **Motorists on Tam Kon Chau Road (T3)** – Motorists on Tam Kon Chau Road will not experience visual impacts of significant magnitude due to their moderate distance from the source of impacts, the panoramic quality of views (a broad, expansive view within which several, distant features are observed and where the Project Area is only one element); and the fact that for the most part, motorists are travelling perpendicular to or away from the Site (rather than towards it). The Project will appear largely as an extension of existing housing at Royal Palms and Palms Springs and will therefore not appear out of place or incongruous in these views of the landscape. Mitigation planting will also help in blending buildings into the landscape. These factors, combined with the limited numbers of people using the road, the relatively low sensitivity of travelling VSRs generally, and the transient nature of views will mean that visual impacts on this VSR group will be Insubstantial.

- **Visitors to Mai Po Nature Reserve (RE1)** – Visitors to the eastern edge of the WWF Mai Po Nature Reserve to the north west of the Site will not experience impacts of significant magnitude at Year 10 due to their relatively great distances from the source of impacts and the panoramic quality of many views. The Project will appear largely as an extension of existing housing at Royal Palms and Palms Springs and will therefore not appear out of place or incongruous in these views of the landscape. Semi-mature mitigation planting will also help in screening and blending buildings into the landscape. These factors, combined with the relatively limited numbers of people using the Reserve and the transient nature of views will mean that visual impacts on this VSR group will be Insubstantial (see **Figure 11.39**).

Table 11-6 Significance of Visual Impacts in the Construction and Operation Phases (Note: All impacts negative unless otherwise noted)

Table 11.6 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		Magnitude of Impact before Mitigation (Negligible, Small, Intermediate, Large)		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many)		Impact Significance BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
		Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation		Construction	Operation DAY 1	Operation YEAR 10
R1	Residents in Royal Palms	Partial 20m	Partial 20m	Intermediate Negative	Intermediate Negative	High Few	High Few	Moderate Negative	Moderate Negative	CM1-3 / CM5&7 / CM9 / OM1–7	Moderate Negative	Moderate Negative	Slight Negative
R2	Residents in Palm Springs	Partial 10m	Partial 10m	Intermediate Negative	Intermediate Negative	High Few	High Few	Moderate Negative	Moderate Negative	CM1-3 / CM5&7 / CM9 / OM1–7	Moderate Negative	Moderate Negative	Slight Negative
R3	Residents in Wo Shang Wai	Partial 80m	Partial 80m	Small Negative	Small Negative	High Very Few	High Very Few	Moderate Negative	Moderate Negative	CM1-3 / CM5&7 / CM9 / OM1–7	Moderate Negative	Moderate Negative	Insubstantial
R4	Residents in Cottage Area South of Mai Po San Tsuen	Partial 100m	Partial 100m	Negligible	Negligible	High Very Few	High Very Few	Insubstantial	Insubstantial	CM1-3 / CM5&7 / CM9 OM1 / OM3-7	Insubstantial	Insubstantial	Insubstantial
R5	Residents in Mai Po San Tsuen and Mai Po Lo Wai	Partial 300m	Partial 300m	Small Negative	Small Negative	High Few	High Few	Moderate Negative	Moderate Negative	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Slight Negative	Slight Negative	Insubstantial
R6	Residents in Tam Kon Chau	Full 400m	Full 400m	Small Negative	Small Negative	High Very Few	High Very Few	Moderate Negative	Moderate Negative	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Slight Negative	Slight Negative	Insubstantial
T1	Motorists on San Tin Highway	Glimpse 20m	Glimpse 20m	Negligible	Negligible	Low Very Many	Low Very Many	Insubstantial	Insubstantial	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Insubstantial	Insubstantial	Insubstantial
T2	Motorists on Castle Peak Road	Glimpse 5m	Glimpse 5m	Negligible	Negligible	Low Many	Low Many	Insubstantial	Insubstantial	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Insubstantial	Insubstantial	Insubstantial

Table 11.6 / **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**		**Magnitude of Impact before Mitigation** (Negligible, Small, Intermediate, Large)		**Receptor Sensitivity & Number** (Low, Medium, High) (Very Few, Few, Many, Very Many)		**Impact Significance BEFORE Mitigation** (Insubstantial, Slight, Moderate, Substantial)		**Recommended Mitigation Measures**	**Residual Impact Significance AFTER Mitigation** (Insubstantial, Slight, Moderate, Substantial)		
											Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation			**DAY 1**	**YEAR 10**
T3	Motorists on Tam Kon Chau Road	Glimpse 400m	Glimpse 400m	Intermediate	Intermediate	Low Very Few	Low Very Few	Slight	Slight	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Slight	Slight	Insubstantial
T4	Pedestrians on San Tin Highway Footbridge	Full 250m	Full 250m	Small Negative	Small Negative	Medium Very Few	Medium Very Few	Moderate Negative	Moderate Negative	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Slight Negative	Slight Negative	Insubstantial
O1	Workers in fishponds in and around Mai Po	Full 10m	Full 10m	Intermediate Negative	Intermediate Negative	Low Very few	Low Very few	Slight Negative	Slight Negative	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Slight Negative	Slight Negative	Insubstantial
O2	Workers in Industrial / Storage Areas north of Royal Palms	Partial 10m	Partial 10m	Small Negative	Small Negative	Low Very few	Low Very few	Slight Negative	Slight Negative	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Slight Negative	Slight Negative	Insubstantial
O3	Workers in Industrial / Storage Areas east of Royal Palms	Partial 10m	Partial 10m	Small Negative	Small Negative	Low Very few	Low Very few	Slight Negative	Slight Negative	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Slight Negative	Slight Negative	Insubstantial
RE1	Visitors to Mai Po Nature Reserve	Partial 620m	Partial 620m	Small Negative	Small Negative	High Few	High Few	Moderate Negative	Moderate Negative	CM1-3 / CM5&7 / CM9 / OM1 / OM3-7	Slight Negative	Slight Negative	Insubstantial

* O = Occupational; R = Residential; T = Travelling; RE = Recreational

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

% 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

11.8 Conclusions

Summary of Landscape and Visual Mitigation Measures

11.8.1 Construction Phase mitigation measures will comprise the following (described in detail in **Table 11–3***)*:

- CM1 - The construction area and contractor's temporary works areas should be minimised.
- CM2 - Screening of construction works by hoardings/noise barriers around Works area in visually unobtrusive colours, to screen Works.
- CM3 - Reduction of construction period to practical minimum.
- CM4 - Topsoil, where identified, and where the soil material meets acceptable criteria, should be stripped and stored for re-use.
- CM5 - Hydroseeding or sheeting of soil stockpiles.
- CM6 – Advance Screen Planting to noise barriers.
- CM7 - Control night-time lighting and glare by hooding all lights.
- CM8 - Ensure no run-off into streams adjacent to Site.
- CM9 - Protection of existing trees on boundary of Site.
- CM10 - Trees unavoidably affected by the works shall be transplanted where practical.

11.8.2 Operation Phase mitigation measures will comprise the following (described in detail in **Table 11–4***)*:

- OM1 - Compensatory Tree Planting for all felled trees
- OM2 - A continuous belt of screen planting along southern perimeter of site with fast growing tree species. A minimum of 450 trees capable of reaching a height > 10m within 10 years should be planted. These quantities are separate from those tree quantities identified for OM3. Planting of the belt of trees shall be carried out as advance works ahead of other site formation and building works.
- OM3 - Maximise landscape planting and amenity water bodies in residential areas of the development. Approximately 750 Heavy Standard size trees should be planted.
- OM4 - Maximise freshwater habitat wetland creation consistent with achieving other parameters (4.74ha). Implementation of the wetland shall be carried out as advance works.
- OM5 - Use appropriate (visually unobtrusive) building materials and colours in built structures.
- OM6 - During detailed design, refine building layout to create a min 10m wider gap between buildings at Wo Shang Wai pond and also two min 10m wide gaps in the row of buildings adjacent to Royal Palms.
- OM7 - Streetscape elements (e.g. paving, signage, street furniture, lighting etc.) shall be sensitively designed in a manner that responds to the rural context. Lighting units

should be directional and minimise unnecessary light spill.

Summary of Predicted Landscape and Visual Impacts in the Construction Phase

11.8.3 Residual landscape impacts in the Construction Phase are listed in **Table 11–5** and mapped in **Figure 11.27** and **Figure 11.29**. Residual visual impacts in the Construction Phase are listed in **Table 11–6** and mapped in **Figure 11.31.**

11.8.4 The potentially most significant landscape impacts during the construction phase will be impacts on **Freshwater Marsh (LR30)** (about 4 ha) which will be Moderate negative. Negative residual landscape impacts of Slight significance will be experienced by **Grassland with Seasonal Marsh Patches and Soils on Site (LR32)** (about 11.7 ha)**;** the **Tree Group on the Site (LR33)** (about 4 trees); **Banana Trees on the Site (LR34)** (about 10 trees); **Trees in Open Storage Area (LR36)** (about 28 young trees and 21 semi-mature trees) and **Trees along Castle Peak Road (Mai Po) (LR39)** (about 9 young trees and 14 semi-mature trees) which will be Slight negative. There will be Slight negative impacts on the landscape character of the **Tsing Lung Tsuen Plain (LCA2).**

11.8.5 The potentially most significant visual impacts during the construction phase will be impacts on **Residents in Royal Palms and Palm Springs and Wo Shang Wai (R1, R2 and R3** and will be Moderate negative. Residual visual impacts of slight negative significance will be experienced by **Residents in Mai Po San Tsuen and Mai Po Lo Wai (R5), Residents in Tam Kon Chau (R6**); **Pedestrians on San Tin Highway Footbridge (T4**); **Workers in Fishponds and in Around Mai Po (O1**); **Workers in Industrial / Storage Areas north of Royal Palms (O2**); **Workers in Industrial / Storage Areas east of Royal Palms (O3)** and on **Visitors to the Mai Po Nature Reserve (RE1)**

Summary of Predicted Landscape and Visual Impacts in the Operation Phase

11.8.6 Residual landscape impacts in the Operation Phase are listed in **Table 11–5** and mapped in **Figure 11.28** and **Figure 11.30.** Residual visual impacts in the Operation Phase are listed in **Table 11–6** and mapped in **Figure 11.32**.

11.8.7 There will be no negative landscape impacts on the landscape resources during the operation phase and in fact the Project will result in the net gain of trees (approximately 1564 in number – if one factors in both young and semi-mature trees currently on site) and a gain of approx 0.05 ha of wetland.

11.8.8 Impacts on landscape resources will therefore be slight positive on Trees on Northern Boundary of Royal Palms (LR31); Freshwater Marsh (LR30); Tree Group on the Site (LR33); Banana Trees on the Site (LR34); Trees in Open Storage Area (LR36); Trees along Castle Peak Road (Mai Po) (LR39); Trees in northern Palm Springs (LR86); Trees in western Palm Springs (LR87) and Trees in northern Palm Springs (LR91).

11.8.9 The project will result in an insubstantial change to the landscape character of the **Tsing Lung Tsuen Plain (LCA2)** by replacing a slightly degraded open site / storage yard with a coherent residential area and wetland.

11.8.10 Residual visual impacts at Year 10 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 in large part screened by a belt of trees or because the Project will appear largely in keeping with the existing residential character of existing views and will not represent a significant change to their character. There will be slight negative visual impacts on a small number of **Residents in Royal Palms and Palm Springs (R1 and R2)** (Palm Springs – about 49 properties; Royal Palms – about 29 properties) who live adjacent to the Project Area and look directly onto it. The views of these VSRs will change from some long-distance views over a variety of features such as derelict land, storage yards, fishponds and urban Shenzhen to views which are of a belt of trees at closer distances. Other VSRs in these locations will mostly experience insubstantial impacts.

Conclusion

11.8.11 Overall, it is considered that, in the terms of Annex 10, Clause 1.1(c) of the EIAO-TM, the landscape and visual impacts are acceptable with mitigation measures ("there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures").

12 IMPACTS SUMMARY

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

12.1 Summary

12.1.1 A summary of all environmental impacts required to be addressed under the Study Brief is tabulated below:

Table 12-1 Impacts Summary

Environmental Aspects	Construction Phase	Operational Phase
Air Quality	Fugitive dust impacts controllable through standard suppression measures.	No unacceptable impact envisaged.
Noise	Noise generated as a result of construction activities can be controlled through standard mitigation measures and noise barriers/ site hoardings.	100% compliance with noise criteria. No adverse impact predicted.
Water Quality	Minor on-site water quality issues associated with excavations and construction works, controllable through standard mitigation measures.	No impact predicted off-site. On-site water quality management at the wetland will be controlled through monitoring and auditing programme.
Sewerage and Sewage Treatment Implications	Temporary toilet facilities provided on-site for workforce.	Discharge of domestic effluent to planned public sewer therefore no impact predicted.

Environmental Aspects	Construction Phase	Operational Phase
Waste Management	2,140m^3 of Category M and Category H sediment to be reused/disposed of.	Waste arisings relate to domestic wastes and "green"/landscaping wastes.
Ecological Impact Assessment	Permanent loss of 11.05ha of grassland, 4ha of freshwater marsh/reedbed, 0.69 of seasonal marsh, 0.81ha of drainage ditches/channels and 4.81ha of bare ground & developed land; and disturbance to wildlife, mitigated through the early establishment of the wetland restoration area in the Project Area and minimize powered mechanical equipment on-site.	Minor disturbance from the development area to wildlife. Ecological enhancement of around 4.74ha of wetland with a variety of habitats of enhanced quality.
Cultural Heritage	No impact predicted.	No impact predicted.
Fisheries Impact Assessment	No direct impact predicted and indirect impacts will be insignificant with good site practices and implementation of dust and water quality control measures as presented in Chapter 3 and 5 respectively.	No impact predicted.

Environmental Aspects	Construction Phase	Operational Phase
Landscape and Visual Impact	Moderate negative Impacts on freshwater marsh (about 4 ha); slight negative residual landscape impacts on grassland with seasonal marsh patches (about 11.7ha), tree groups (including banana trees) on-site, in open storage and along Castle Peak Road (Mai Po) (about 86 trees in total); and slight negative impacts on the landscape character of the Tsing Lung Tsuen Plain. Mitigated through standard measures and protection of trees. Moderate negative visual impacts experienced by residents in Royal Palms, Palm Springs and Wo Shang Wai; slight negative residual visual impacts experienced by residents, pedestrians and workers in a further distance, mitigated through screens and hoardings /noise barriers around works area.	Insubstantial change to the landscape character of the Tsing Lung Tsuen Plain and insubstantial residual visual impacts for more distant VSRs. Landscape visual enhancement through net gain of landscape resources. Slight negative visual impacts on a small number of residents in Royal Palms and Palm Springs by change of view from long-distance views to belt of trees at closer distances.

13 SUMMARY OF ENVIRONMENTAL OUTCOMES

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

13.1 Overall

13.1.1 The primary environmental outcome of this Project is that the zoning intent of the Site can be achieved through the development proposed. The EIA has demonstrated that there will be environmental, ecological and planning gain realized from the development Project. The environmental outcomes are summarized in the following paragraphs in the same order as it is presented in the Study Brief.

13.2 Air Quality

13.2.1 Full compliance with the Air Quality Objectives is anticipated for this Project.

13.3 Noise

13.3.1 100% compliance with the Noise Control Ordinance is expected as well as the requirements set forth in the associated Technical Memoranda. During the operational phase there will be no exceedance of the traffic noise criterion at all dwellings despite the forecasted increase in vehicle movements on the adjacent roads including San Tin Highway and Castle Peak Road in future.

13.4 Water Quality

13.4.1 Full compliance with the "no net increase" in pollution load for Deep Bay through phasing of the implementation of this project to tie in with the provision of the public sewer (along Castle Peak Road). The water quality of the restored wetland will be monitored as part of the overall management plan for the restored wetland. To this end, a series of Water Quality Objectives have been designed. The creation of a restored wetland will provide an ecological enhancement of the water/wetland resources in the area.

13.5 Sewerage and Sewage Treatment

13.5.1 The disposal of domestic effluent from the development will be via the planned public sewer underneath the Castle Peak Road.

13.6 Waste Management

13.6.1 The basic tenet of the construction phase is to avoid off-site disposal of materials and to re-use materials on-site as far as possible. This has been demonstrated as being possible in the EIA, with the exception of 2,140m^3 of sediment located in the wetland restoration area. The sediment could also be disposed of either on or off site and the ultimate decision will be made during detailed design.

13.7 Ecology

13.7.1 The baseline surveys and ecological impact assessments have concluded that there is an area of around 4 hectares of permanent freshwater marsh / reedbed on-site which is characterized by patches of permanent standing water and clumps of reeds. In addition, several isolated patches of seasonal marsh (about 0.69ha) were found within the Project Area. The mitigation measure for the loss of this marsh and the few wetland patches is to provide around 4.74 hectares of restored wetland (Wetland Restoration Area) with target habitats and species which enhance the ecological function of the area.

13.8 Fisheries

13.8.1 No aquaculture activities will be affected directly as a consequence of this Project and the indirect impacts will be insignificant with good site practices and implementation of dust and water quality control measures.

13.9 Cultural Heritage

13.9.1 No cultural heritage features or buildings will be affected either directly or indirectly as a consequence of implementing this Project.

13.10 Landscape and Visual Impact

13.10.1 From the surveys undertaken and the impact assessments conducted as part of this EIA it was concluded that during the operational phase, the outcome on the landscape resources would be insubstantial and that no negative residual impact would arise. Arising from the landscaping proposals there will be a net gain in the number of trees planted, in addition to the provision of around 4.74 hectares of restored wetland and associated planting. The residual visual impacts during the operational phase on almost all receivers will be insubstantial, the development will for the most part be screened by a belt of trees. There will be slight negative visual impacts on a small number of residents who live adjacent to the Project Area and look directly onto it, but these can be eliminated reduced or offset to a large extent by specific mitigation measures.

14 ENVIRONMENTAL MONITORING AND AUDIT (EM&A) REQUIREMENTS

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

14.1 Overview

14.1.1 A detailed EM&A Manual has been prepared for this project as required under the Study Brief. The following sections provide a summary of the need for monitoring and auditing of the individual environmental aspects.

14.2 Air Quality

14.2.1 It is expected that full compliance with the air quality criteria will be achieved at all ASRs with the implementation of mitigation measures. Environmental monitoring and audit is however recommended to ensure that the air quality levels do not exceed the criteria during the construction phase as discussed in the EM&A Manual in recognition of the proximity of the residential developments. No operational monitoring is considered to be necessary for this project.

14.3 Noise Impact

14.3.1 Full compliance with the noise criteria will be achieved at all NSRs with the implementation of mitigation measures. Environmental monitoring and audit is however recommended to ensure that the noise levels do not exceed the criteria during the construction phase as discussed in the EM&A Manual especially in recognition of the close proximity of the Conservation Area and residential developments. No operational monitoring is recommended.

14.4 Water Quality

14.4.1 Water quality monitoring and auditing is proposed, to ensure mitigation measures during construction phase will be implemented to protect the water bodies in the adjacent sensitive areas from being further degraded. A water quality monitoring programme for the created wetland during operational phase is also recommended. The monitoring and audit details are provided in the EM&A Manual with the water quality monitoring for the created wetland presented in the wetland restoration plan (see **Appendix H**).

14.5 Sewerage and Sewage Treatment Implications

14.5.1 There is no requirement for formal monitoring to be undertaken for this Project as all sewage generated at the proposed development will be discharged into the planned public sewer. No sewage effluent will be discharged into the nearby water bodies even during the construction phase.

14.6 Waste Management

14.6.1 Auditing of each waste stream is recommended to be carried out periodically during the construction phase to determine if wastes are being managed in accordance with approved procedures. A site waste management plan will be prepared by the Contractor to define the waste management procedures and protocols. The audits will examine all aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal and would be conducted on a monthly basis or more frequently if required.

14.7 Ecology

14.7.1 The implementation of the ecological mitigation measures stated in Section 8.9 should be checked as part of the environmental monitoring and audit (EM&A) procedures during the construction period. Furthermore, the target species identified in the EcoIA should be monitored in accordance with the Wetland Restoration Plan in Section 7 of the **Appendix H**, to ensure the effectiveness of the proposed mitigation measures. The details of the recommended monitoring and audit programmes are presented in a separate EM&A Manual.

14.8 Fisheries

14.8.1 With the implementation of proper site practices to control dust and site runoff during construction for air quality and water quality, no impact on the adjacent fishponds is expected. No fisheries-specific EM&A requirement is therefore required during the construction and operational phases.

14.9 Cultural Heritage

14.9.1 Neither construction nor operational impact is anticipated and hence no EM&A will be required during the construction and operational phases.

14.10 Landscape and Visual Impact

14.10.1 The implementation of the recommended mitigation measures stated in section 11.6.11-11.6.30, the potential landscape and visual impacts are acceptable. The details of the recommended monitoring and audit programmes are presented in a separate EM&A Manual.

15 PROJECT IMPLEMENTATION SCHEDULE

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
Air Quality					
3.6.1	**During Construction** Dust which may be generated during the construction of the proposed Comprehensive Development is expected to be released as a result of construction activities such as material handling, excavation, vehicle movement and erosion of unpaved area and stockpiles. The potential air quality impact is however anticipated to be short-term and be controlled through appropriate design and good site practice stipulated in the *Air Pollution Control (Construction Dust) Regulation.*	Contractor	Construction Work Sites	During Construction	Air Pollution Control (Construction Dust) Regulation
	To ensure compliance with the guidelines and AQOs at the ASRs all time, it is recommended to implement the *Air Pollution Control (Construction Dust) Regulation* and include good site practice in the contract clauses to minimize cumulative dust impact. In addition, a comprehensive dust monitoring and audit programme is recommended to ensure proper implementation of the identified mitigation measures. Details of the monitoring and audit requirements are provided in a separate EM&A Manual.				
	• 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;				
	• dump trucks for material transport 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 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;				
	• the portion of road leading only to a construction site that is within 30m of a designated vehicle entrance or exit should be kept clear of dusty materials;				

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
	• stockpile of dusty materials to 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;	Contractor	Construction Work Sites	During Construction	Air Pollution Control (Construction Dust) Regulation
	• 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;				
	• 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;				
	• all malodorous excavated material should be placed as far as possible from any ASRs;				
	• the stockpiled malodorous materials should be removed from site as soon as possible; and				
	• the stockpiled malodorous materials should be covered entirely by plastic tarpaulin sheets.				
	In order to minimise the potential odour nuisance arising from the excavation of pond deposit, the following control measures shall be implemented:	Contractor	Construction Work Sites	During excavation and dredging	
	• all malodorous excavated material should be placed as far as possible from any ASRs;				
	• the stockpiled malodorous material should be removed from site as soon as possible; and				
	• the stockpiled malodorous material should be covered entirely by plastic tarpaulin sheets.				
3.6.2	**During Operation** The potential impacts on air quality during the operation phase are insignificant, therefore specific mitigation measures are not required.	N/A	N/A	N/A	N/A

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
Noise					
4.8.1	**During Construction** The noise impact of unmitigated construction activities for Wo Shang Wai together with the wetland restoration would cause exceedance of the daytime construction noise criterion at all the representative NSRs except NSR8 during the normal working hours. Mitigation measures for construction site are proposed and should be incorporated into the Contract Specifications. While it is recognised that the Contractor may develop a different package of mitigation measures to meet the required noise standards, the following suite of practical and implementable measures demonstrate an approach that would be feasible to reduce noise to acceptable levels.	Contractor	Construction Work Sites	During Construction	PN 2/93 Noise from Construction Activities & EIAO
	Good Site Practice Good site practice and noise management can significantly reduce the impact of construction site activities on nearby NSRs. The following package of measures should be followed during construction: • only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works; • machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum; • plant known to emit noise strongly in one direction should, where possible, be orientated to direct noise away from the NSRs; • silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction period; • mobile plant should be sited as far away from NSRs as possible; • material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities; and • The Contractor shall at all times comply with all current statutory environmental legislation.	Contractor	Construction Work Sites	During Construction	PN 2/93 Noise from Construction Activities & EIAO
	Selection of quieter plant and working methods The Contractor shall obtain particular models of plant that are quieter than standards given in GW-TM. The list of assumed quieter plants can be found in the **Table 4–14** of the EIA report. The Contractor shall select from the available models achieving the assumed sound levels while making reference to the GW-TM and BS5228: Part 1: 1997	Contractor	Construction Work Sites	During Construction	PN 2/93 Noise from Construction Activities & EIAO

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
	Use of Noise Barriers/ Site Hoardings Noise barriers and site hoardings are proposed along the site boundary to block the direct line of sight from the most affected NSRs to the major noise contribution construction phases as shown in **Figures 4.6** and **4.7** of the EIA Report. The height of the noise barriers ranged from 9-10m, while the height of the site hoardings ranged from 2.4-3m. The noise barriers and site hoardings shall be built before the commencement of construction works in order to ensure protection to nearby NSRs. The noise barriers and site hoardings should have a surface density of at least $10kg/m^2$ or material providing equivalent transmission loss. The noise barriers and site hoardings should have no gaps and openings to avoid noise leakage.	Contractor	Construction Work Sites	Before the commencement of construction works	PN 2/93 Noise from Construction Activities & EIAO
  4.7.5	**During Operation** *Fixed Noise Sources* Open storage site at the northeast corner of the Project Area and the sewage treatment plant in Royal Palms are potential fixed noise sources, the assessment result comply with both day and night time noise criteria. No mitigation measures are required.	N/A	N/A	N/A	N/A
4.7.6	*Road Traffic Noise* During the operational phase, road traffic noise will be the dominant noise source within the Study Area, and will potentially affect the planned noise sensitive developments. This assessment has predicted that the traffic noise levels including the contribution from existing network at the year 2027 will comply with the road traffic noise criterion of $L_{10\ (peak\ hour)}$ 70 dB(A). The increased noise levels in 2028 are minimal and insignificant. No mitigation measures are required.	N/A	N/A	N/A	N/A
Water Quality					
5.6.1	**During Construction** Potential water quality impacts primarily relate to the un-controlled discharge of sediments/ silts during construction. Good site practices in addition to the implementation of mitigation measures would minimize the impact to the surrounding environment.	Contractor	Construction Work Sites	During Construction	Practice Note for Professional Persons with regard to site drainage (ProPECC PN 1/94) and WQO
	General Precautions				
	• The site should be confined to avoid silt runoff to the site.				
	• No discharge of silty water into the storm drain and drainage channel within and the vicinity of the site.				
	• Any soil contaminated with chemicals/oils shall be removed from site and the void created shall be filled with suitable materials.				
	• Stockpiles to be covered by tarpaulin to avoid spreading of materials during rainstorms;				

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
	• Suitable containers shall be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport;				
	• Chemical waste containers shall be labelled with appropriate warning signs in English and Chinese to avoid accidents. there shall also be clear instructions showing what action to take in the event of an accidental;	Contractor	Construction Work Sites	During Construction	Practice Note for Professional Persons with regard to site drainage (ProPECC PN 1/94) and WQO
	• Storage areas shall be selected at safe locations on site and adequate space shall be allocated to the storage area;				
	• Any construction plant which causes pollution to the water system due to leakage of oil or fuel shall be removed off-site immediately;				
	• Spillage or leakage of chemical waste to be controlled by using suitable absorbent materials;				
	• Chemicals will always be stored on drip trays or in bunded areas where the volume is 110% of the stored volume;				
	• Regular clearance of domestic waste generated in the temporary sanitary facilities to avoid waste water spillage.				
	• Temporary sanitary facilities to be provided for on-site workers during construction.				
	Diversion of Existing Water Ditches and Marsh Temporary drainage channel and associated facilities will be provided to collect the surface runoff generated within the Project Area during the construction phase.	Contractor	Construction Work Sites	During Construction	Practice Note for Professional Persons with regard to site drainage (ProPECC PN 1/94) and WQO
	Draining of Existing Water Ditches Sandbags or silt traps will need to be placed to avoid silt runoff to the drainage channel draining the water in the northern ditch. Draining of the ditches should avoid rainy weather.	Contractor	Construction Work Sites	During Construction	Practice Note for Professional Persons with regard to site drainage (ProPECC PN 1/94) and WQO
	Soil Excavation and Stockpiling Excavated soil which needs to be temporarily stockpiled should be stored in a specially designated area and provided with a tarpaulin cover to avoid runoff into the drainage channels.	Contractor	Construction Work Sites	During Construction	Practice Note for Professional Persons with regard to site drainage (ProPECC PN 1/94) and WQO

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
5.6.2	**During Operation**				
	Provisional Measures to Emergency Sewage Discharges/Spillages As described in Section 6, the sewage generated from the residents of this development will be discharged to the planned public sewer. For discharging the sewage to the public sewers in the permanent case, no special mitigation measures are required. In order to minimize the potential impacts arising from sewer bursting, concrete surround to the sewers is proposed within the proposed development as an additional protection measures for the pipelines. (Study Brief Section 3.9.3.4 (xxviii))	Residential Management Contractor	Project Area	During Operation	WPCO WQO
	Diversion of Existing Water Ditches and Marsh Future internal drainage network will have sufficient capacity to cater for the runoff generated from the proposed development, to replace the existing water ditches and marsh. The tentative drainage scheme is shown on **Figure 5.3**. (Study Brief Section 3.9.3.4 (iv)).	N/A	N/A	N/A	N/A
	Provision of Soft-landscaping An internal drainage network will be provided to collect runoff from the residential development. Runoff from the developed areas will be diverted into the internal drainage system during storm and adverse weather conditions. Soft landscaping in between the boundary of the wetland and the residential area will be provided to act as a buffer zone to absorb any overflow or flood waters before enters into wetland area.	Residential Management Contractor	Interface of Residential Development and Restored Wetland	During Operation	N/A
<u>Waste Management</u>					
7.5.1	**During Construction** *Site Clearance Waste* The major construction works of Wo Shang Wai is in the development of residential buildings and other associated facilities (club house, tennis courts, etc). The amount of site clearance works will be limited with the exception of the excavated materials. The thin layer of vegetation removed can be stored and reused for landscaping.	Contractor	Construction Work Sites	During Construction	Waste Disposal Ordinance (Cap.354); Waste Disposal (Chemical Wastes) (General) Regulation (Cap 354) and ETWBTC No. 15/2003, Waste Management on Construction Site
7.5.2	*Excavated Materials* The intention is to maximize the reuse of the excavated materials on-site as fill materials.				
7.5.3	*Imported Filling Material* The excavated/imported filling material may have to be temporarily stockpiled on-site for the construction of road embankment and foundation of viaduct substructure. Control measures should be taken at the stockpiling area to prevent the generation of dust and pollution of stormwater channels. However, to eliminate the risk of blocking drains in the wet season, it is recommended that stockpiling of excavated materials at during wet season should be avoided as far as practicable.				

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
7.5.4	*Construction and Demolition Materials* Careful design, planning and good site management can minimise over-ordering and generation of waste materials such as concrete, mortars and cement grouts. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork of plastic facing should be considered to increase the potential for reuse.	Contractor	Construction Work Sites	During Construction Planning	Waste Disposal Ordinance (Cap.354); Waste Disposal (Chemical Wastes) (General) Regulation (Cap 354) and ETWBTC No. 15/2003, Waste Management on Construction Site
	The Contractor should reuse any C&D material on-site. C&D waste should be segregated and stored in different containers to other wastes to encourage the re-use or recycling of materials and their proper disposal.	Contractor	Construction Work Sites	During Construction	
7.5.5	*Chemical Waste* For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.				
	Chemical waste that is produced, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, should be handed in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Waste as follows:				
	Containers used for the storage of chemical wastes should:				
	• be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed:				
	• have a capacity of less than 450 litres unless the specification have been approved by the EPD; and				
	• display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations,				
	The storage area for chemical wastes should:				
	• be clearly labelled and used solely for the storage of chemical waste;				
	• be enclosed on at least 3 sides;				
	• have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area whichever is the greatest;				
	• have adequate ventilation;				
	• be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary); and				
	• be arranged so that incompatible materials are adequately separated.				
	Disposal of chemical waste should:				
	• be via a licensed waste collector; and				
	• be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers, or				

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
	• to be re-user of the waste, under approval from the EPD.				
7.5.6	General Refuse Should be stored in enclosed bins or compaction units separate from C&D and chemical wastes. The Contractor should employ a reputable waste collector to remove general refuse from the site, separate from C&D and chemical wastes, on a regular basis to minimise odour, pest and litter impacts. Burning of refuse on construction sites is prohibited by law.	Contractor	Construction Work Sites	During Construction	WDO (Cap.354) and ETWBTC No. 15/2003
7.8.13	**Disposal of Excavated Sediment at Sea** The requirements and procedures for excavated sediment disposal are specified under the ETWB TCW No. 34/2002 and PNAP 252. The management of the excavation, use and disposal of sediment is monitored by Fill Management Committee, whilst the licensing of marine dumping is the responsibility of the Director of Environmental Protection (DEP).	Contractor	Project Area	Construction	ETWB TCW No. 34/2002 and PNAP 252
	The excavated sediment would be loaded onto barges or other appropriate vessel and transported to the designated marine disposal site. Category L sediment and Category M sediment passing the biological test would be suitable for disposal at a gazetted open sea disposal ground. Category M sediment failing the biological test and Category H sediment passing the biological test would require confined marine disposal. During transportation and disposal of the dredged sediment, the following measures should be taken to minimize potential impacts on water quality: - • Bottom opening transport vessels should be fitted with tight fitting seals to prevent leakage of material. Excess material should be cleaned from the decks and exposed fittings of vessels before the vessel is moved. • Monitoring of the barge loading should be conducted to ensure that loss of material does not take place during transportation. Transport barges or vessels should be equipped with automatic self-monitoring devices as specified by the DEP.	Contractor	Project Area	Construction	Practice Note for Professional Persons with regard to site drainage (ProPECC PN 1/94) and WQO
Ecology					
8.9.2	**During Construction** Major potential impacts on ecology during the construction phase include habitat loss and disturbances to wildlife. These impacts were assessed in section 8.8. The following specific mitigation measures to minimise impacts and disturbance to the surrounding habitats, are recommended.				

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
8.9.20-8.9.21	*Clear Definition of Site Limit* Clear definition of the site limit should be provided in order to minimize and confine the disturbance during the construction period, especially the northern limit of the Site which is adjacent to fishponds within the Conservation Area (CA) zone and are considered to be ecological sensitive receivers. During wetland construction stage the WRA boundary will be delineated using a temporary hoarding in order to reduce disturbance to off-site habitats and wildlife. During the establishment phase this hoarding will be replaced with a 1 m high chain-link fence in order to reduce disturbance to the WRA through access by humans and dogs, and a hoarding will be established around the residential construction site.	Contractor	Construction Work Sites	During Construction	EIAO
8.9.20-8.9.21	*Dust and Noise Suppression and Avoidance of Water Pollution* Good site practices of dust and noise suppression should be strictly implemented to ensure that disturbance is minimized to acceptable levels. Mitigation measures for the off-site disturbance impacts on the fishponds in the CA include hoarding at the northern site boundary during construction of the WRA to reduce noise and dust impacts to the adjacent habitats. Through the use of quieter plant and temporary/movable noise barriers, the noise level would be reduced significantly to an acceptable level. Hoarding at the northern boundary should be replaced with a 1 m high chain-link fence following construction and the WRA will then act as a buffer between the existing wetland areas and the residential part of the site until construction is completed. Hoarding will be retained between the WRA and ongoing construction work to avoid visual disturbance and reduce noise and dust emissions. Pollution of watercourses and sedimentary runoff will be minimized by good site practice, especially the containment of water and sediment within the site for removal. These standard noise and air and water quality site practices are considered to be effective measures for minimizing the disturbance impact during the construction period.	Contractor	Construction Work Sites	During Construction	EIAO and Deep Bay Guidelines (TPB PG – No.12B)

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
	Planning of Construction Schedule The construction of the proposed project should be scheduled in phases. Because mitigation is preferably carried out in advance of the main works rather than after the completion of works, the construction of the WRA will commence at the start of the project. Construction work within the WRA is scheduled to take place in a single wet season, followed by 1.5 years of wetland establishment. During the wetland establishment period no noisy work will be undertaken within the WRA to minimize the disturbance to off-site habitats and wildlife.	Contractor	Construction Work Sites	During Construction	EIAO and Deep Bay Guidelines (TPB PG – No.12B)
	Reusing Onsite Materials Soil and plants on-site should be reused (e.g. used as fill material) as far as practical. Stock piles of these reusable materials should be stored in an appropriate area on-site. In particular, the re-use of the wetland soils and topsoil should be considered.	Contractor	Construction Work Sites	During Construction	Waste Disposal Ordinance (Cap.354); Waste Disposal (Chemical Wastes) (General) Regulation (Cap 354) and ETWBTC No. 15/2003, Waste Management on Construction Site
	Construction of the Wetland Restoration Area The WRA will be operational within 2.5 yrs from the commencement of construction (1 year for site formation and1.5 years for establishment) and will compensate for the predicted ecological impacts of the proposed development.	Contractor to construct and Wetland Manager to manage	The defined area for the proposed Wetland Restoration Area	During construction phase prior to the construction of the residential area	EIAO and the proposed Wetland Restoration Plan (WRP)
8.9.3	During Operation The major impact would be the habitat change resulting from the proposed project and disturbance from the proposed residential area.				
	Operational Phase Operational impacts include disturbance to wildlife and loss of habitat. Species that potentially receive significant impacts from the proposed development are Little Egret, Cattle Egret and Chinese Pond Heron.	Contractor to construct and Wetland Manager to manage	The defined area for the proposed Wetland Restoration Area	During construction phase prior to the construction of the residential area	EIAO and the proposed Wetland Restoration Plan (WRP)
	The recommended mitigation measure to reduce/eliminate the impacts on these species is the provision of the WRA. The location of the WRA at the northern portion of the Site is selected to minimise impacts on bird flight paths, to buffer the existing wetland areas from the proposed residential areas and to enhance integration with existing wetland habitats outside the Project Area.				
	Protect the Offsite Fishpond Habitats & Perform Buffer Function These objectives can best be achieved by locating the WRA between the WCA/CA and residential areas to separate the two types of land use. In addition, the area of the existing lorry park site will be incorporated into the WRA to further enhance the buffer function.				

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
	Provide Suitable Habitats of Enhanced Quality for the Target Species The Wetland Restoration Area of a minimum size of 4.74 ha will be established, to mitigate the loss of 4.69 ha of wetland habitats. In addition to the habitat loss, the WRA is designed to mitigate for on-site and/or off-site disturbance during construction and operational phases as identified in Section 8.8 of the final EIA report. The habitats in the WRA will be designed specifically to meet the habitat requirements of the target species rather than simply restore specific habitats of ecological value.	Contractor to construct and Wetland Manager to manage	The defined area for the proposed Wetland Restoration Area	During construction phase prior to the construction of the residential area	EIAO and the proposed Wetland Restoration Plan (WRP)
	The following micro-habitats will be provided within the wetland restoration area to meet the requirements for the target species: • Open water up to 2.5 m in depth with shallow water margins (0-20 cm depth); • reedbed with shallow water margins (0-20 cm depth) and deeper water areas up (to 1 m depth); • vegetated and non-vegetated islands and shallow water margins (0-20 cm depth); • trees/tall shrubs overhanging parts of the main water body; • short grass; and • a mixture of tall grass and shrubs.				
	Building Height with Consideration of Bird Flight Path Under the OZP for the area (OZP No. S/YL-MP/6) the maximum permitted height for buildings within the Project Area is six storeys. This is considerably higher than the buildings at Palm Springs and Royal Palms residential estates, and would potentially impact the flight paths of birds over the Project Area. To minimise such impacts the maximum height of buildings within the Project Area will be four storeys; such buildings will be generally three metres higher than existing buildings in adjacent residential estates. Furthermore, the development has been zoned in such a way that the WRA is located adjacent to surrounding wetlands, and the lowest buildings on site will be those closest to the WRA. This part of the site is the most likely to be used by low-flying birds, and the reduction in building height will minimise potential impacts to flight paths. There will be some residual impact to flight paths in the northern part of the Project Area during the construction phase of the WRA, resulting from the presence of construction machinery and from site fencing (required to avoid visual disturbance impacts to foraging waterbirds) and potentially also from noise disturbance. These impacts will be limited in duration to the construction period of the WRA (scheduled to take place in a single wet season), and the timing of the WRA formation at the start of the construction period will ensure that the duration of these construction-phase impacts to flight paths will be minimised	Developer	The defined area for the proposed Wetland Restoration Area	During planning stage	Mai Po and Fairview Park OZP No. S/YL-MP/6

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
Fisheries					
9.7	With good site practices and implementation of dust and water quality control measures addressed in S.3.6 and S.5.6 of this EIA report (including site confinement with scaffolding erection around the perimeter of the construction site, covering of stockpile by impervious sheeting to avoid spread of dusty materials and proper storage and disposal of chemical waste to avoid discharge to the existing water system, etc.), the dust and water quality impacts on the adjacent fishponds are expected be controlled to within acceptable levels, which will also protect the fisheries resources from being impacted. The moderate-low impacts for the event of high dose chemical waste pollution would also be avoided by the proper handling and disposal of chemical waste released from mechanical equipment during construction phase. All indirect off-site impacts on pond culture activities are expected to be insignificant. Thus, no specific mitigation measure for fisheries impacts is required during the construction and operation phases.	Contractor	Construction Work Sites	During Construction	EIAO
Cultural Heritage					
10.5	As no impacts on recorded archaeological sites or area with archaeological potential were identified within the Study Area, no mitigation measure for archaeological resources is considered necessary. The assessment results showed that neither declared / deemed monuments nor graded historical buildings were located within the study area. No impact on cultural heritage elements was anticipated and no associated mitigation measures therefore were considered necessary.				
Landscape & Visual Impact					
11.6	Overall, it is considered that, in the terms of Annex 10 of the EIAO-TM, the landscape and visual impacts are acceptable with the mitigation measures outlined below. **During Construction** Mitigation measures will comprise the following:				
Table 11-3	CM1- The construction area and contractor's temporary works areas should be minimised to avoid impacts on adjacent landscape.	Developer via Contractor	Construction Work Sites	During Construction	EIAO
	CM2 - Screening of construction works by hoarding / noise barriers.	Developer via Contractor	Construction Work Sites	During Construction	EIAO
	CM3 - Reduction of construction period to practical minimum.	Developer via Contractor	Construction Work Sites	During Construction	EIAO
	CM4 - Topsoil, where identified, should be stripped and stored for re-use in the construction of the soft landscape works, where the soil material meets acceptable criteria and where practical. The Contract Specification shall include storage and reuse of topsoil as appropriate.	Developer via Contractor	Construction Work Sites	During Construction	EIAO

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
	CM5 - Hydroseeding or sheeting of soil stockpiles with visually unobtrusive material (in earth tone).	Developer via Contractor	Construction Work Sites	During Construction	EIAO
	CM6 – Advance screen planting of noise barriers	Developer via Contractor	Construction Work Sites	During Construction	EIAO
	CM7 - Control night-time lighting and glare by hooding all lights.	Developer via Contractor	Construction Work Sites	During Construction	EIAO
	CM8 - Ensure no run-off into streams adjacent to the Project Area.	Developer via Contractor	Construction Work Sites	During Construction	EIAO
	CM9 - Protection of existing trees on boundary of site shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this specification, the Contractor shall be required to submit, for approval, a detailed working method statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas. (Tree protection measures will be detailed at S16 and Tree Removal Application stage).	Developer via Contractor	Construction Work Sites	During Construction	EIAO
	CM10 - Trees unavoidably affected by the works shall be transplanted where practical. Trees should be transplanted straight to their destinations and not held in a nursery. A detailed Tree Transplanting Specification shall be provided in the Contract Specification, if applicable. Sufficient time for necessary tree root and crown preparation periods shall be allowed in the project programme.	Developer via Contractor	Construction Work Sites	During Construction	EIAO
	During Operation				
11.6	Mitigation measures will comprise the following:				
Table 11-4	OM1 - Compensatory Tree Planting for all felled trees shall be provided to the satisfaction of relevant Government departments. 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.	Developer / Detailed Designer	Across Project Site	Before Day 1 of Opening	EIAO & ETWBTC 3/2006
	OM2 - A continuous belt of screen planting along southern perimeter of site with fast growing tree species. At least 450 trees capable of reaching a height > 10m within 10 years should be planted. Planting of the belt of trees shall be carried out as advance works ahead of other site formation and building works.	Contractor / Developer	Southern perimeter of Project Site	Immediately on completion of Site Formation Works	EIAO
	OM3 - Maximise soft landscape and amenity water bodies in residential areas of the development. Approximately 750 trees of Heavy Standard size should be planted. Where space permits, roadside berms should be created. Street trees should be of species that reach a mature height of no less than 15m.	Developer / Detailed Designer	Across Project Site	Before Day 1 of Opening	EIAO
	OM4 - Maximise wetland creation consistent with achieving other parameters. Minimum 4.74 ha will be provided. Implementation of the wetland shall be carried out as advance works.	Developer	Wetland areas, other than wetland purely for visual amenity.	Before Day 1 of Opening	EIAO
	OM5 - Use appropriate (visually unobtrusive and non-reflective) building materials and colours in built structures.	Developer / Detailed Designer	Across Project Site	Before Day 1 of Opening	EIAO

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve?
	OM6 - During detailed design, refine building layout to create a min 10m wider gap between buildings at Wo Shang Wai pond and also two min 10m wide gaps in the row of buildings adjacent to Royal Palms.	Developer / Detailed Designer	Across Project Site	Before Day 1 of Opening	EIAO
	OM7 - Streetscape elements (e.g. paving, signage, street furniture, lighting etc.) shall be sensitively designed in a manner that responds to the rural context. Lighting units should be directional and minimise unnecessary light spill.	Developer / Detailed Designer	Across Project Site	Before Day 1 of Opening	EIAO

16 SUMMARY AND CONCLUSIONS

PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6).

16.1 Summary

16.1.1 The overall conclusion of the EIA is that the comprehensive residential development with wetland restoration at Wo Shang Wai offers an exciting opportunity to provide the required enhancement to the area, which is implicitly required under the statutory outline zoning plan. The proposed Project has also been developed taking cognizance of the conclusions of the "Study on Ecological Value of Fishponds in Deep Bay Area". Specifically the creation of wetland within the Project Area, yet screened from the residential developments, has been carefully planned and designed and will not only provide mitigation for the ecological losses due to development of the existing site but will also enhance the ecological function of the local area.

16.1.2 Through the planning and environmental studies which underpin this Environmental Impact Assessment (EIA) the Project, it will create a harmonious blend of high quality residential development with the associated wetland restoration.

16.2 Conclusions

16.2.1 The conclusions of the technical assessments are described below.

Air Quality

16.2.2 During the construction phase, fugitive dusts may be generated on-site. It is envisaged that with the implementation of appropriate on-site environmental management measures, this will not present any adverse impacts to the surroundings or nearby sensitive receivers. During operational phase, no adverse impact is anticipated, especially as there will be no on-site sewage treatment plant and therefore no source of malodour.

Noise Impact

16.2.3 During the construction phase, noise sensitive receivers include the adjacent residential developments and also birds using the nearby Conservation Area (CA), fishponds and feeding grounds. The restrictions on noise and disturbance to the CA and its inhabitants have been taken into consideration when designing the construction programme, and the assessment of noise impacts. The assessments have demonstrated that with careful planning of the works and the adoption of standard mitigation measures, the required noise standards can be achieved throughout the year. Following construction, the potential impacts of the increased vehicular traffic using the San Tin Highway were assessed in terms of the impacts on residents at Wo Shang Wai. The results have confirmed that there will be full compliance with the road traffic and fixed noise source standards following the construction of the development project.

Water Quality Impact

16.2.4 The “no net increase” in pollution load of Deep Bay is a constraint on development at this site. However with proper phasing of the implementation programme to tie in with the commissioning of the public sewer along Castle Peak Road, it is anticipated that this Project will not cause net increase in pollution load to Deep Bay. Water quality impacts during the construction phase will be controlled through the implementation of good site practice. Once operational, the water on-site in the restored wetland will be managed through a Management Plan with appropriate monitoring. The provision of appropriate site drainage including soft landscaping and measures to prevent incursion of surface runoff from roads into the restored wetland will further protect the water quality.

Sewerage and Sewage Treatment Implications

16.2.5 Confirmation has been received from both the Environmental Protection Department and Drainage Services Department in respect of discharging the domestic effluent into the planned trunk sewer along Castle Peak Road. Therefore, the sewage generated from the development will be collected through the internal sewerage network and then discharged to this planned trunk sewer. There is therefore no ‘net’ discharge from site.

Waste Management

16.2.6 This Project will generate general construction and municipal wastes in the early stages of its construction. Provided good site management practices are adopted, it is not anticipated that there will be any adverse waste management issues associated with the residential development.

16.2.7 For bulk excavation at the wetland restoration area, no contaminated material will be excavated. Upon finalisation of the detailed design, the findings of the investigations should be presented in a Contamination Assessment Report (CAR) and the final remediation options should be presented in a Remediation Assessment Plan (RAP).

16.2.8 For bulk excavation at the wetland restoration area, around 2,140 m^3 of Category M and Category H sediment will be excavated and disposed of or reused within the Project Area. If disposal at sea is adopted, a Sediment Quality Report will be prepared and submitted to the Authorities for approval. If reuse is to be adopted, the specific arrangements will be developed as part of the detailed design when a Contamination Assessment Report (CAR) and Remediation Assessment Plan (RAP) are prepared and submitted to the Authorities for approval.

Ecological Impact Assessment

16.2.9 The ecological impact assessment has been based upon baseline survey data collected between April 2005 and June 2006, and supplemented with published data where appropriate. The dominant habitat within the Project Area has been found to be grassland derived from vegetative succession on land created by filling of fishponds during the early 1990s. Due to variation in topography, small areas (totally 0.69 ha) within the grassland hold water seasonally and function as seasonal marsh. A larger area (4.00 ha) holds water permanently and has evolved into a freshwater marsh habitat. The dominant plant species present is *Phragmites*, although vegetation management has prevented this from fully maturing into reedbed habitat. Faunal surveys recorded wetland-dependent species present within the seasonal marsh and freshwater marsh/reedbed habitats present in the Project Area.

16.2.10 Development of the Project Area would result in loss of 4.69 ha of wetland habitats (0.69 ha of seasonal marsh and 4.00 ha of freshwater marsh/reedbed) close to the Deep Bay wetland ecosystems. This would have potential impacts through loss of habitat for local fauna, especially foraging egrets (including birds breeding in local egretries). This habitat loss would be mitigated by the creation of a Wetland Restoration Area (WRA) of 4.74 ha to the north of the Project Area, adjacent to existing wetland habitats. Details of habitat creation and management in the WRA are described in the Wetland Restoration Plan. Creation of the WRA would result in no-net-loss in wetland within the Project Area and would allow for management of wetland habitats within the Project Area as well as integration of these with existing wetland habitats nearby. The loss of open storage within the Project Area is however considered an ecological gain.

16.2.11 Other indirect impacts have been predicted to result from disturbance to waterbirds in adjacent fishpond habitats and impedance of flight paths for birds flying over the Project Area. The avoidance and minimisation of these potential impacts have been addressed by designed features at the site, including the WRA at the northern edge of the Project Area and the design and layout of buildings within the residential area. Construction of the WRA has been scheduled at the commencement of the construction period not only to reduce the duration of disturbance impacts but also to minimise the duration of temporary habitat loss within the Project Area.

16.2.12 Ecological impacts arising from the development are envisaged to be fully mitigated by the proposed mitigation measures. No significant, long-term ecological impacts should arise from the proposed development at the Project Area.

Fisheries Impact Assessment

16.2.13 For the avoidance of doubt it should be noted that there will be no infilling of fishponds as a result of this proposed development. The proposed project will have no direct impact on the pond culture activities. Indirect impacts on the existing aquaculture resources or activities as a result of water quality deterioration due to construction dust, sediment release, silt runoff and chemical waste pollution will be insignificant with good site practices and implementation of dust and water quality control measures. No direct and indirect impacts on the pond culture activities in the brackish fishponds and inactive ponds around Mai Po are anticipated during both the construction and operation phases due to the distant and separation by the existing residential development.

Cultural Heritage

16.2.14 From surveys and examination of records, it is confirmed that there are no declared or deemed monuments or graded historical buildings present in the Assessment Area. Most houses within the Mai Po Village and Wo Shang Wai Village are modern houses and their ancestral halls are located at least 100m from the development site. Fishpond features adjacent to the site are of low landscape sensitivity. No construction activities which could result in unacceptable vibrations are planned for the construction of the Project. Given the distance between the development site and the villages, there is no anticipated effect on cultural heritage resources.

Landscape and Visual Impact

16.2.15 The close proximity of dwellings at Palm Springs, Royal Palms, and Wo Shang Wai Village implies that they are the most affected visually sensitive receivers. From surveys conducted and results of the impact assessments as part of this EIA, as well as a result of the mitigation measures adopted (greening, landscape planning, similar built height, building setback and landscape buffer etc.), it can be concluded that during the operational phase, the outcome on the landscape resources would be insubstantial and that no negative residual impact would arise. Arising from the landscaping proposals there will be a net gain in the number of trees planted, in addition to the provision of around 4.74 hectares of restored wetland and associated planting. The residual visual impacts during the operational phase on almost all receivers will be insubstantial, the development will for the most part be screened by a belt of trees. The Project Proponent will continue the CPI program through the planning application stage and the construction stage to ensure the harmonious implementation relationship with the surrounding communities.

PLATES

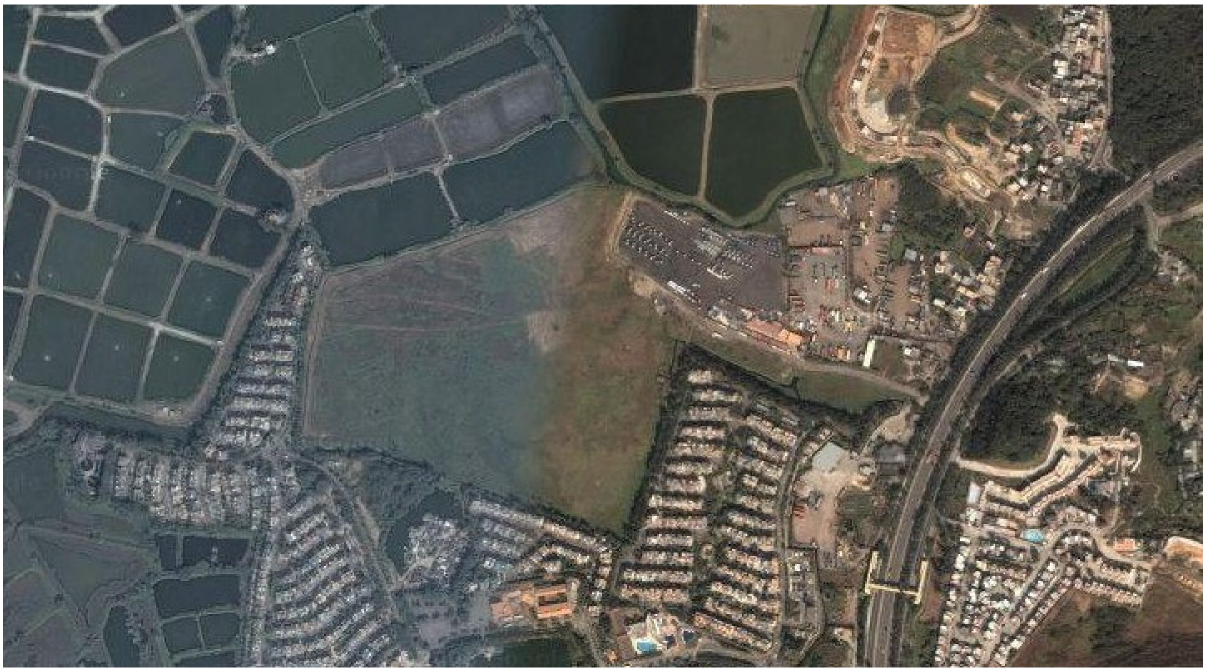

Plate 1.1 Aerial Photo Showing the Proposed Development and the adjacent Environment

Plate 8.1 Grassland

Plate 8.2 Seasonal Marsh

Plate 8.3 Freshwater Marsh/Reedbed

Plate 8.4 Active Fishpond

Plate 8.5 Abandoned Fishpond

Plate 8.6 Drainage Channel/ Ditch

Plate 8.7 Secondary Woodland

Plate 8.8 Plantation

Plate 8.9 Active Dry Agricultural Land

Plate 8.10 Inactive Dry Agricultural Land

Plate 8.11 Wasteland

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Plate 8.13 Developed Area

Plate 9.1 Fishpond in maintenance stage (not in the Project Area, refer to Figure 9.1 for location)

Plate 9.2 Abandoned fishpond with reeds growing (refer to Figure 9.1 for location)

Plate 9.3 Recreational fishing ground at Wo Shang Wai Village

Plate 9.4 Wetland dependent birds foraging in partially drained fishpond

Plate 9.5 Release of fish fingerlings into fishpond after maintenance

Plate 9.6 Capturing freshwater shrimps and Mosquito Fish in the fishpond

Plate 9.7 **Mosquito Fish captured in the fishponds**

Plate 9.8 Brackish fishponds in Mai Po

Plate 9.9 Brackish fish cultured in Mai Po fishponds

Plate 10.1 Ancestral Hall (Hin Hing Tong) in Mai Po Village

Plate 10.2 Ancestral Hall in Wo Shang Wai Village

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long

Environmental Impact Assessment

Figures

(Volume 2 of 3)

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Mott Connell Ltd
7th Floor, West Wing Office Building
New World Centre
20 Salisbury Road
Tsim Sha Tsui, Kowloon
Hong Kong

Tel: 2828 5757

Fax: 2827 1823

Anne.Kerr@mottconnell.com.hk

in association with

Urbis Limited
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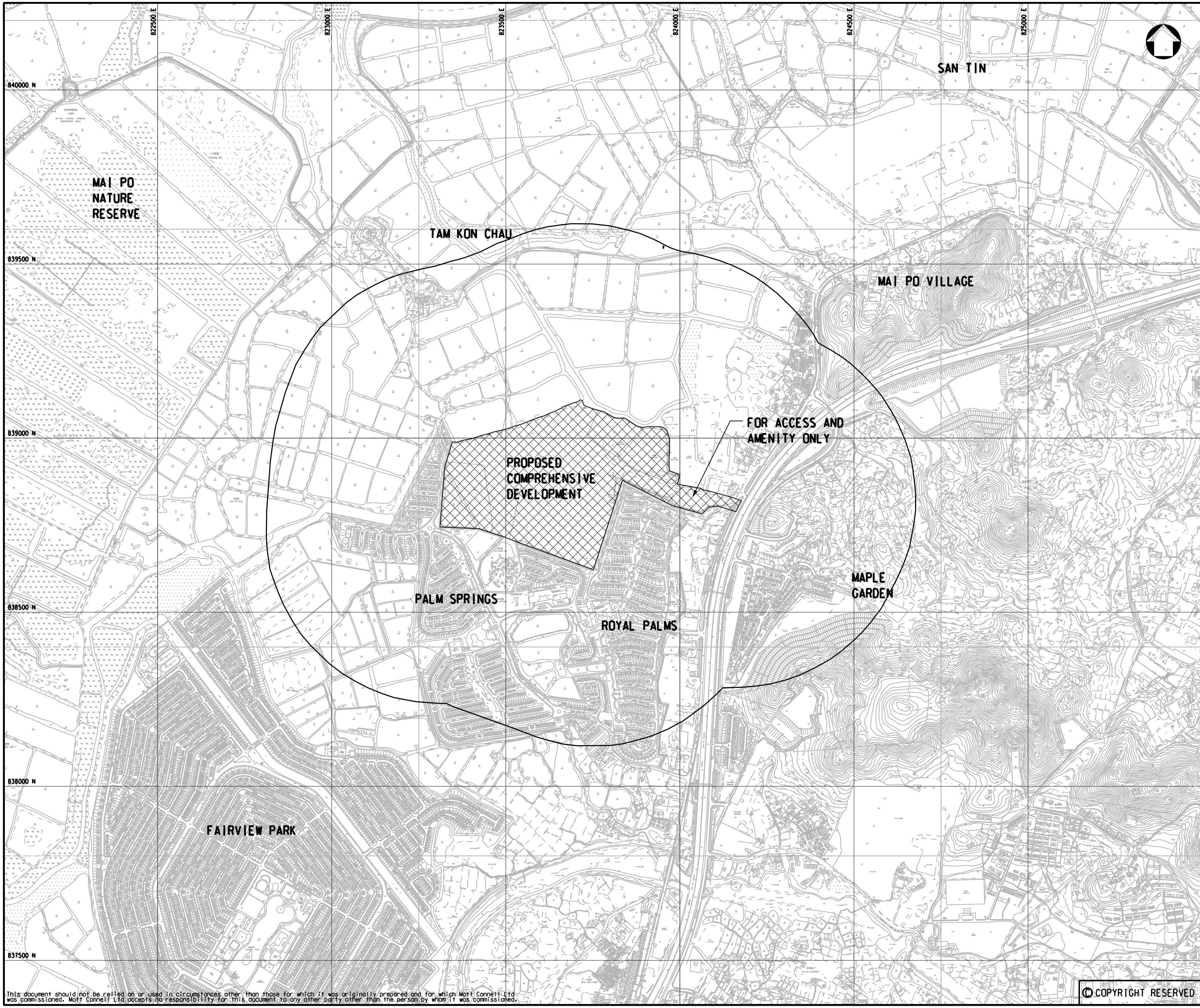

LEGENDS:

ASSESSMENT AREA (500m FROM PROJECT AREA AND SITE OF CONSERVATION CONCERN)

PROPOSED COMPREHENSIVE DEVELOPMENT

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Mott Connell 萬隆
Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

Client

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Project

PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

LOCATIONS AND ASSESSMENT AREA OF THE PROPOSED DEVELOPMENT SITE

Designed	PW	Eng.Chk.	
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Dwg.Chk.	JC	Approved	AFK
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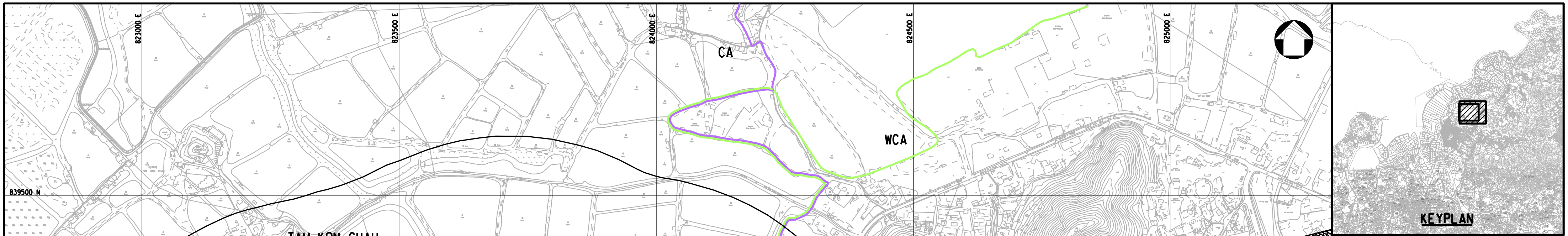

LEGEND:

- CONSERVATION AREA (CA)
- BOUNDARY OF WETLAND CONSERVATION AREA (WCA)
- EXISTING OPEN STORAGE AREA
- BOUNDARY OF ASSESSMENT AREA
- BOUNDARY OF WETLAND BUFFER AREA (WBA)

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Mott Connell 萬隆
Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

Client
PROFIT POINT ENTERPRISES LTD

Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LOCATION OF CONSERVATION AREA, WETLAND CONSERVATION AREA AND BUFFER AREA BOUNDARIES

Designed	JC	Eng.Chk.	
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Dwg.Chk.	JC	Approved	AFK
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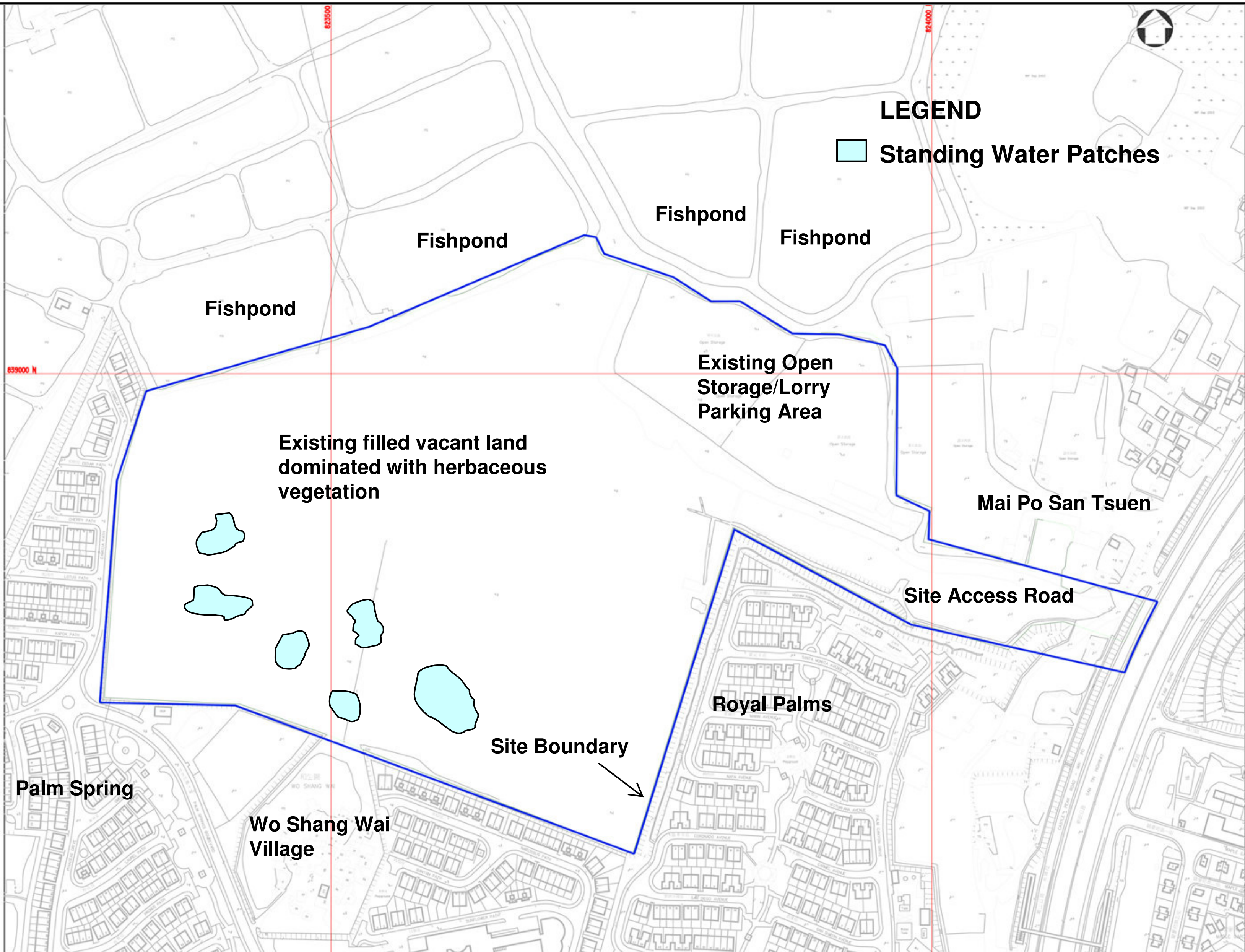
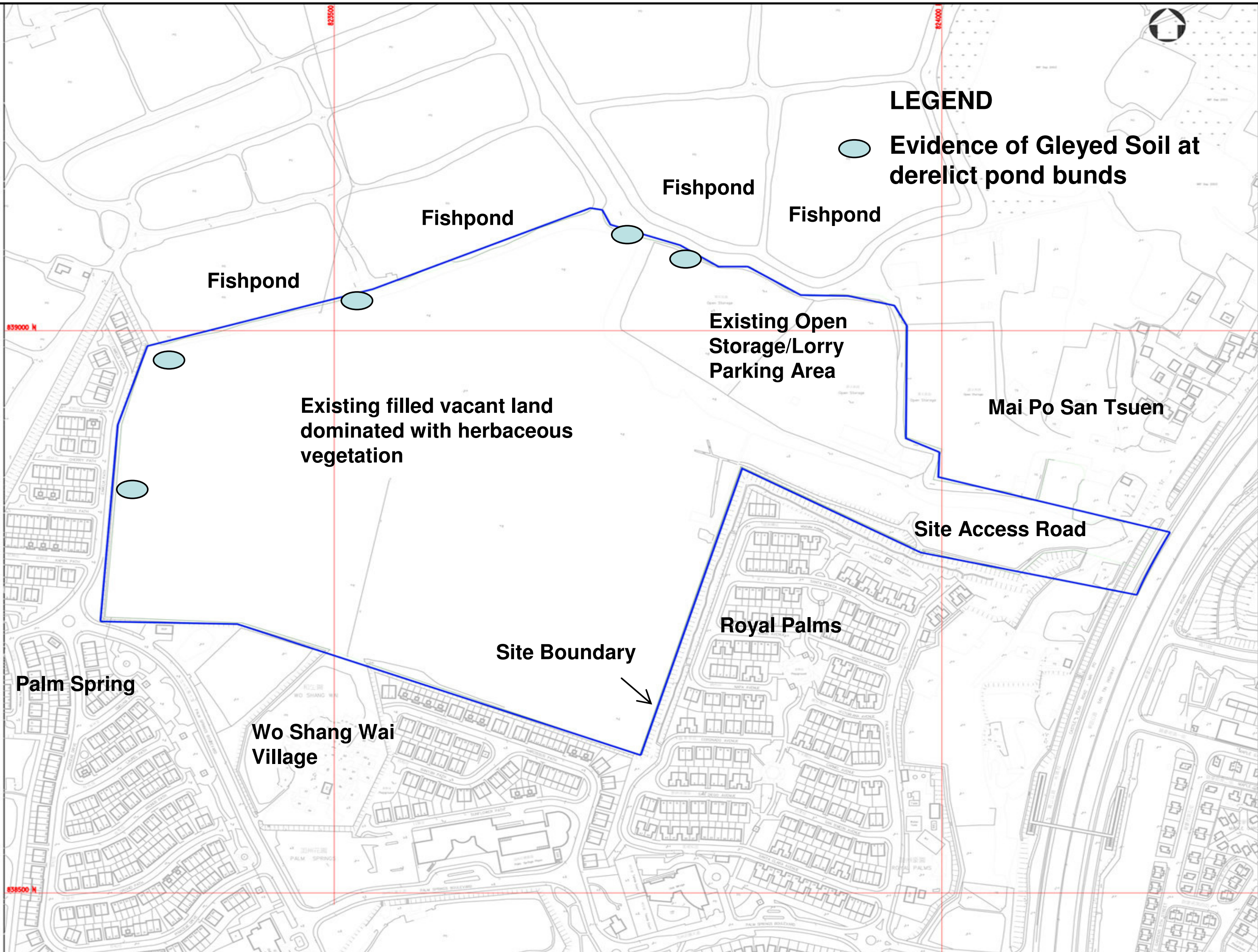


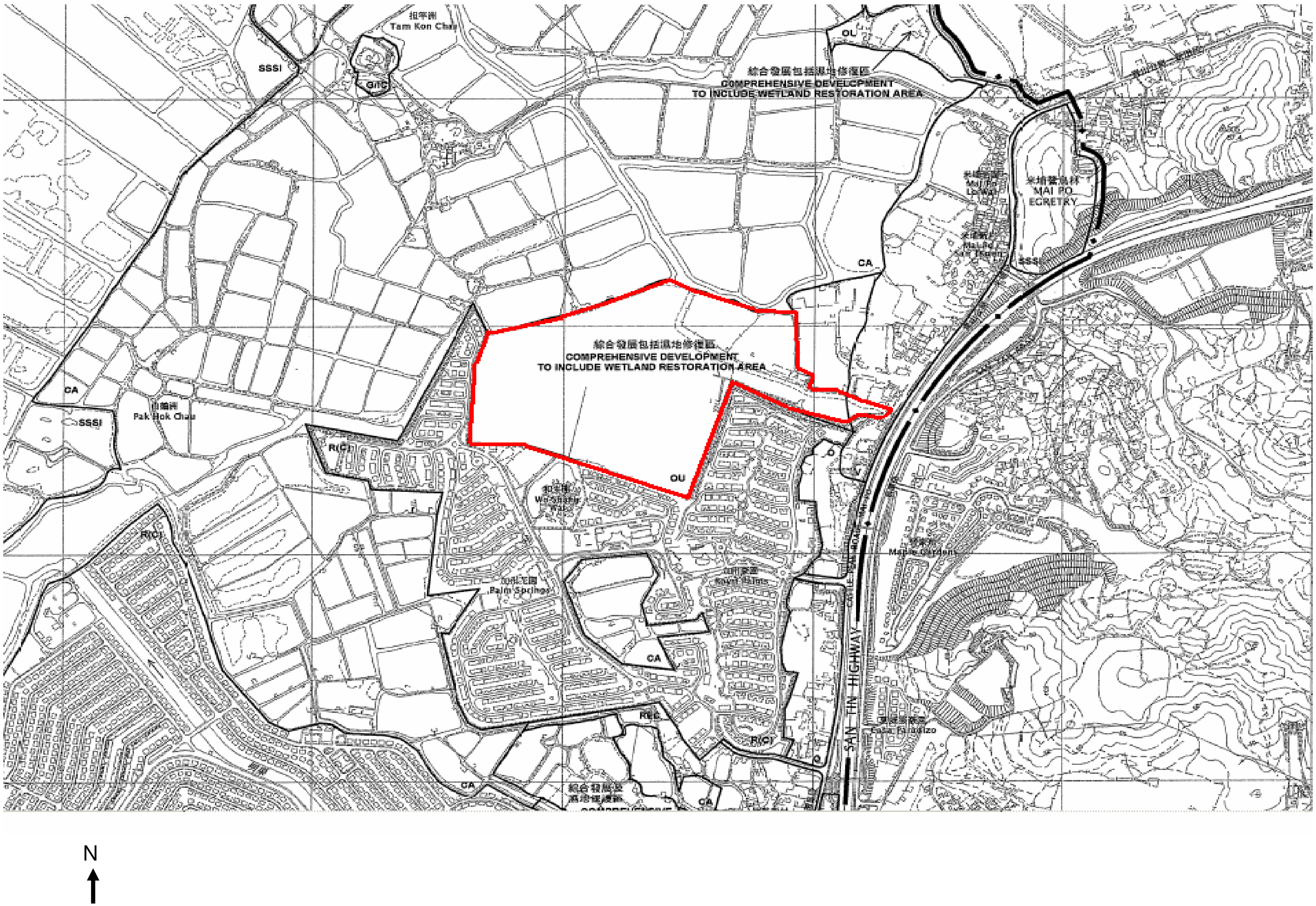
Project	Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Title	Standing Water patches Observed in Dry Season
Date	Aug,2006

Mott Connell

Figure 1.3



Project	Proposed Comprehensive Development at Wo Shang Wai, Yuen Long	Mott Connell
Title	Location of Gleyed Soil	Figure 1.4
Date Aug,2006		



LEGEND

Site area

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Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Web www.mottmac.com

Client
PROFIT POINT ENTERPRISES LTD.

Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
EXTRACT OF RELEVANT OZP

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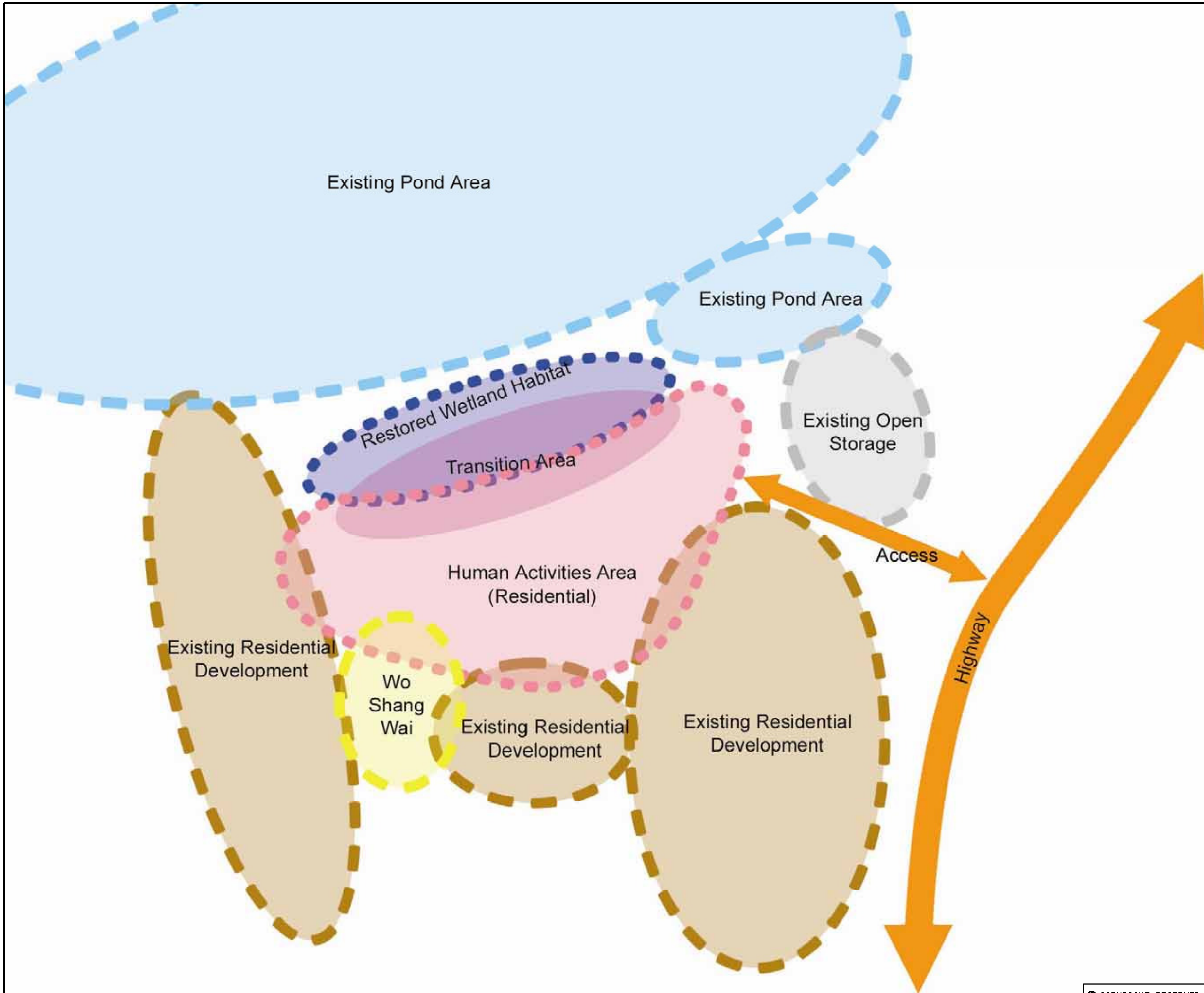

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Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
PRELIMINARY DEVELOPMENT CONCEPT

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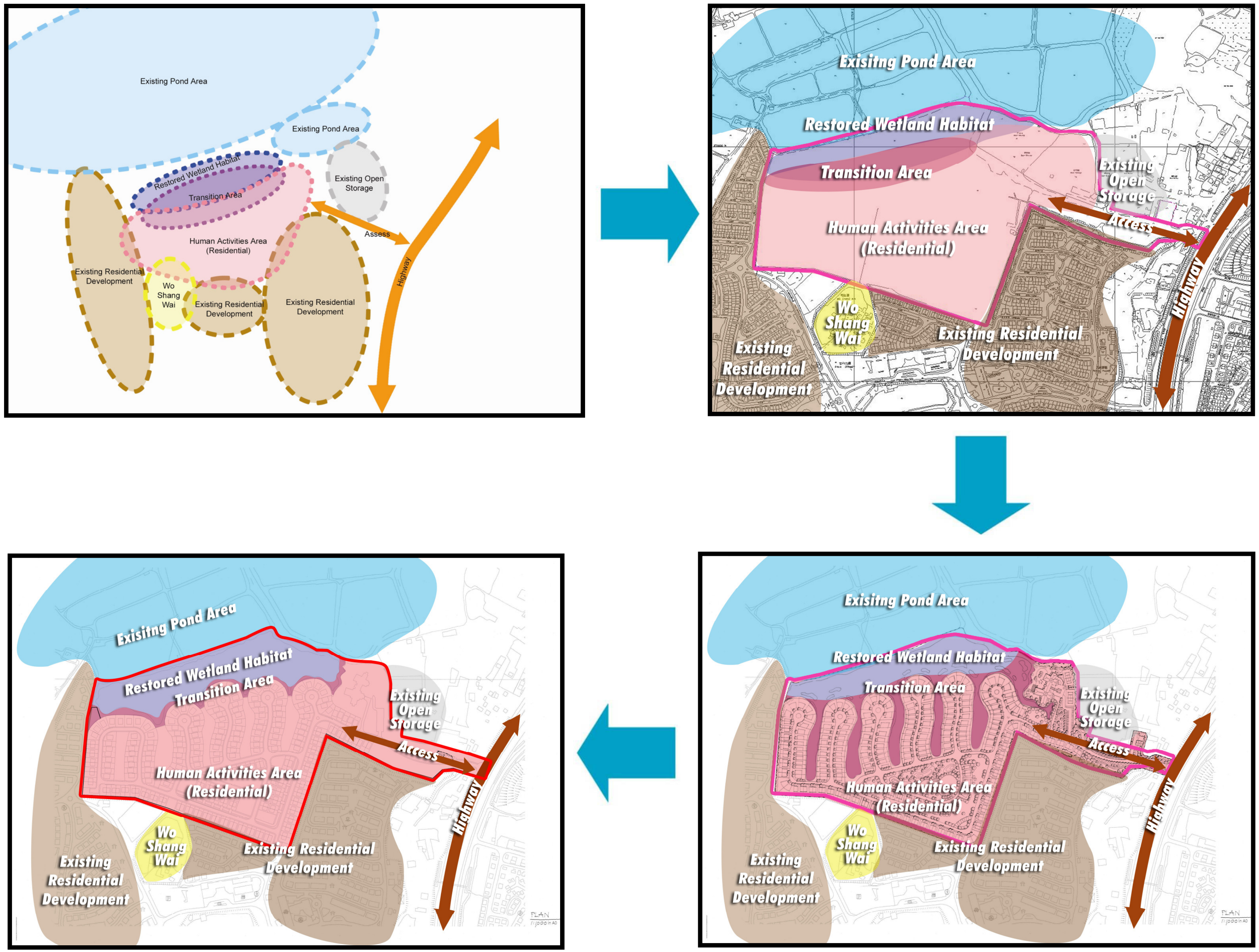

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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
GENERATION OF OPTIONS

Designed JC		Eng.Chk.	
Drawn		Coordination	
Dwg.Chk. JC		Approved AFK	
Scale NTS	Project 221005 / CAD File J:\22005\CAD_ADMIN\WCL-22005-P-Al-N.dgn		Status 2
Drawing No.	Figure 2.2		Rev

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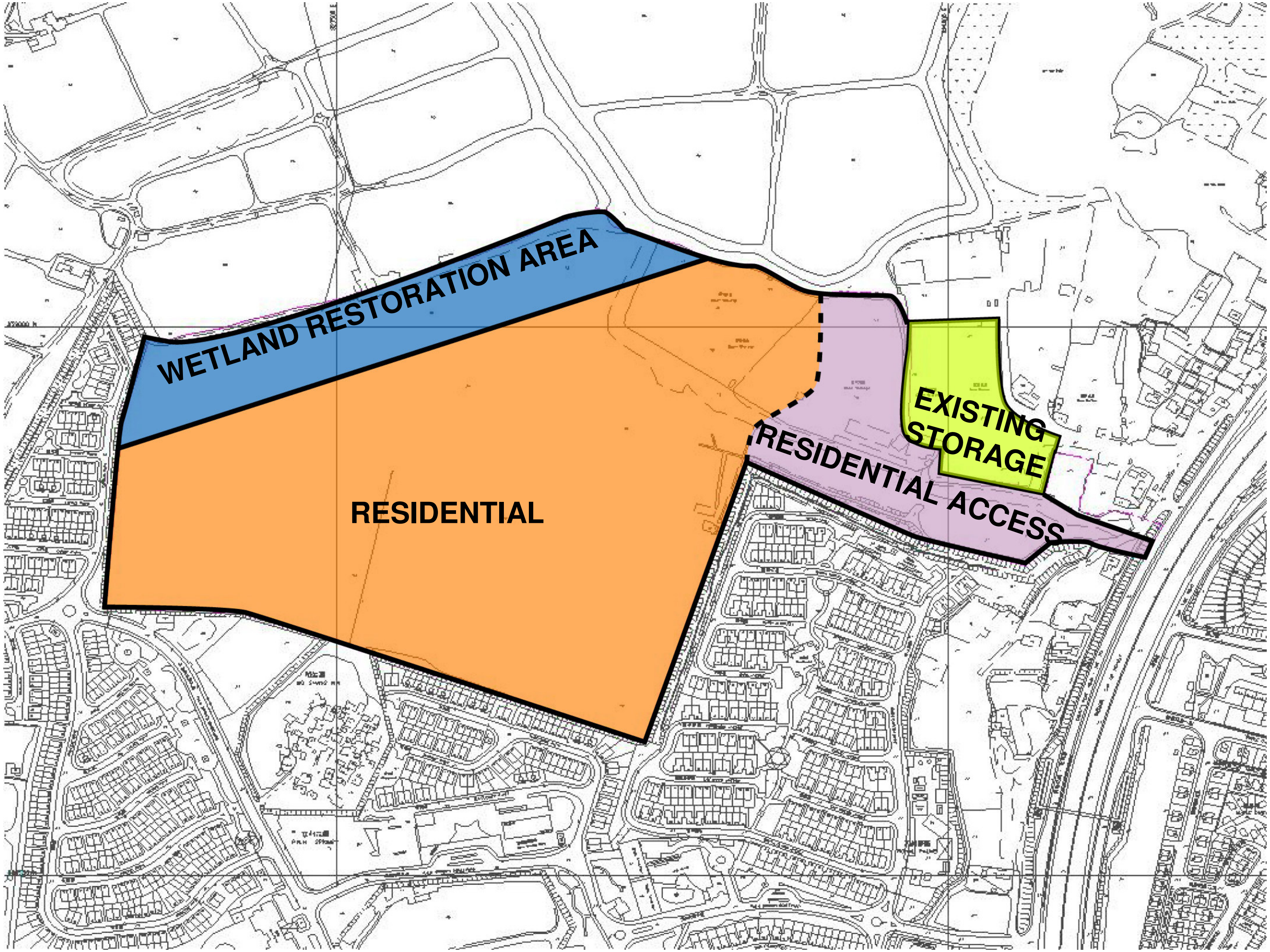
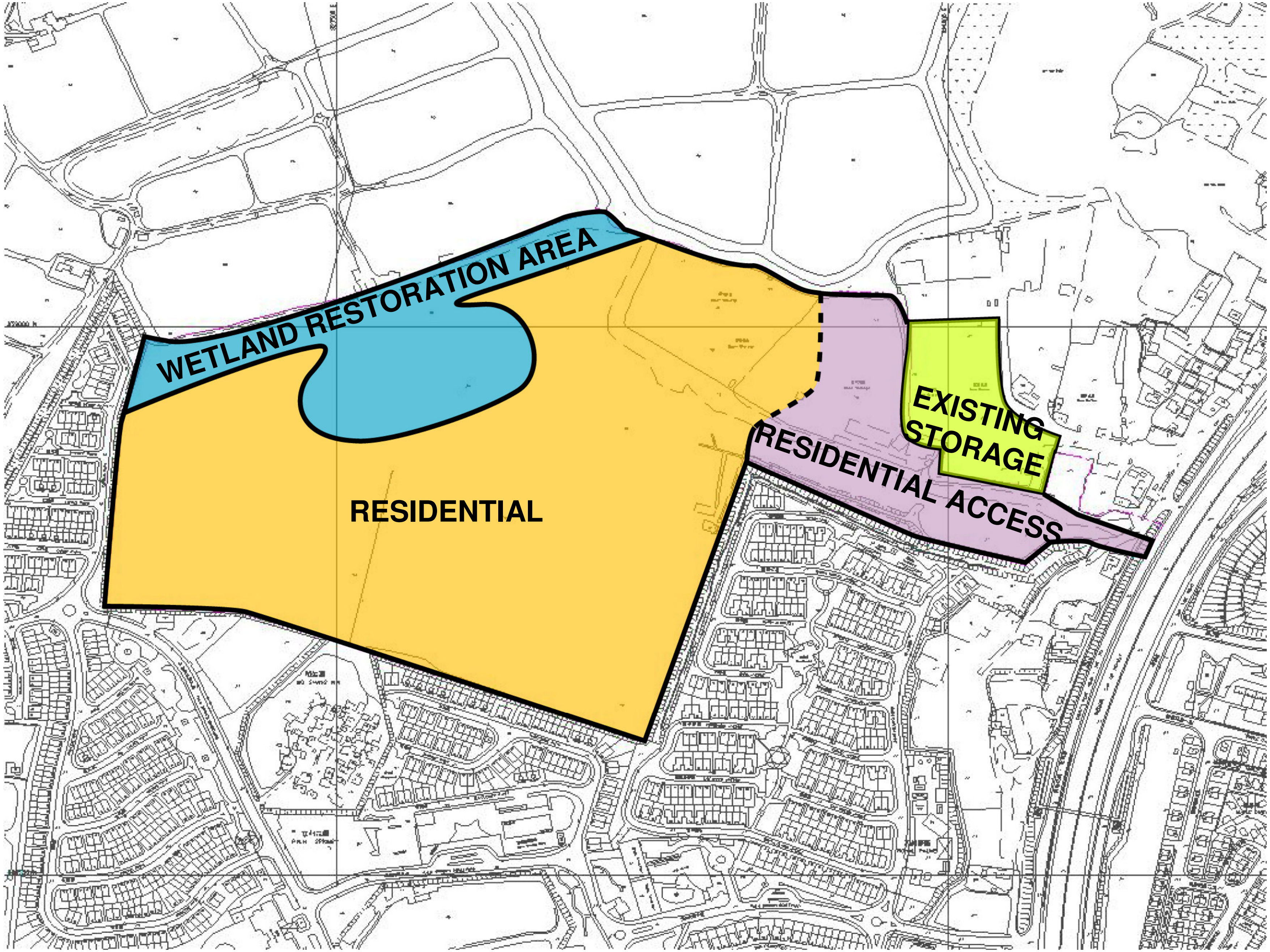


Project	Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Title	Schematic 'Rectangular' development
Date	May, 2007

Mott Connell

Figure 2.3a



Project	Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Title	Schematic 'Horse Shoe' Concept
Date	May, 2007

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Figure 2.4a

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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
CONCEPT LAYOUT NUCLEATED (HORSE SHOE) (4 STOREYS)

Designed		Eng.Chk.	
Drawn	LW	Coordination	
Dwg.Chk.	DM	Approved	DM
Scale NTS	Project 221005	CAD File	Status
Drawing No.	**Figure 2.4b**		Rev

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Project

PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

Sketch Master Layout Plan
Option A - All 2.5/3-Storey Houses

Designed		Eng.Chk.		
Drawn	LW	Coordination		
Dwg.Chk.	DM	Approved	DM	
Scale		Project 221005		Status
		CAD File		
Drawing No.	FIGURE 2.5			Rev

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
Sketch Master Layout Plan
Option B - All 6-Storey Apartments

Designed		Eng.Chk.	
Drawn	LW	Coordination	
Dwg.Chk.	DM	Approved	DM
Scale		Project 221005	Status
		CAD File	
Drawing No.		FIGURE 2.6	Rev

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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
Sketch Master Layout Plan
Option C - Mixed Height Scheme

Designed		Eng.Chk.	
Drawn	LW	Coordination	
Dwg.Chk.	DM	Approved	DM
Scale		Project	221005
		CAD File	
Drawing No.	FIGURE 2.7	Rev	

Status

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Project

PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

Sketch Master Layout Plan
Option D - 2.5/3 Storey Houses with Duplex-on-Duplex

Designed		Eng.Chk.	
Drawn	LW	Coordination	
Dwg.Chk.	DM	Approved	DM
Scale		Project: 221005	Status
		CAD File	
Drawing No.	FIGURE 2.8		Rev

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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
Sketch Master Layout Plan
Option E - 2-2.5/3 Storey Houses

Designed		Eng.Chk.	
Drawn	LW	Coordination	
Dwg.Chk.	DM	Approved	DM
Scale		Project 221005	Status
		CAD File	
Drawing No.		FIGURE 2.9	Rev

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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
Sketch Master Layout Plan
Option F - 2.5/3 Storey Houses
Duplex-on-Duplex

Designed		Eng.Chk.			
Drawn	DK	Coordination			
Dwg.Chk.	CD	Approved	CD		
Scale		Project	221005	Status	
		CAD File			
Drawing No.		FIGURE 2.10		Rev	A

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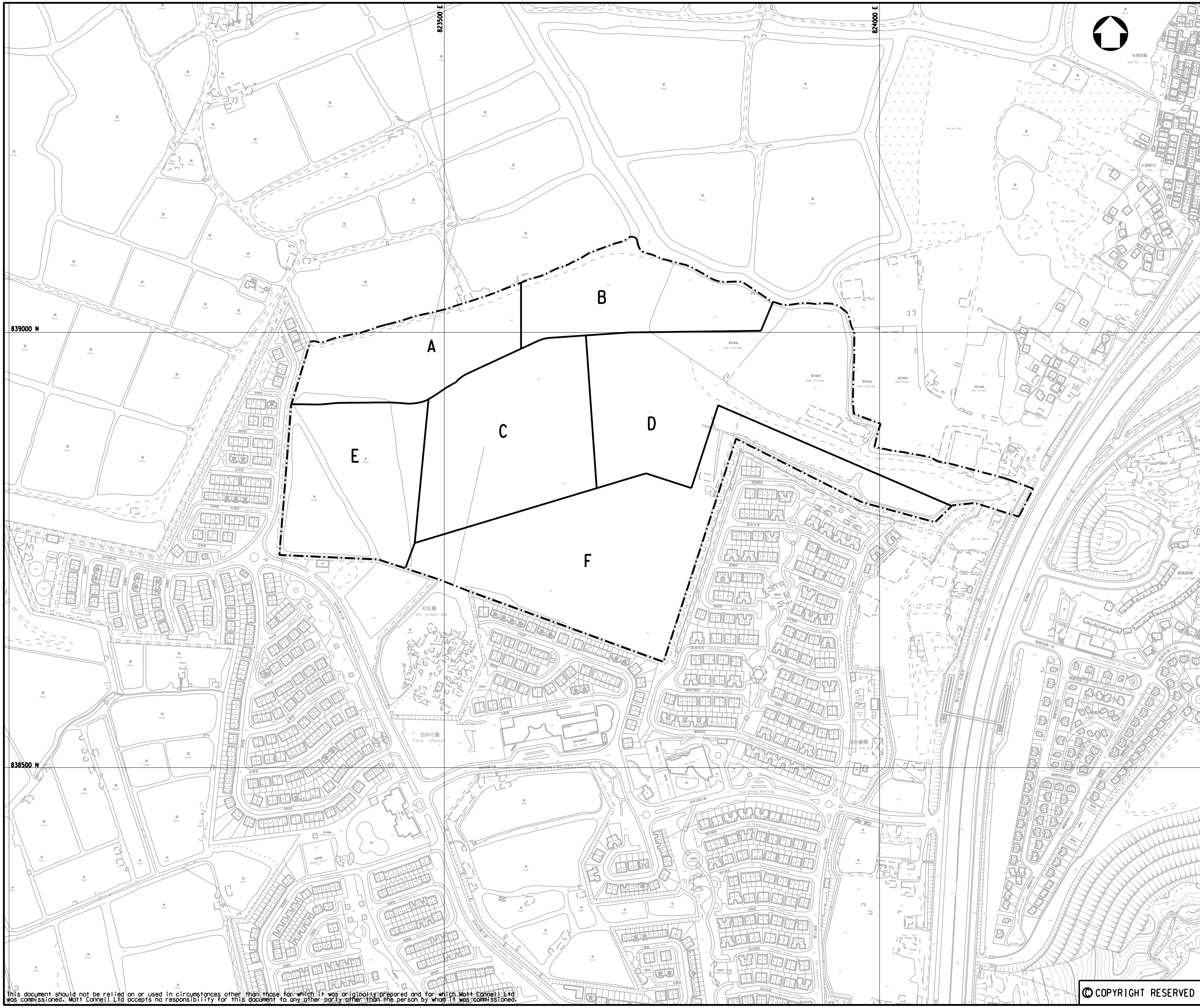

LEGEND:

A CONSTRUCTION PHASE NO.

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

PHASE LAYOUT PLAN FOR CONSTRUCTION

Designed	CWK	Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.	JC	Approved	AFK
Scale 1:4000@A3	Project 221005		Status
	CAD File j:\221005\report\env\eia_report080818\env-fig2_ll.dgn		
Drawing No.	FIGURE 2.11		Rev 4

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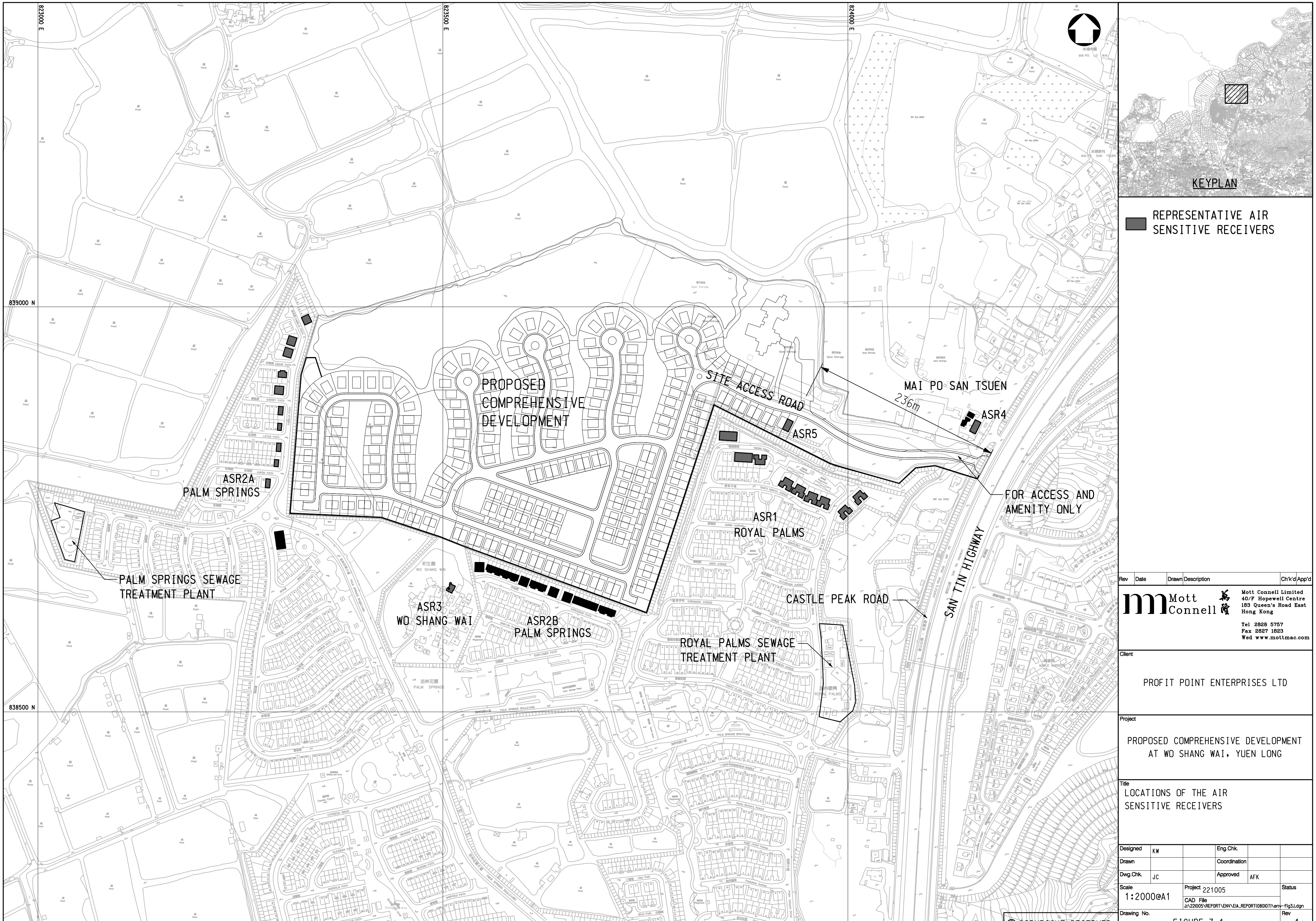

Legend: REPRESENTATIVE AIR SENSITIVE RECEIVERS

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Client
PROFIT POINT ENTERPRISES LTD

Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LOCATIONS OF THE AIR SENSITIVE RECEIVERS

Designed	KW	Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.	JC	Approved	AFK
Scale 1:2000@A1	Project 221005		Status
	CAD File J:\221005\REPORT\ENV\EIA_REPORT(080107)\env-fig3.1.dgn		
Drawing No.	FIGURE 3.1		Rev 4

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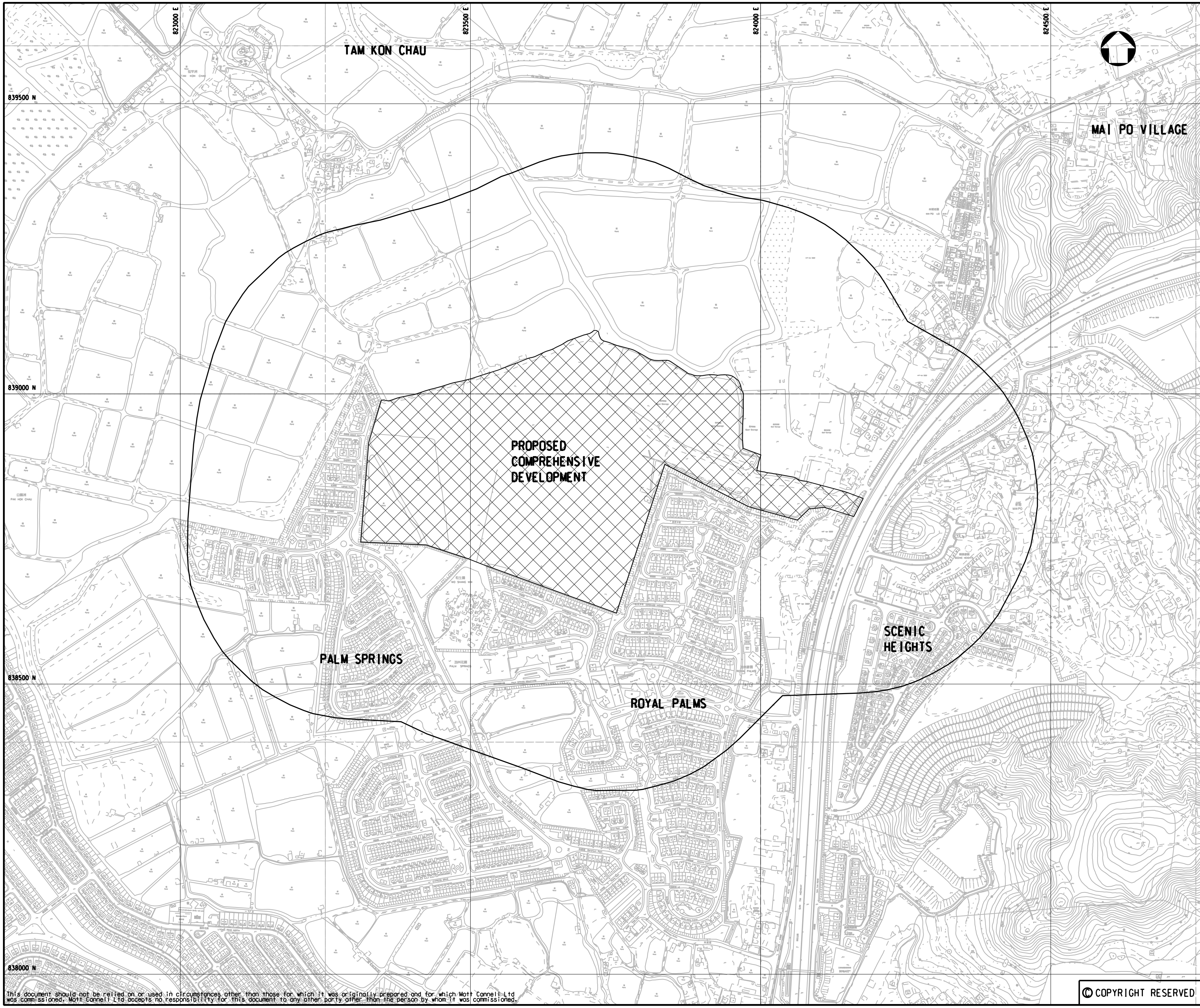

LEGENDS:

ASSESSMENT AREA (300m FROM PROJECT AREA)

PROPOSED COMPREHENSIVE DEVELOPMENT

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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
ASSESSMENT AREA OF THE PROPOSED DEVELOPMENT SITE

Designed	CWK	Eng.Chk.	
Drawn	TSG	Coordination	
Dwg.Chk.	CWK	Approved	AFK
Scale 1:6000@A3		Project	Status
		CAD File J:\221005\REPORT\ENV\EIA_REPORT(080130)\env-fig4.1.dgn	
Drawing No. FIGURE 4.1			Rev 1

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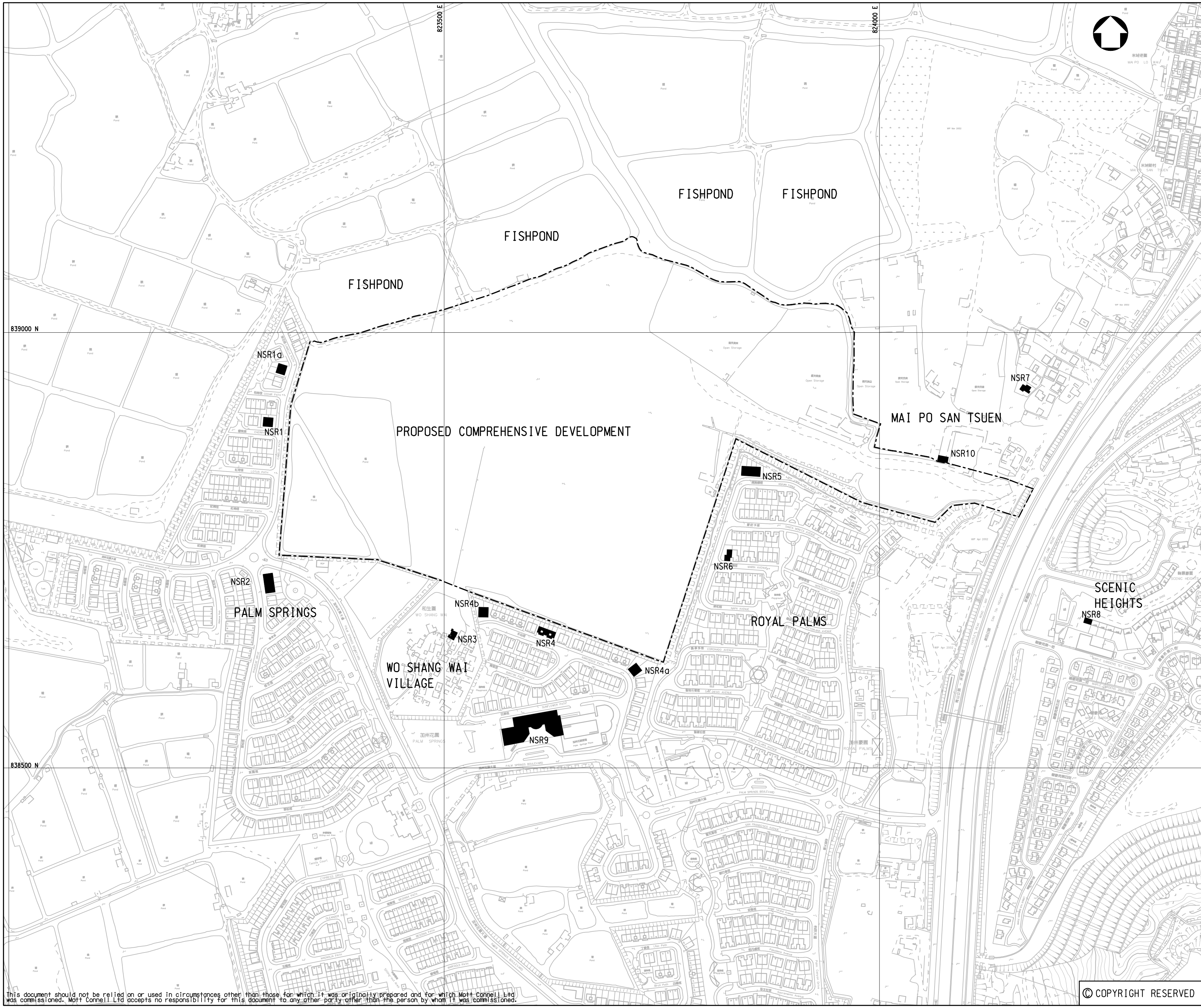

LEGEND

- - - SITE BOUNDARY

■ REPRESENTATIVE NOISE SENSITIVE RECEIVERS (NSRs) IN CONSTRUCTION PHASE

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PROFIT POINT ENTERPRISES LTD

Project

PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

LOCATION OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS (NSRs) IN CONSTRUCTION PHASE

Designed	CWK	Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.	CWK	Approved	AFK
Scale 1:4000@A3		Project 221005	Status
		CAD File J:\221005\REPORT\ENV\EIA_REPORT(080107)\env-fig4.2.dgn	
Drawing No. FIGURE 4.2			Rev 1

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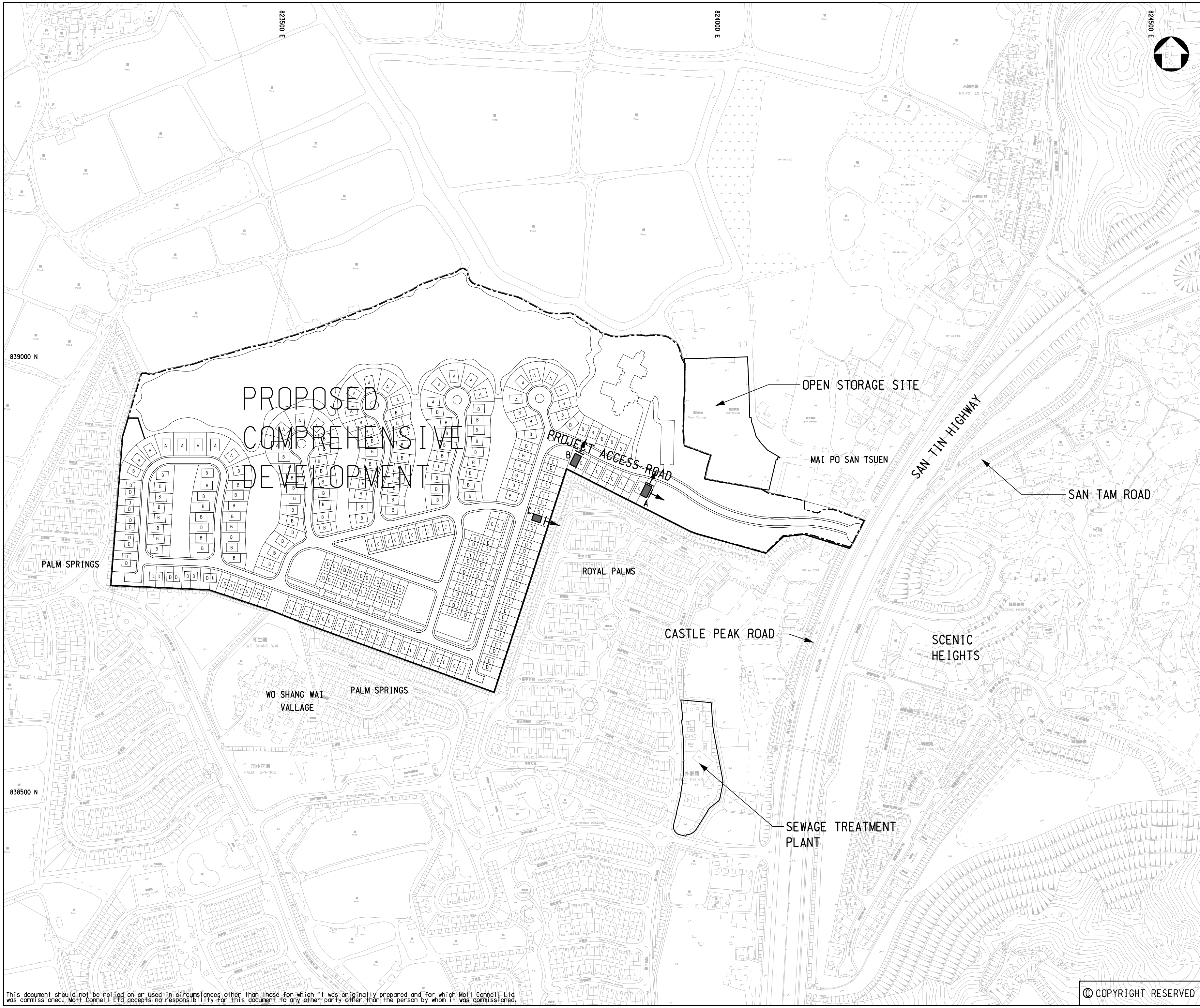

LEGEND :

A ■ REPRESENTATIVE NOISE SENSITIVE RECEIVERS IN OPERATIONAL PHASE

FACADE FACING

TYPE OF HOUSE

- A 2.5/3 STOREY HOUSE
- B 2.5/3 STOREY HOUSE
- C 2.5/3 STOREY HOUSE
- D 4 STOREY DUPLEX-ON-DUPLEX

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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LOCATIONS OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS (NSRs) IN OPERATIONAL PHASE

Designed	CWK	Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.	CWK	Approved	AFK
Scale 1:2000@A1	Project 221005		Status
	CAD File J:\221005\REPORT\ENV\EIA_REPORT(080107)\env-fig4.3.dgn		
Drawing No.	FIGURE 4.3		Rev 3

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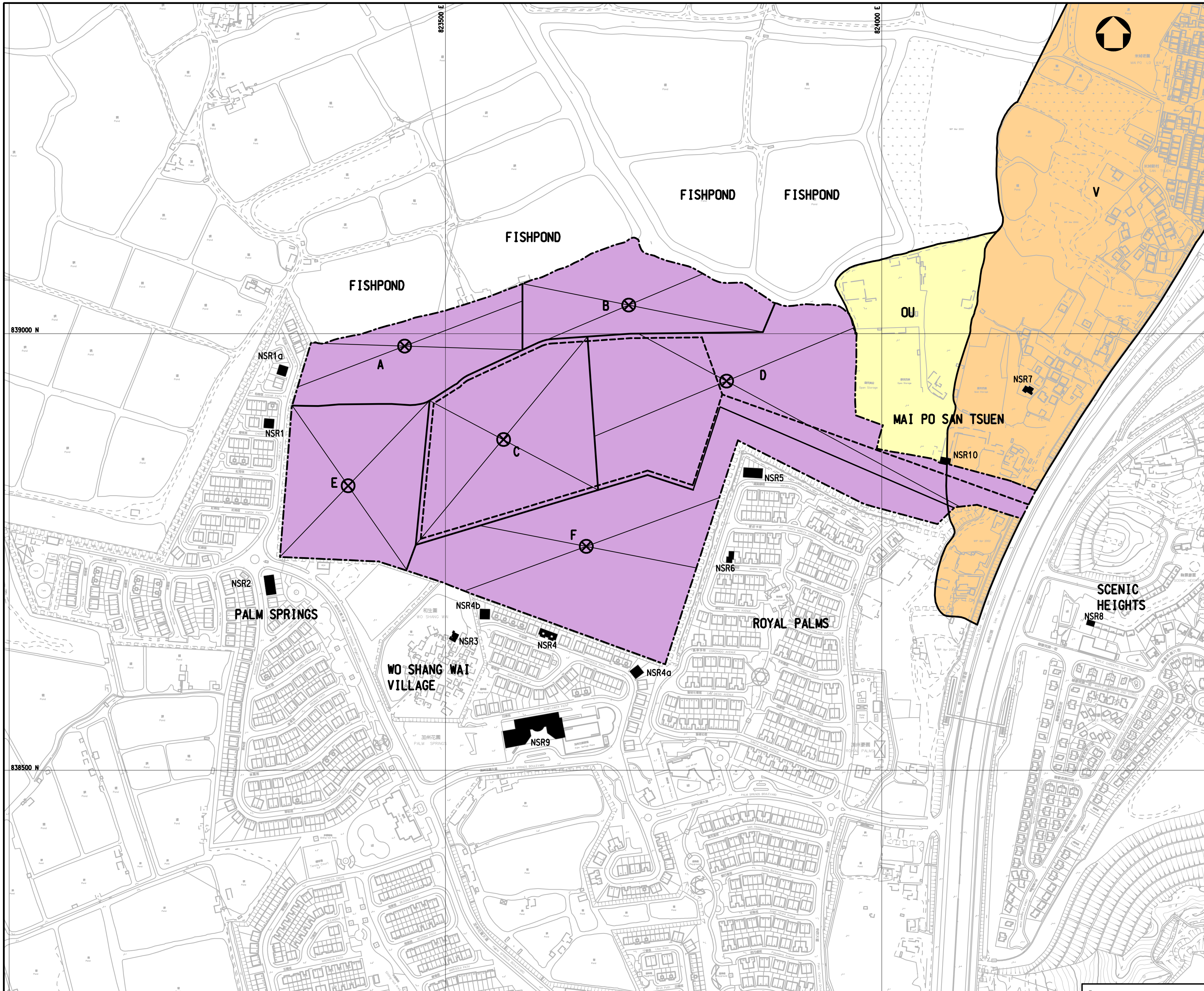

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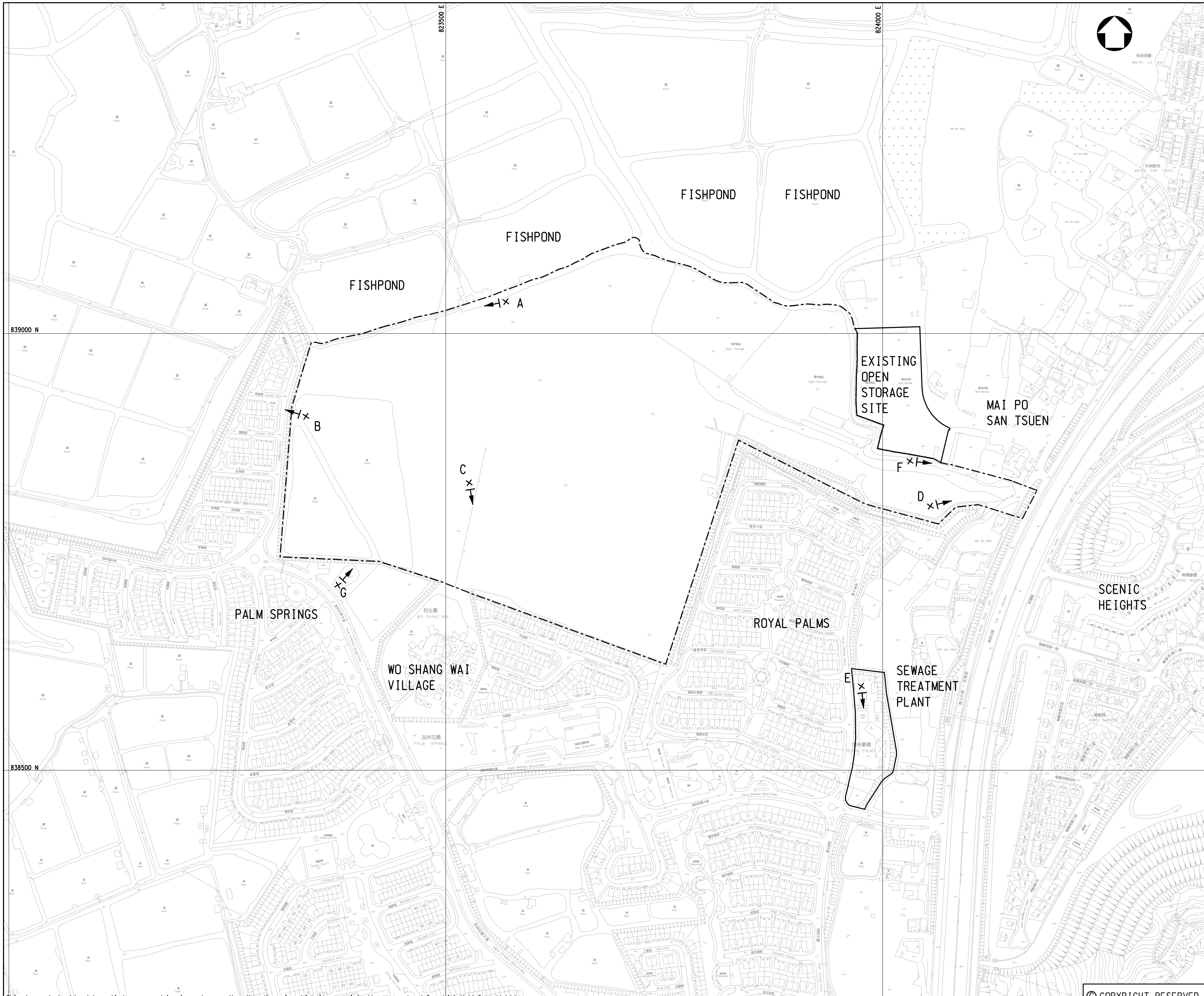
Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
ALIGNMENT OF SITE ACCESS ROAD AND HAUL ROAD

Designed	CWK	Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.	CWK	Approved	AFK
Scale 1:4000@A3		Project 221005	Status
		CAD File J:\221005\REPORT\ENV\EIA_REPORT(080107)\env-fig4.4.dgn	
Drawing No.		FIGURE 4.4	Rev 1



LEGEND

A × LOCATION OF BASELINE NOISE MEASUREMENT

POINTING DIRECTION OF SOUND LEVEL METER

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Project

PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

LOCATION OF BASELINE NOISE MEASUREMENT

Designed	CWK	Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.	CWK	Approved	AFK
Scale 1:4000@A3		Project 221005	Status
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Drawing No. FIGURE 4.5			Rev –

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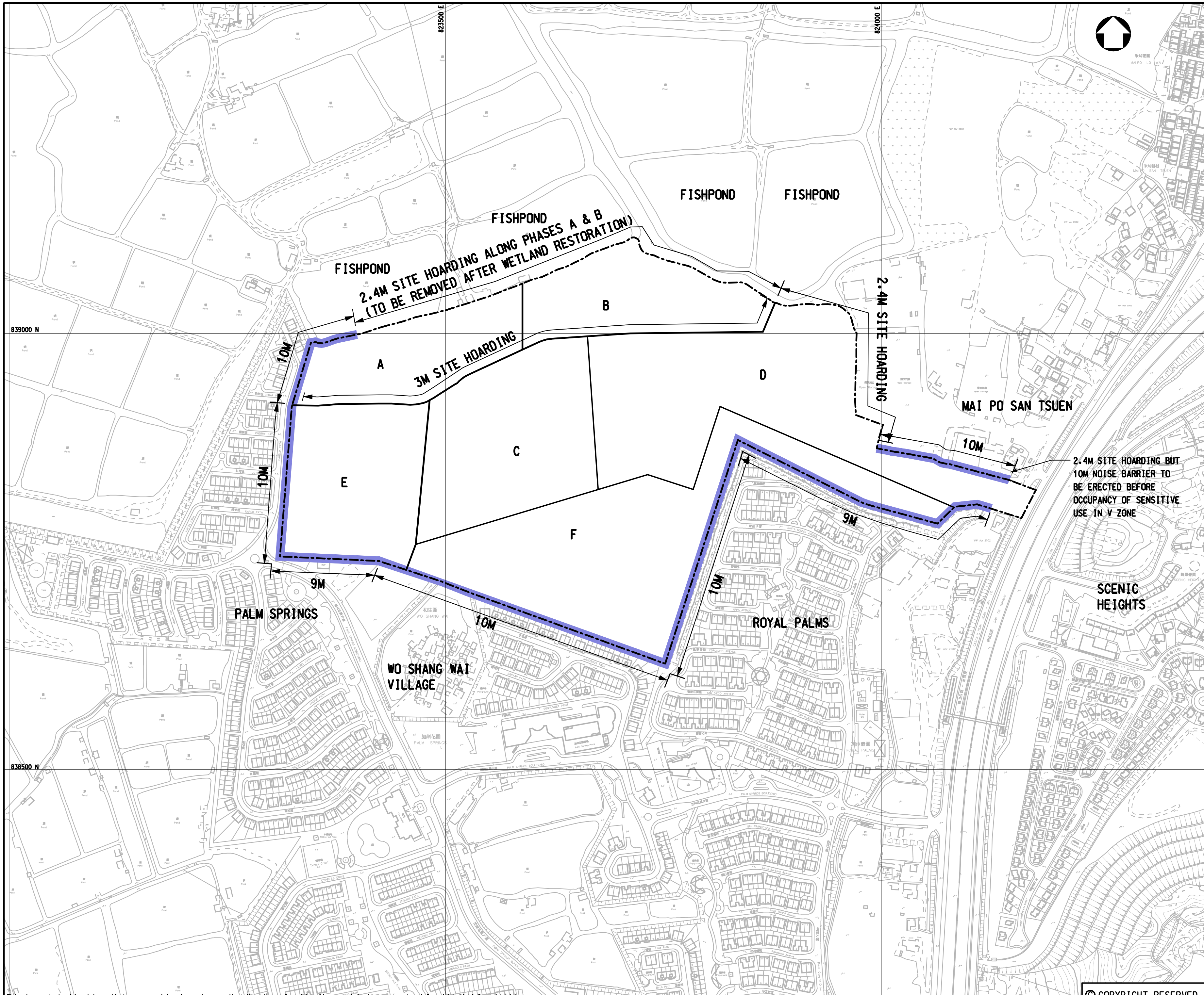

LEGEND

---·---	SITE BOUNDARY
———	PHASE BOUNDARY
A	CONSTRUCTION PHASE NO.
(shaded)	EXTEND OF NOISE BARRIERS
10M	10m HIGH NOISE BARRIER

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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
MINIMUM HEIGHT REQUIRED FOR PROPOSED NOISE BARRIERS AND SITE HOARDINGS

Designed	CWK	Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.	CWK	Approved	AFK
Scale 1:4000@A3	Project 221005	Status	
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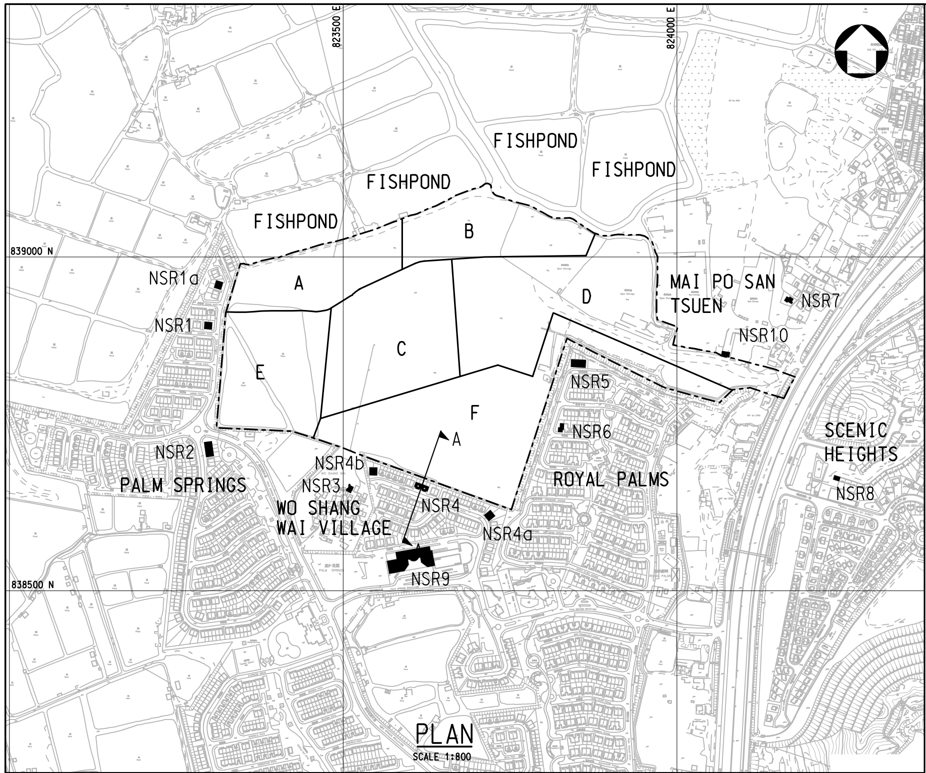

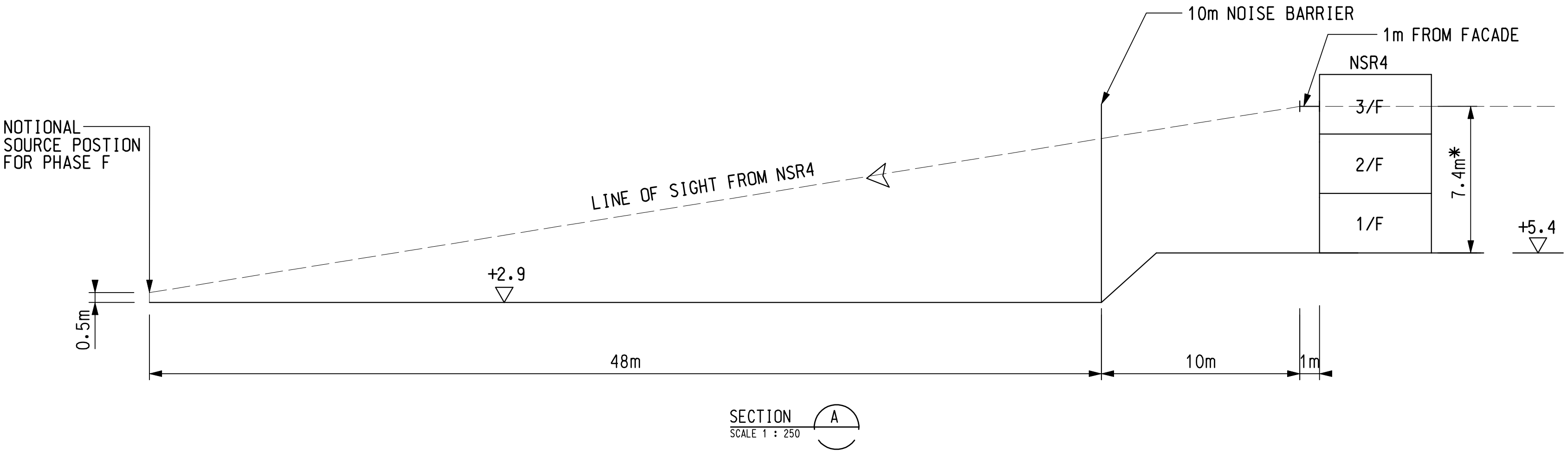

CROSS SECTION DIAGRAM SHOWING PROPOSED NOISE BARRIERS

* BUILDING HEIGHT IS OBTAINED FROM BUILDING DEPARTMENT

LEGEND

■ REPRESENTATIVE NOISE SENSITIVE RECEIVERS (NSRs) IN CONSTRUCTION PHASE

A CONSTRUCTION PHASE NO.

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Client: PROFIT POINT ENTERPRISES LTD

Project: PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title: CROSS SECTION DIAGRAM SHOWING PROPOSED NOISE BARRIERS

Designed	CWK	Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.	CWK	Approved	AFK
Scale: AS SHOWN@A1	Project 221005	CAD File J:\221005\REPORT\ENV\EIA_REPORT(080107)\env-fig4.7.dgn	Status
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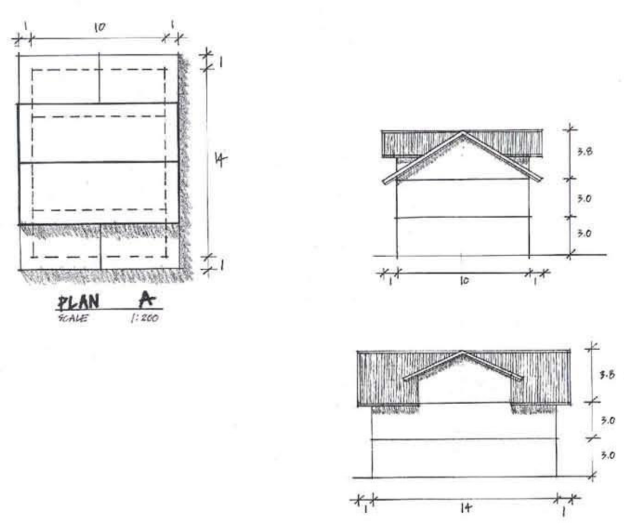
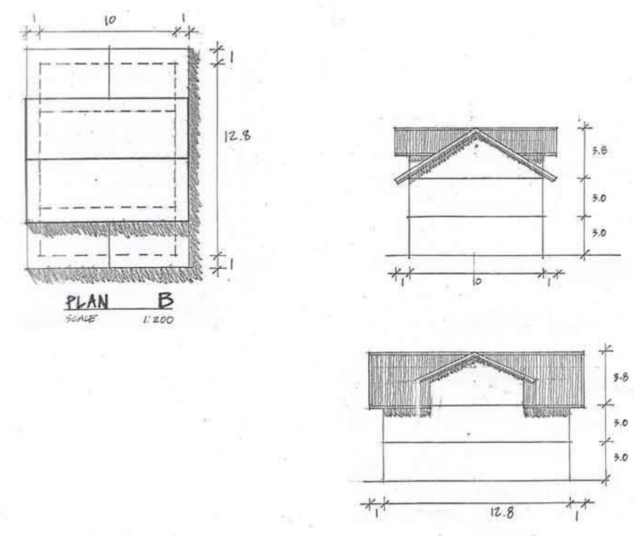
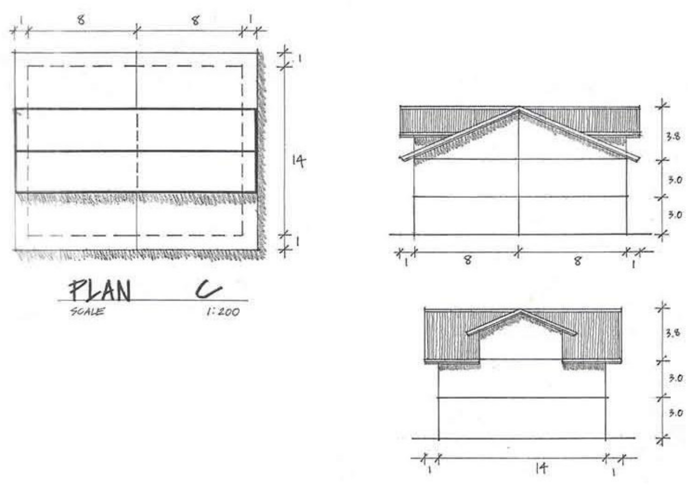


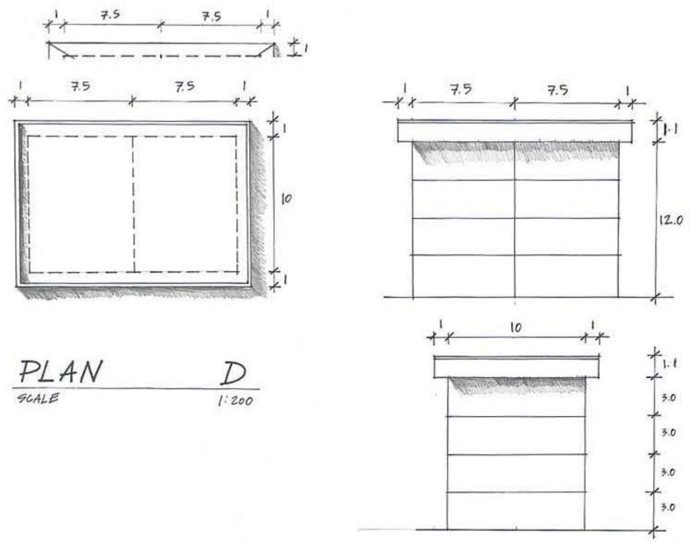
2.5/3 STOREY DETACHED HOUSE



2.5/3 STOREY DETACHED HOUSE



2.5/3 STOREY SEMI-DETACHED HOUSE



4 STOREY DUPLEX-ON-DUPLEX

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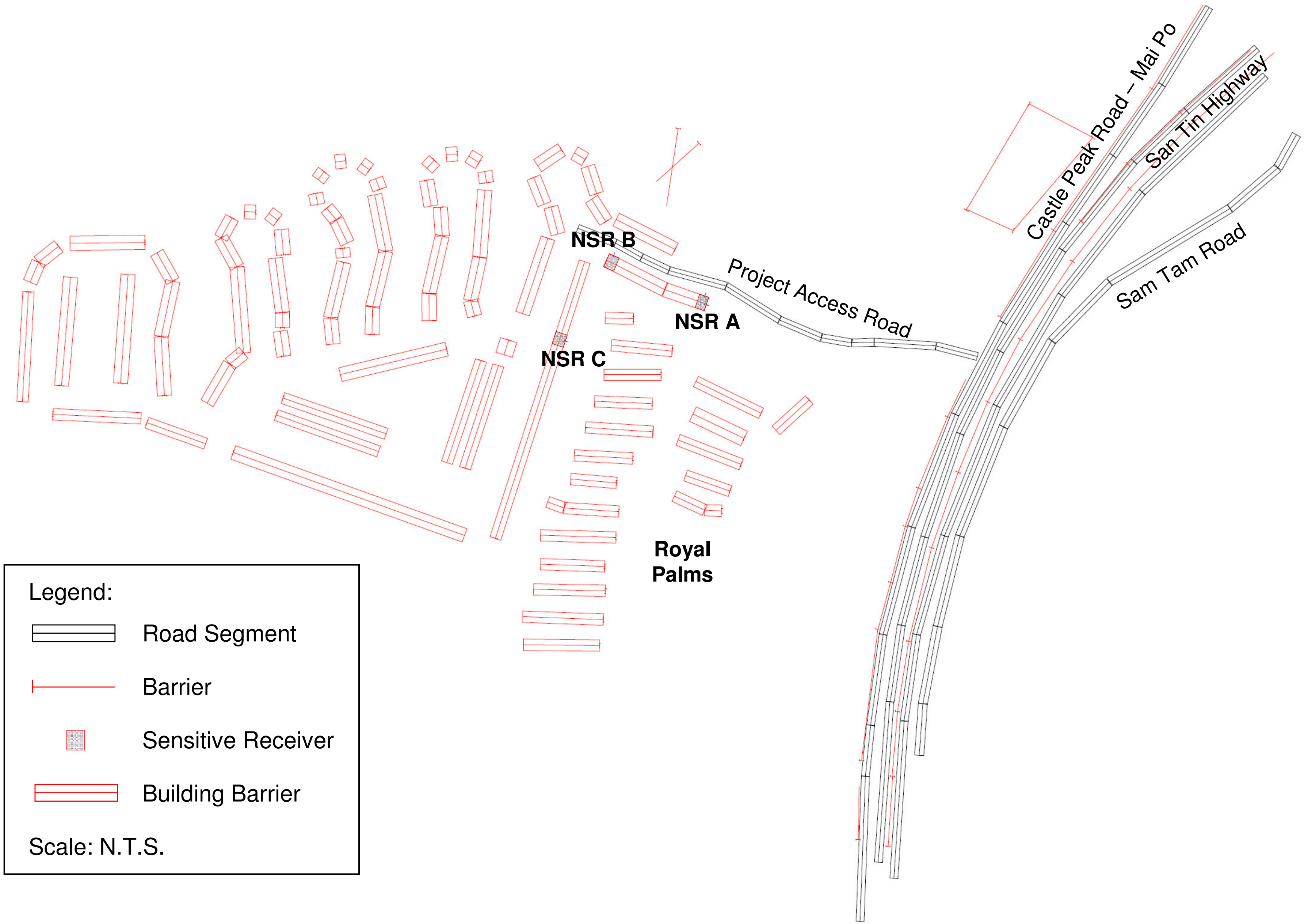
Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
CROSS-SECTIONAL DIAGRAMS OF FOUR TYPES OF HOUSES IN RESIDENTIAL DEVELOPMENT

Designed	CWK	Eng.Chk.	
Drawn	SL	Coordination	
Dwg.Chk.	CD	Approved	CD
Scale	N.T.S.	Project 221005	Status
		CAD File J:\221005\REPORT\ENV\EIA_REPORT\070430\env-fig4.4.dgn	
Drawing No.	FIGURE 4.8		Rev A



Project	Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Title	Computer Plot of Noise Model
Date	Jan, 2008

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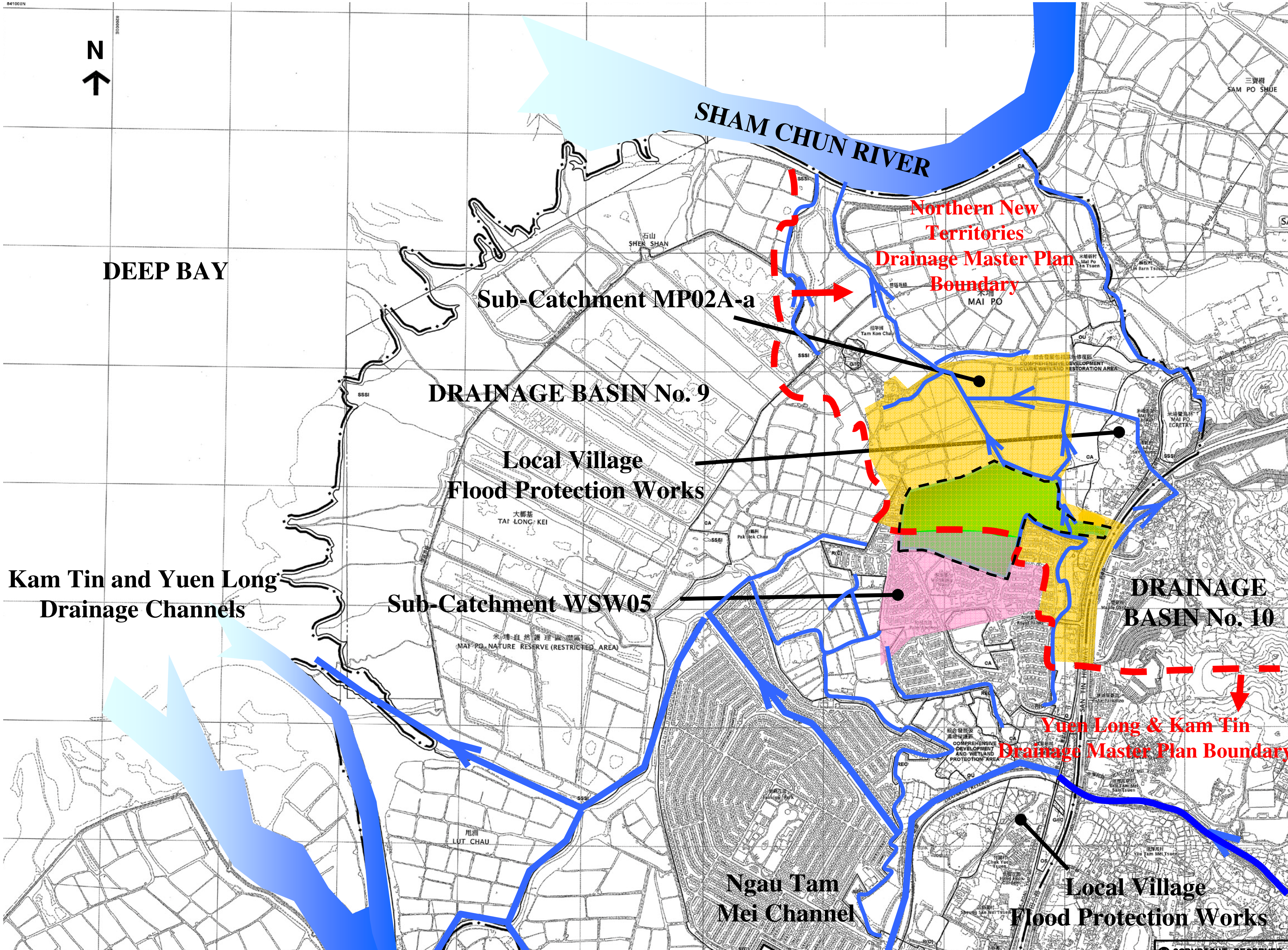
Figure 4.9



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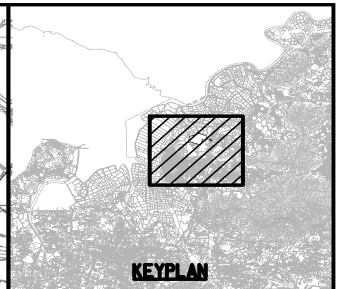

Proposed Comprehensive Development

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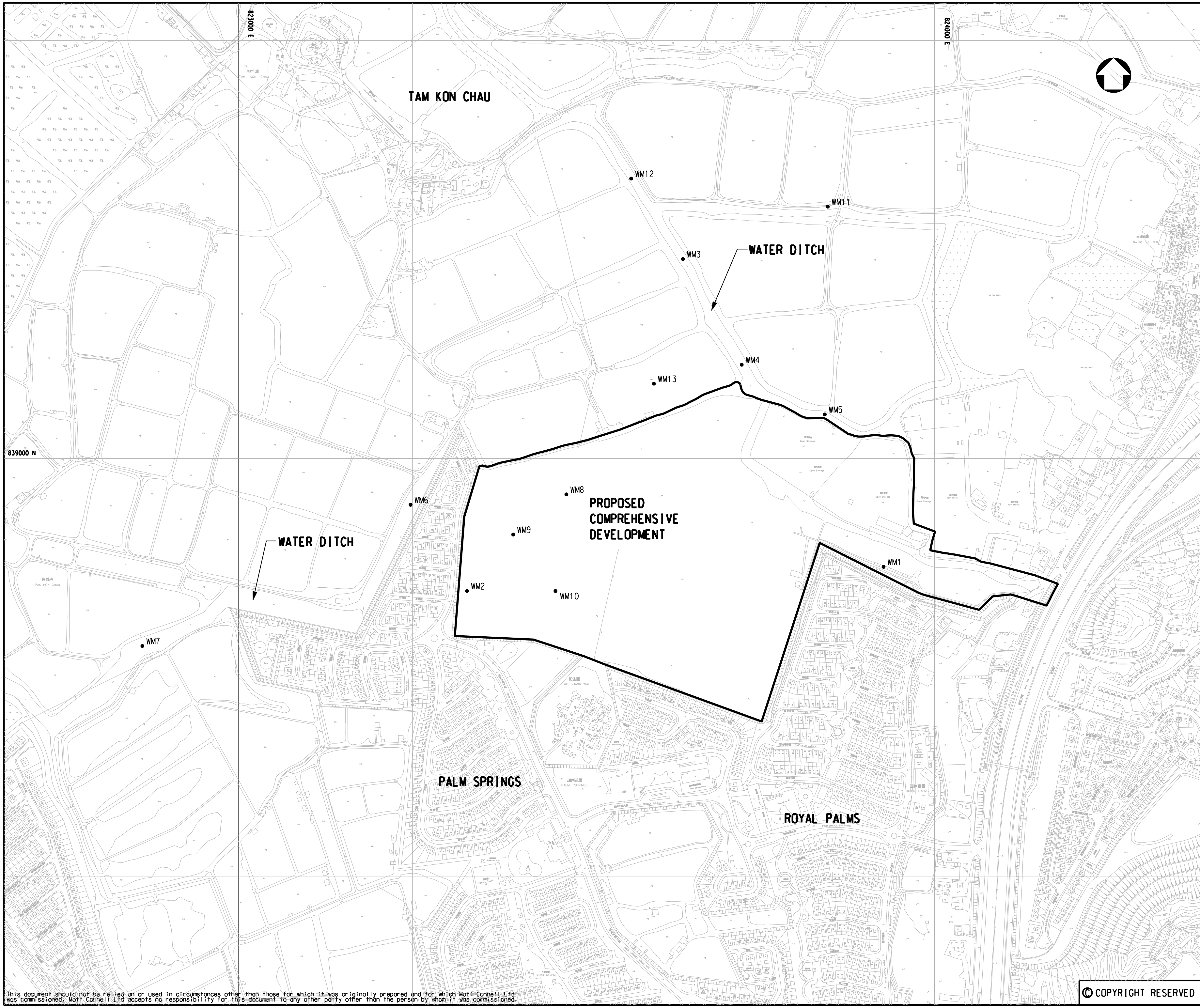
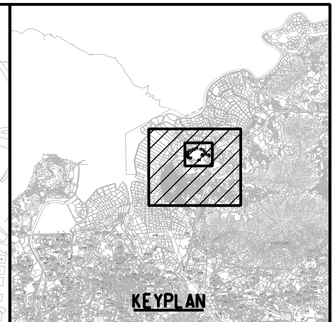
Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
EXISTING DRAINAGE PATTERN IN WO SHANG WAI

Designed	MMA	Eng.Chk.	MMA
Drawn	KK	Coordination	
Dwg.Chk.	MMA	Approved	AFK
Scale	N.T.S.	Project	221005
		CAD File	D:\TEMP\MCL-G-WAT-000.dgn
Status		Rev	–

FIGURE 5.1





NOTES:

1. GRIDLINES REFER TO HONG KONG METRIC GRID (1980).

LEGENDS :

• WM1 PROPOSED WATER QUALITY SAMPLING LOCATION

NUMBER	NORTH	EAST
WM1	838844.14	823926.70
WM2	838809.51	823328.51
WM3	839286.14	823638.55
WM4	839134.35	823722.99
WM5	839063.02	823842.25
WM6	838933.26	823247.41
WM7	838730.50	822862.25
WM8	838948.22	823471.11
WM9	838890.55	823394.74
WM10	838809.43	823455.47
WM11	823846.57	839361.47
WM12	823564.19	839401.74
WM13	823596.84	839107.17

Rev	Date	Drawn	Description	Ch'k'd	App'd

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183 Queen's Road East
Hong Kong

Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

Client: PROFIT POINT ENTERPRISES LTD

Project: PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title: WATER QUALITY SAMPLING LOCATIONS

Designed	JC	Eng.Chk.	
Drawn	KK	Coordination	
Dwg.Chk.	JC	Approved	AFK
Scale 1:2500@A1		Project 221005	Status
		CAD File j:\221005\report\env\eia_report\080818\env-fig5_2.dgn	
Drawing No. FIGURE 5.2			Rev 1

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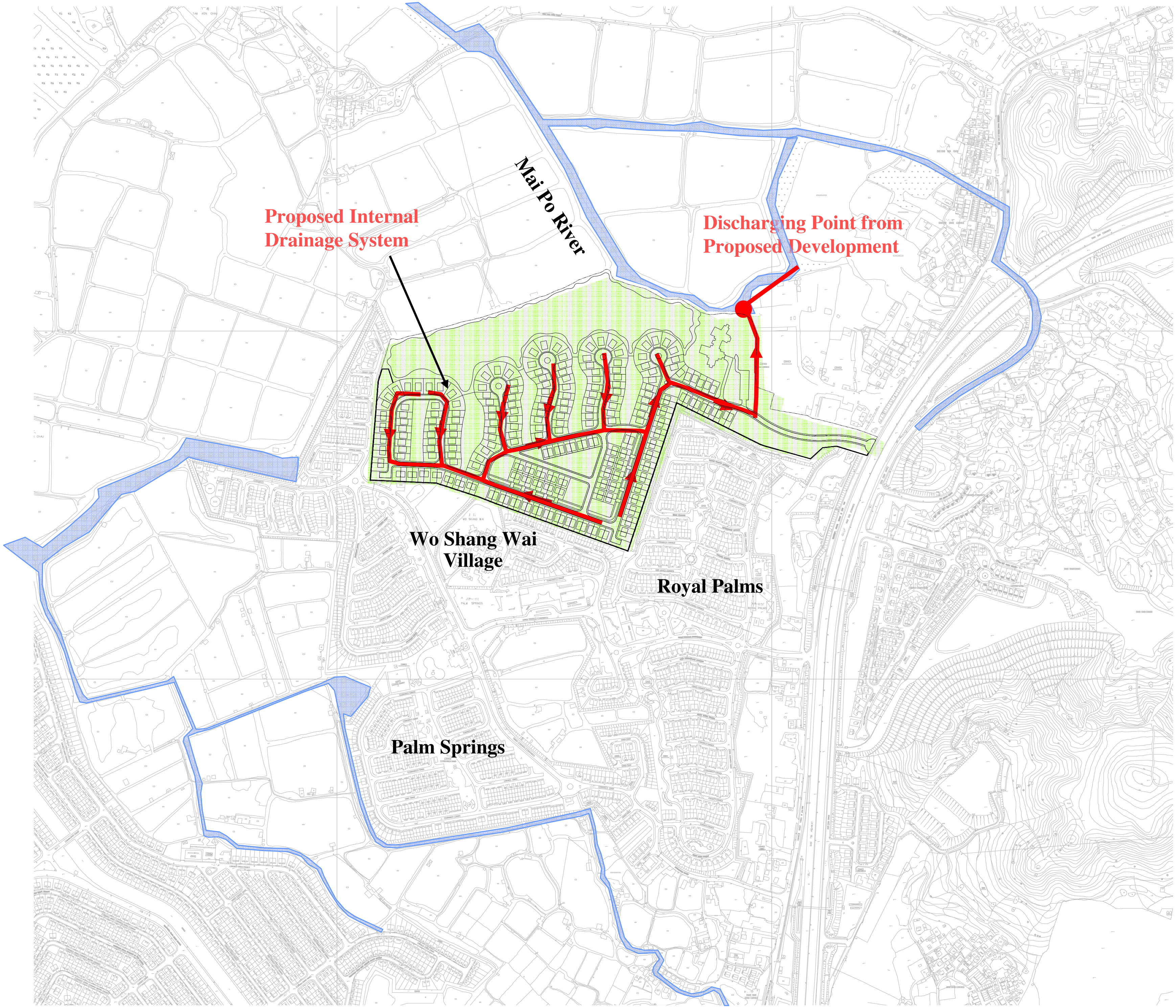

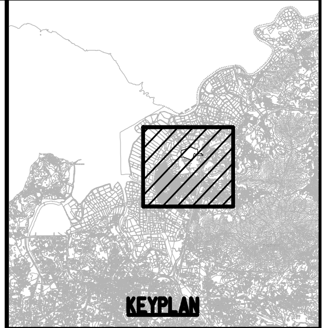

Legend

Proposed Development

Proposed drainage pipeline

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Fax 2827 1823
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Client: PROFIT POINT ENTERPRISES LTD.

Project: PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title: Tentative Drainage Discharge Arrangement

Designed	MMA	Eng.Chk.	MMA
Drawn	KK	Coordination	
Dwg.Chk.	MMA	Approved	AFK
Scale: N.T.S.	Project: 221005		Status
	CAD File: G:\TEMP\MCL-G-MAT-003.dgn		

FIGURE 5.3 | Rev: -

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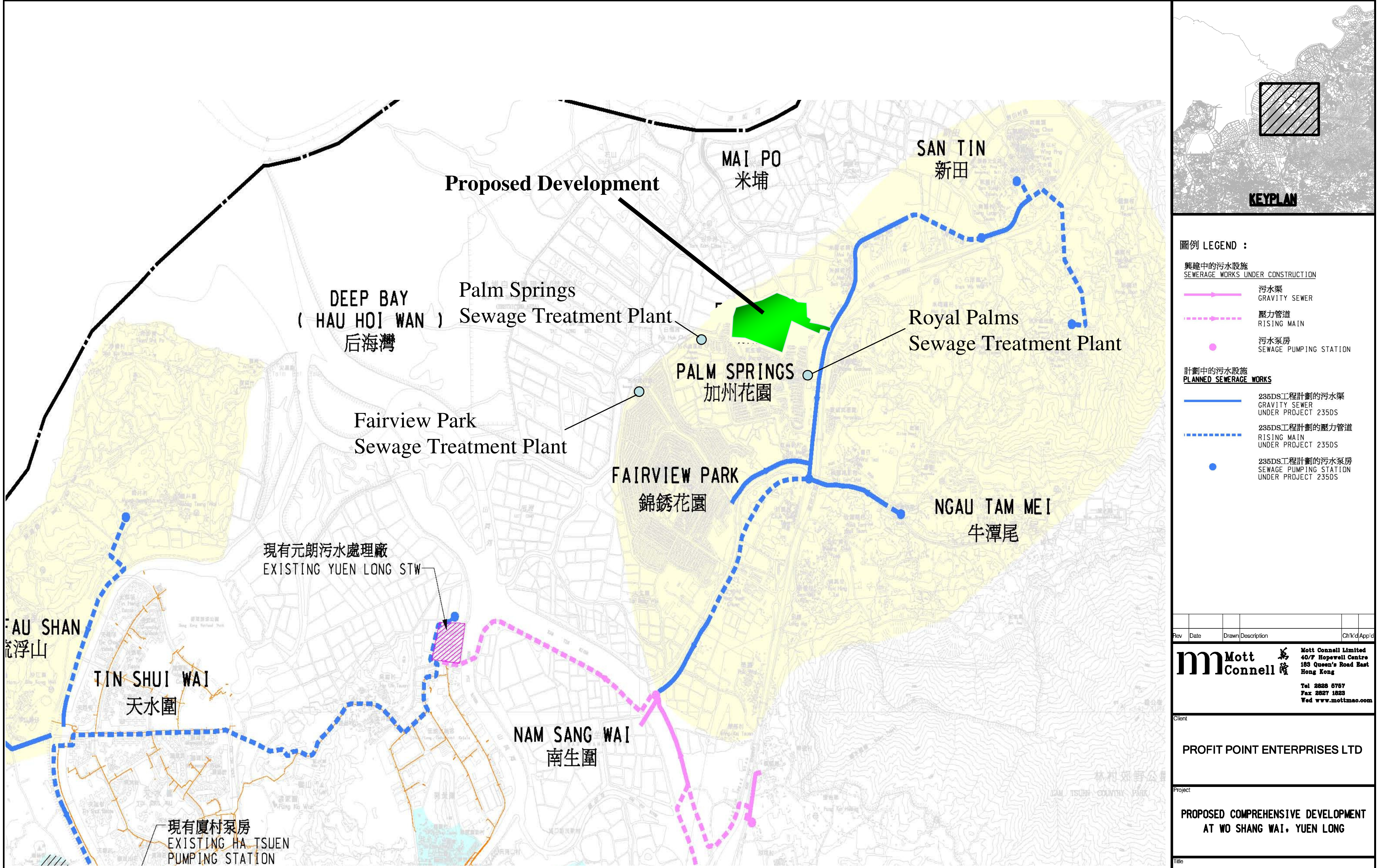

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Tel 2828 5757
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Wed www.mottmac.com

Client
PROFIT POINT ENTERPRISES LTD

Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
Planned Major Sewerage Works in Northwest New Territories from DSD

Designed	MMA	Eng.Chk.	MMA
Drawn	KK	Coordination	
Dwg.Chk.	MMA	Approved	AFK
Scale N.T.S.		Project 221005	Status
		CAD File G:\TEMP\MCL-G-MAT-COOL.dgn	
Drawing No. FIGURE 6.1			Rev -

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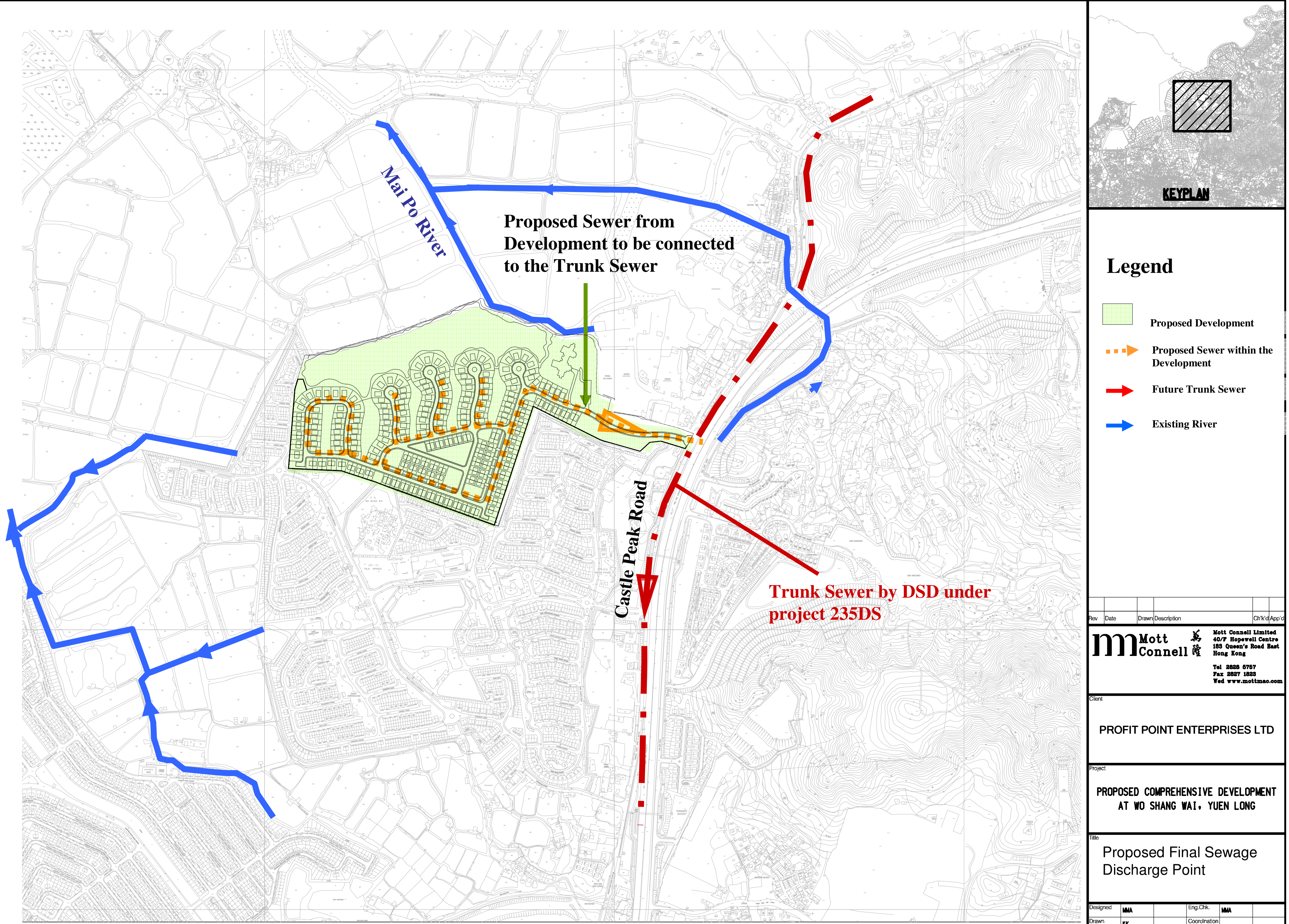

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Client
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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
Proposed Final Sewage Discharge Point

Designed	MMA	Eng.Chk.	MMA		
Drawn	KK	Coordination			
Dwg.Chk.	MMA	Approved	AFK		
Scale	N.T.S.	Project	221005	Status	
		CAD File	G:\TEMP\MCL-GI-MAT-C00L.dgn		

FIGURE 6.2

Rev -

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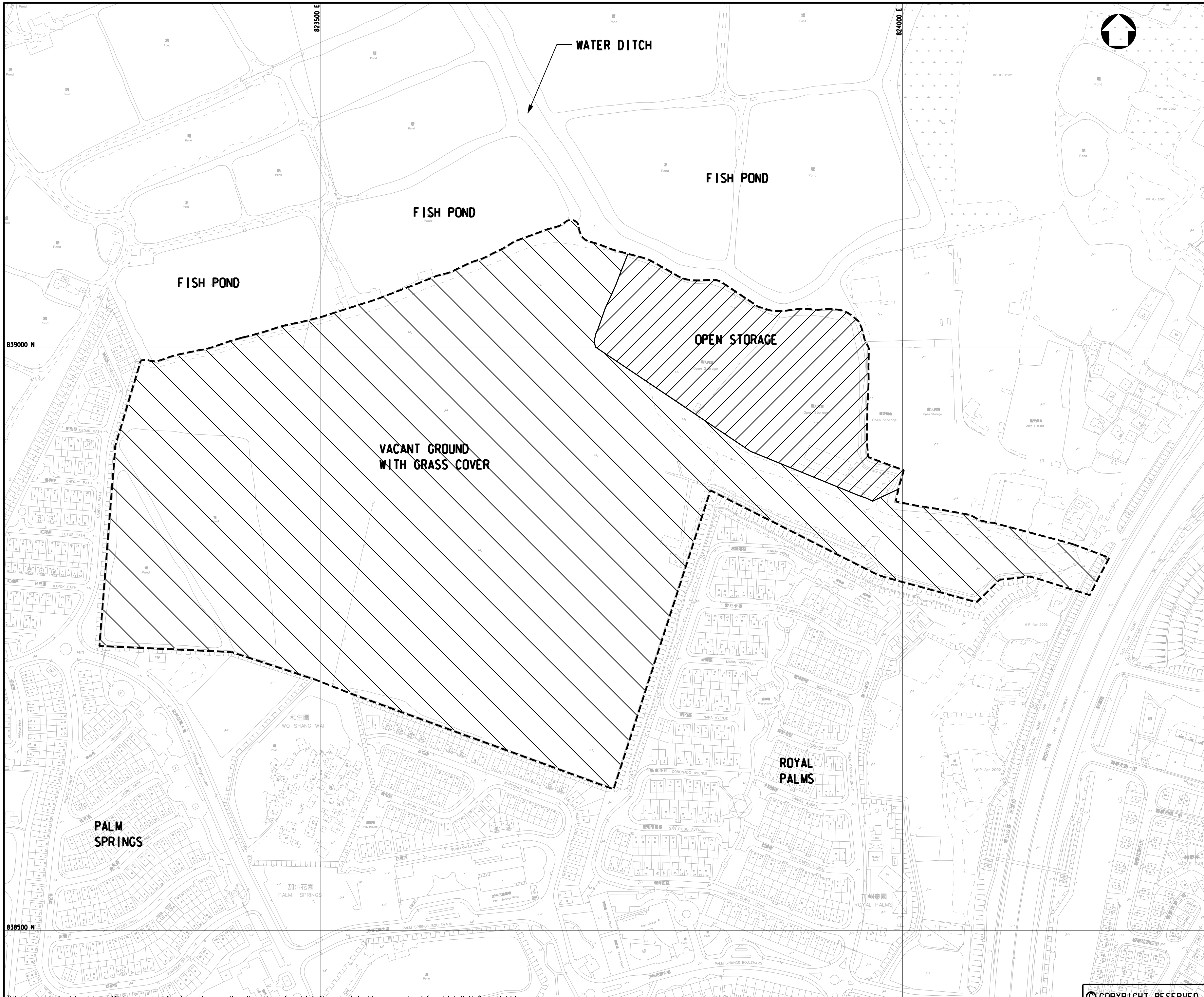

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRE UNLESS STATED OTHERWISE.
2. GRIDLINES ARE HONG KONG METRE GRID 1980.

LEGEND:

PROJECT AREA BOUNDARY

LORRY PARKING AREA SINCE 1991 AFTER FILLING OF FISH PONDS

UNUSED OPEN GRASSLAND SINCE FILLING OF FISH PONDS BETWEEN 1987 AND 1991

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Mott Connell Limited
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183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

Client
PROFIT POINT ENTERPRISES LTD

Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
CURRENT LAND USE AT PROJECT AREA
AUGUST 2006

Designed	MMA	Eng.Chk.	MMA
Drawn	LYK	Coordination	
Dwg.Chk.	MMA	Approved	AFK
Scale 1:1500@A1	Project		Status
	CAD File j:\22005\report\env\eia_report\080818\env-fig7.Ldgn		
Drawing No. FIGURE 7.1			Rev -

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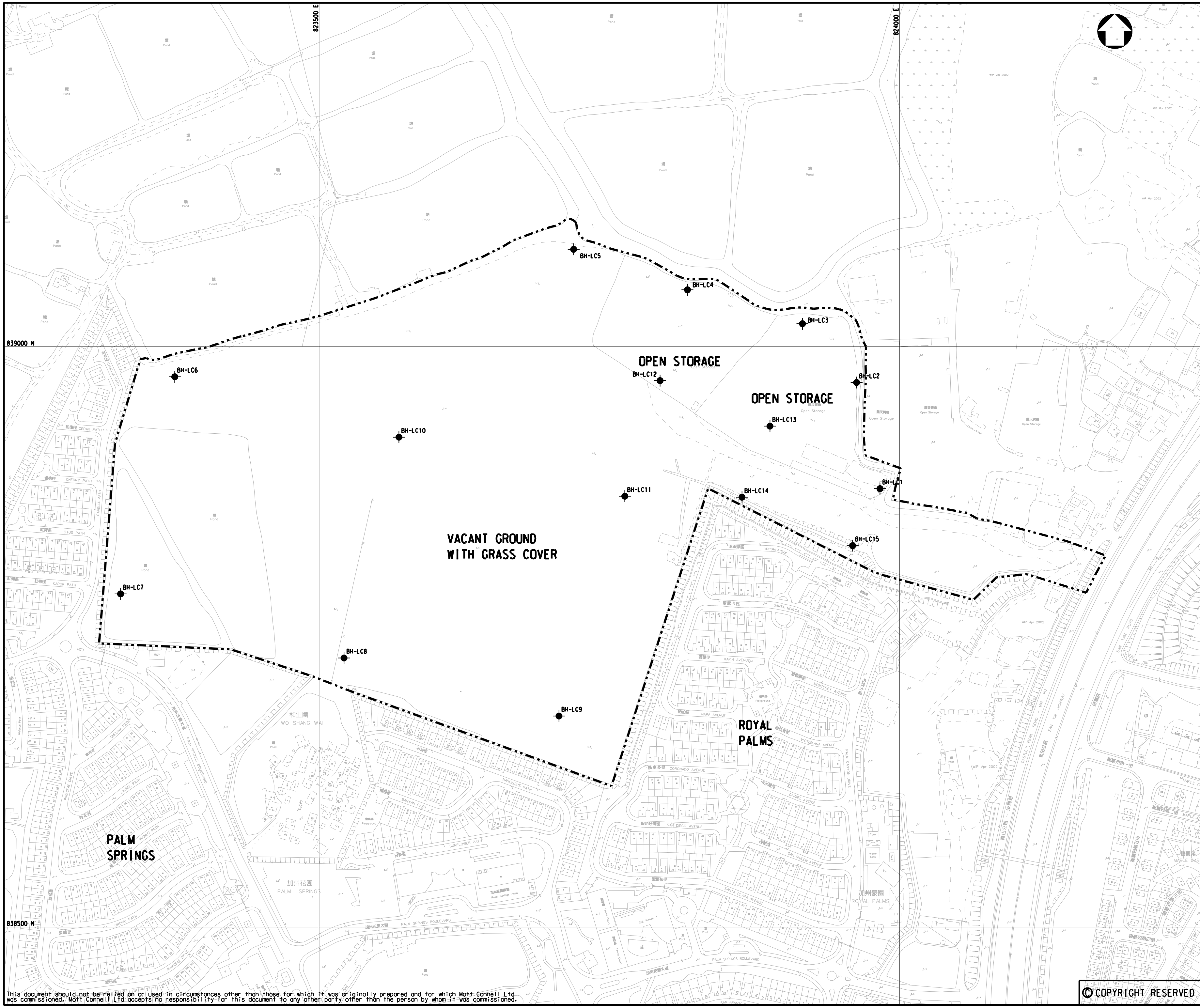

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LEGEND:

BH-LC4 LAND CONTAMINATION BOREHOLE

PROJECT AREA BOUNDARY

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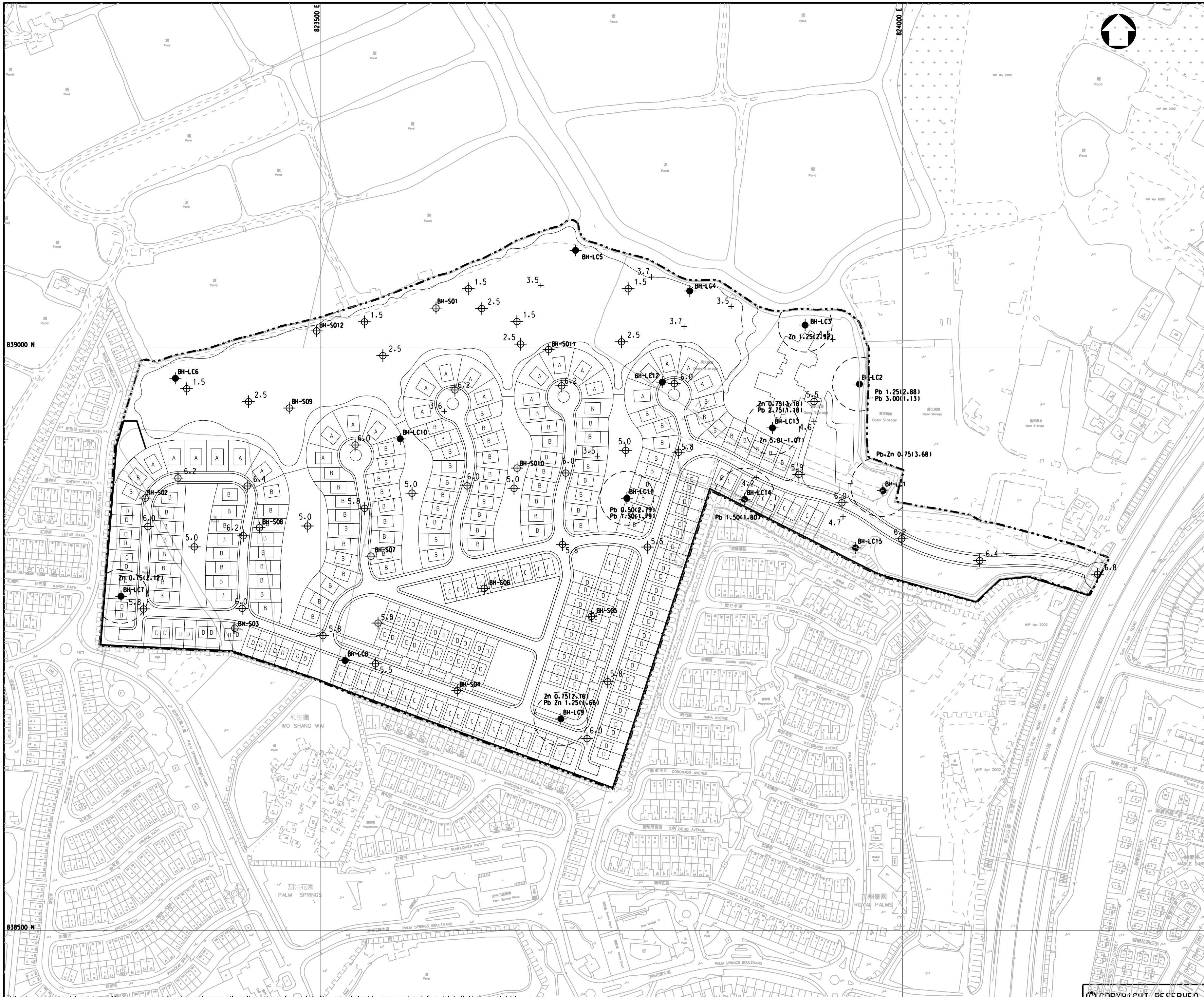
Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

Client
PROFIT POINT ENTERPRISES LTD

Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LAND CONTAMINATION ASSESSMENT BOREHOLE LOCATIONS

Designed	MMA	Eng.Chk.	MMA
Drawn	LYK	Coordination	
Dwg.Chk.	MMA	Approved	AFK
Scale 1:1500@A1		Project 221005	Status
		CAD File j:\221005\report\env\eia_report080818\env-fig7_2.dgn	
Drawing No. FIGURE 7.2			Rev 1



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LEGEND:

BH-LC4	LAND CONTAMINATION BOREHOLE
	PROJECT AREA BOUNDARY
3.5+	EXISTING GROUND LEVEL (mPD)
Zn	ZINC LEVEL EXCEEDING DUTCH 'B' LEVEL
Pb	LEAD LEVEL EXCEEDING DUTCH 'B' LEVEL
0.75	DEPTH (LEVEL) OF SAMPLE EXCEEDING DUTCH 'B' LEVEL
6.0	PROPOSED FINISHED GROUND LEVEL IN mPD (SUBJECT TO DETAIL DESIGN)
	ADOPTED 50m WIDE DIAMETER ZONE OF CONTAMINATION

Rev	Date	Drawn	Description	Ch'k'd	App'd

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Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

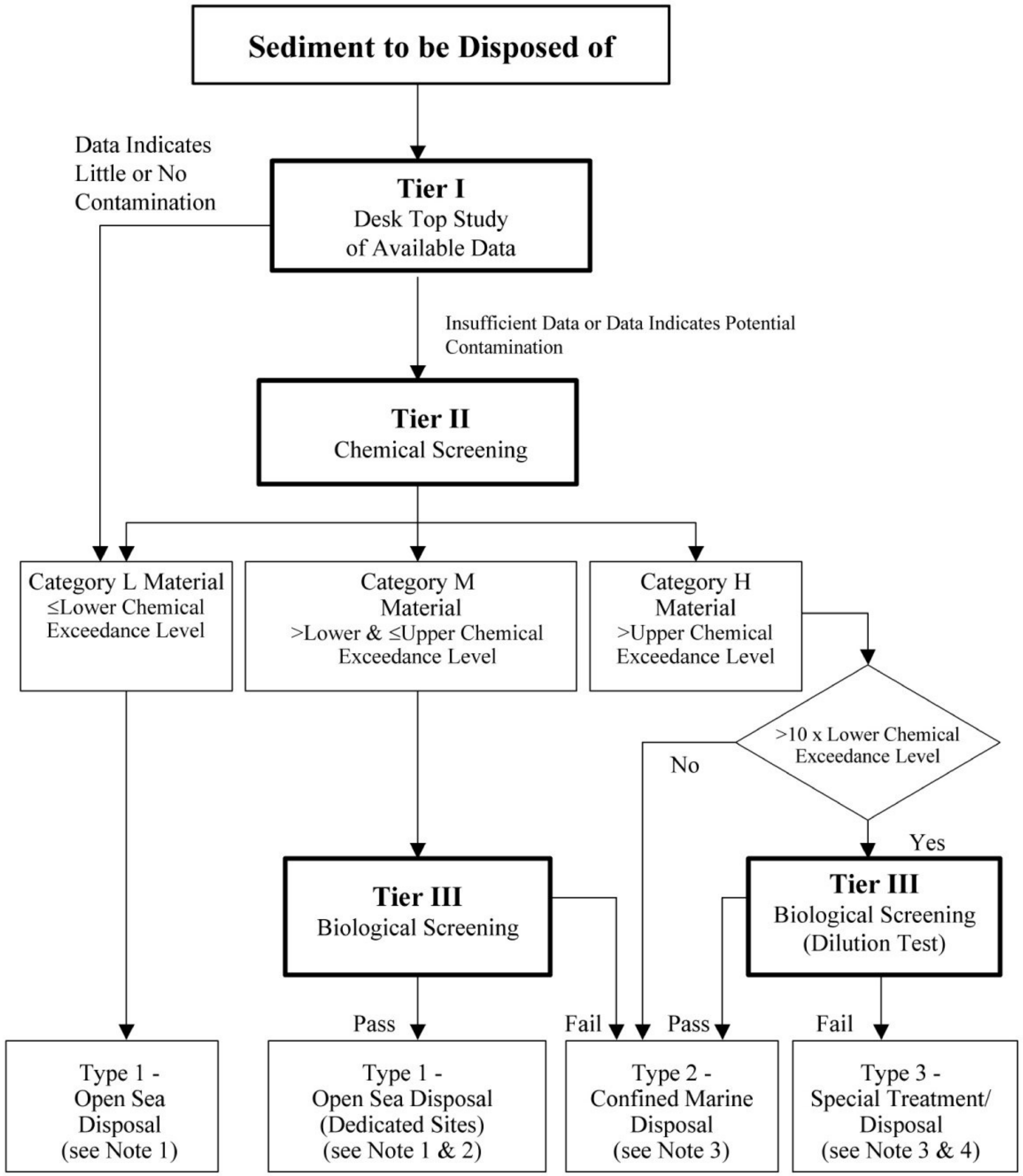
Client
PROFIT POINT ENTERPRISES LTD

Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
CONTAMINATED LAND EXCAVATION

Designed	MMA	Eng.Chk.	MMA
Drawn	LYK	Coordination	
Dwg.Chk.	MMA	Approved	AFK
Scale 1:1500@A1	Project 221005	CAD File j:\221005\report\env\eia_report080818\env-fig7_3.dgn	Status
Drawing No.	FIGURE 7.3	Rev	3

Management Framework for Dredged/Excavated Sediment



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183 Queen's Road East
Hong Kong
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Client
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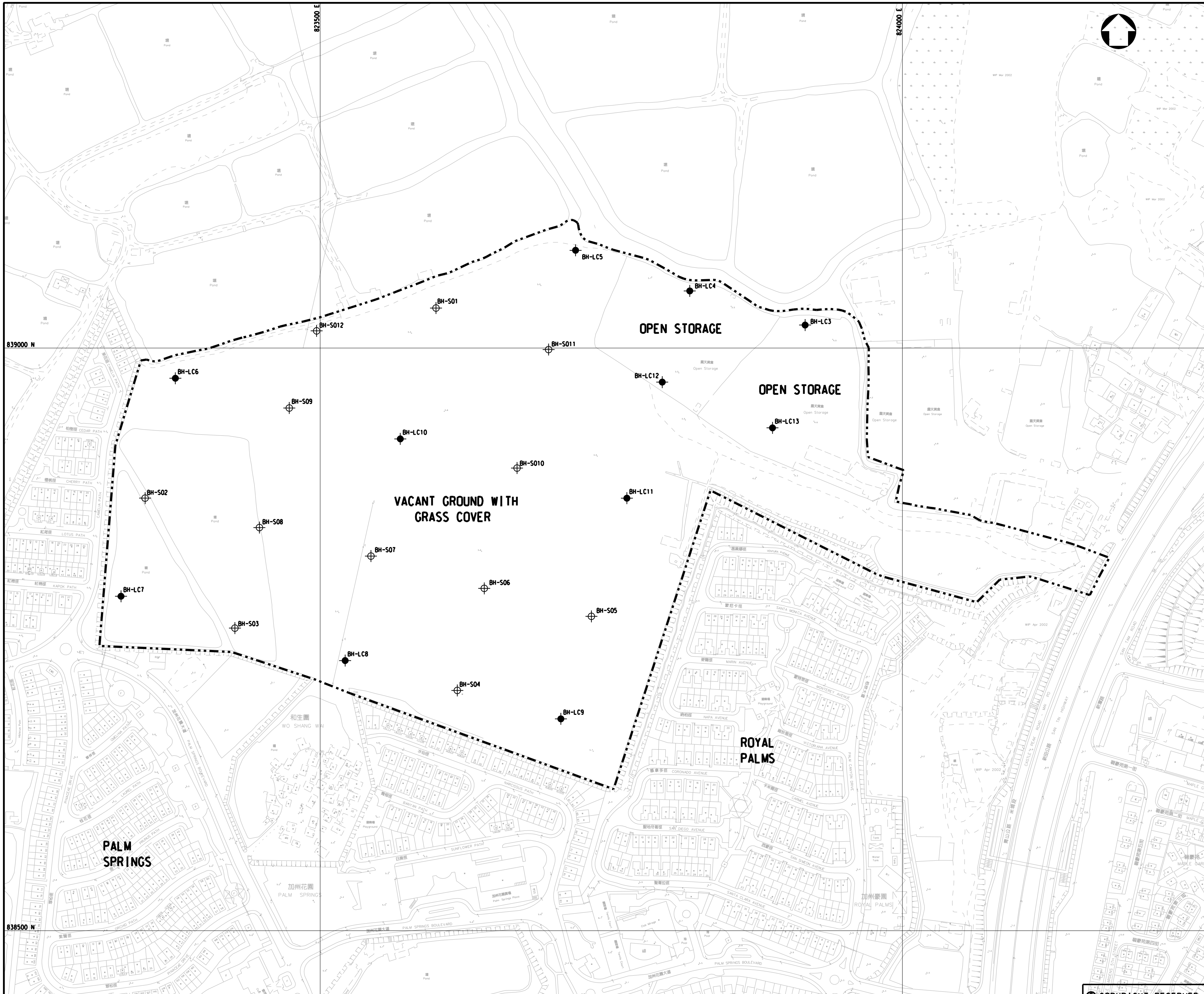
Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
Management Framework for Dredged/Excavated Sediment

Designed		Eng.Chk.		
Drawn		Coordination		
Dwg.Chk.		Approved		
Scale	Project	221005		Status
	CAD File J:\221005\CAD_ADMIN\WCL-221005-P-AI-N.dgn			
Drawing No.	FIGURE 7.4			Rev



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRE UNLESS STATED OTHERWISE.
2. GRIDLINES ARE HONG KONG METRE GRID 1980.

LEGEND:

BH-S01 SEDIMENT QUALITY BOREHOLE

BH-LC4 COMBINED LAND CONTAMINATION/ SEDIMENT QUALITY BOREHOLE

PROJECT AREA BOUNDARY

NUMBER	NORTH	EAST
BH-LC3	839019.75	823916.46
BH-LC4	839049.03	823817.40
BH-LC5	839083.90	823719.33
BH-LC6	838974.07	823375.65
BH-LC7	838786.96	823328.97
BH-LC8	838731.79	823521.45
BH-LC9	838681.77	823706.71
BH-LC10	838922.04	823568.82
BH-LC11	838871.15	823763.43
BH-LC12	838970.75	823793.78
BH-LC13	838931.50	823888.45
BH-S01	839034.35	823599.49
BH-S02	838871.20	823349.67
BH-S03	838759.65	823426.78
BH-S04	838706.17	823617.79
BH-S05	838769.73	823732.94
BH-S06	838793.74	823640.92
BH-S07	838821.46	823543.61
BH-S08	838845.95	823447.84
BH-S09	838948.55	823473.49
BH-S010	838897.01	823669.08
BH-S011	838998.71	823696.17
BH-S012	839014.74	823496.97

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Mott Connell Limited
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183 Queen's Road East
Hong Kong
Tel 2828 5757
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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
SEDIMENT ASSESSMENT BOREHOLE LOCATIONS

Designed	MMA	Eng.Chk.	MMA
Drawn	LYK	Coordination	
Dwg.Chk.	MMA	Approved	AFK
Scale 1:1500@A1	Project 221005		Status
	CAD File j:\221005\report\env\eia_report080818\env-fig7_5.dgn		
Drawing No.	FIGURE 7.5		Rev 2

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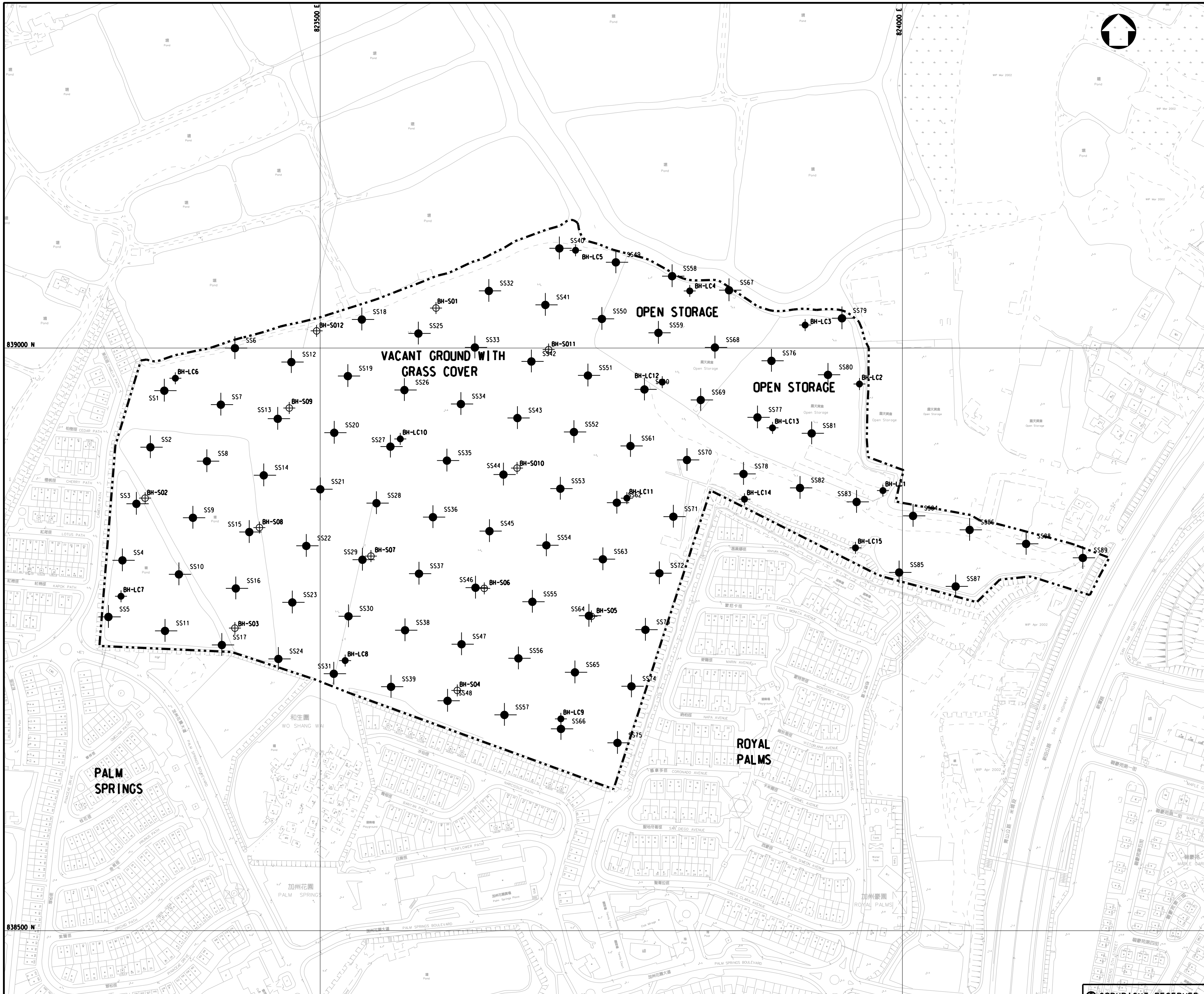

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LEGEND:

SS85 GAS SPIKE SURVEY LOCATION

BH-S01 BOREHOLE

BH-LC4 BOREHOLE

PROJECT AREA BOUNDARY

NUMBER	NORTH	EAST	NUMBER	NORTH	EAST
SS1	838963.45	823366.06	SS46	838794.37	823633.29
SS2	838914.91	823354.06	SS47	838745.83	823621.28
SS3	838866.37	823342.05	SS48	838697.29	823609.28
SS4	838817.84	823330.05	SS49	839073.60	823753.83
SS5	838769.30	823318.05	SS50	839025.06	823741.83
SS6	838999.99	823426.60	SS51	838976.52	823729.83
SS7	838951.45	823414.60	SS52	838927.98	823717.83
SS8	838902.91	823402.59	SS53	838879.33	823706.13
SS9	838854.37	823390.59	SS54	838830.80	823694.12
SS10	838805.84	823378.59	SS55	838782.26	823682.12
SS11	838757.30	823366.59	SS56	838733.72	823670.12
SS12	838987.99	823475.13	SS57	838685.18	823658.12
SS13	838939.34	823463.43	SS58	839061.67	823802.09
SS14	838890.80	823451.43	SS59	839013.06	823790.37
SS15	838842.26	823439.43	SS60	838964.52	823778.37
SS16	838793.72	823427.43	SS61	838915.98	823766.36
SS17	838745.19	823415.43	SS62	838867.33	823754.66
SS18	839024.53	823535.67	SS63	838818.80	823742.66
SS19	838975.99	823523.67	SS64	838770.26	823730.66
SS20	838927.34	823511.97	SS65	838721.72	823718.66
SS21	838878.80	823499.97	SS66	838673.18	823706.66
SS22	838830.26	823487.97	SS67	839049.60	823850.91
SS23	838781.72	823475.97	SS68	839001.06	823838.91
SS24	838733.19	823463.97	SS69	838952.52	823826.90
SS25	839012.52	823584.21	SS70	838903.98	823814.90
SS26	838963.99	823572.21	SS71	838855.33	823803.20
SS27	838915.45	823560.21	SS72	838806.79	823791.20
SS28	838866.91	823548.21	SS73	838758.26	823779.20
SS29	838818.37	823536.21	SS74	838709.72	823767.20
SS30	838769.83	823524.21	SS75	838661.18	823755.20
SS31	838721.29	823512.21	SS76	838989.06	823887.44
SS32	839049.06	823644.75	SS77	838940.52	823875.44
SS33	839000.52	823632.75	SS78	838891.98	823863.44
SS34	838951.99	823620.75	SS79	839025.59	823947.98
SS35	838903.45	823608.75	SS80	838977.06	823935.98
SS36	838854.91	823596.75	SS81	838928.52	823923.98
SS37	838806.37	823584.75	SS82	838879.98	823911.98
SS38	838757.83	823572.75	SS83	838867.98	823960.52
SS39	838709.29	823560.74	SS84	838855.98	824009.06
SS40	839085.60	823705.29	SS85	838807.44	823997.06
SS41	839037.06	823693.29	SS86	838843.98	824057.60
SS42	838988.52	823681.29	SS87	838795.44	824045.59
SS43	838939.98	823669.29	SS88	838831.98	824106.13
SS44	838891.45	823657.29	SS89	838819.97	824154.67
SS45	838842.91	823645.29			

Rev	Date	Drawn	Description	Ch'k'd	App'd

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Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
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PROFIT POINT ENTERPRISES LTD

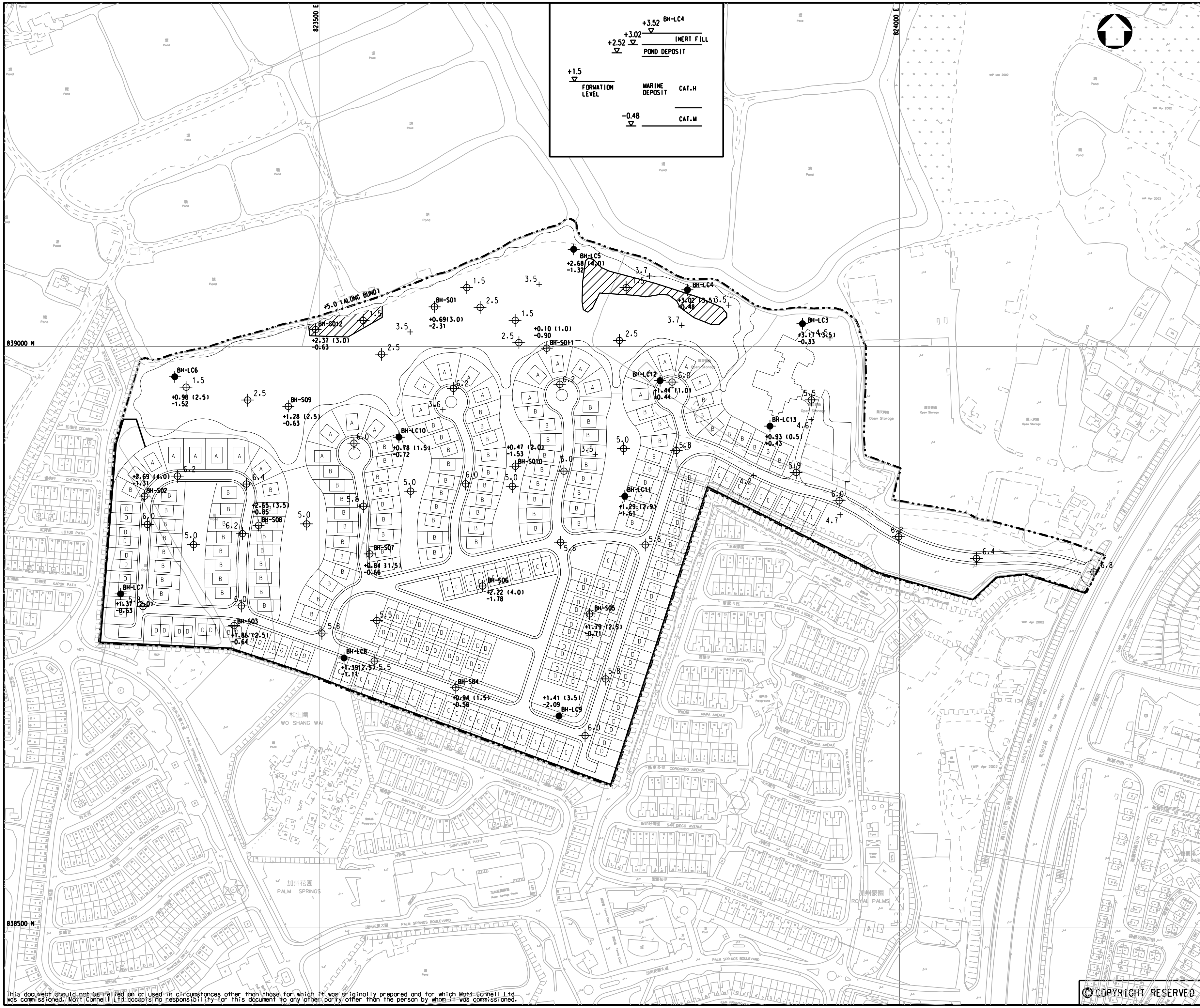
Project

PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

GAS SPIKE SURVEY AND BIOGAS INVESTIGATION LOCATIONS

Designed	MMA	Eng.Chk.	MMA
Drawn	LYK	Coordination	
Dwg.Chk.	MMA	Approved	AFK
Scale 1:1500@A1	Project 221005		Status
	CAD File j:\221005\report\env\eia_report080818\env-fig7_6.dgn		
Drawing No.	FIGURE 7.6		Rev 2



NOTES:

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LEGEND:

BH-SO10	SEDIMENT QUALITY BOREHOLE
BH-LC4	LAND CONTAMINATION BOREHOLE
	PROJECT AREA BOUNDARY
3.7	EXISTING GROUND LEVEL (mPD)
+0.69	TOP OF SEDIMENT (mPD)
-2.31	BOTTOM OF SEDIMENT (mPD)
(4.0)	THICK NESS OF SEDIMENT
5.8	FINISHED LEVEL (mPD)
	EXTENT OF EXCAVATIONS IN SEDIMENT

Rev	Date	Drawn	Description	Ch'k'd	App'd

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Hong Kong

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PROFIT POINT ENTERPRISES LTD

Project

PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

MARINE SEDIMENT EXCAVATION

Designed	MMA	Eng.Chk.	MMA
Drawn	LYK	Coordination	
Dwg.Chk.	MMA	Approved	AFK
Scale	1:1500@A1	Project 221005	Status
		CAD File j:\221005\report\env\eia_report080818\env-fig7_7.dgn	
Drawing No.	FIGURE 7.7	Rev	3

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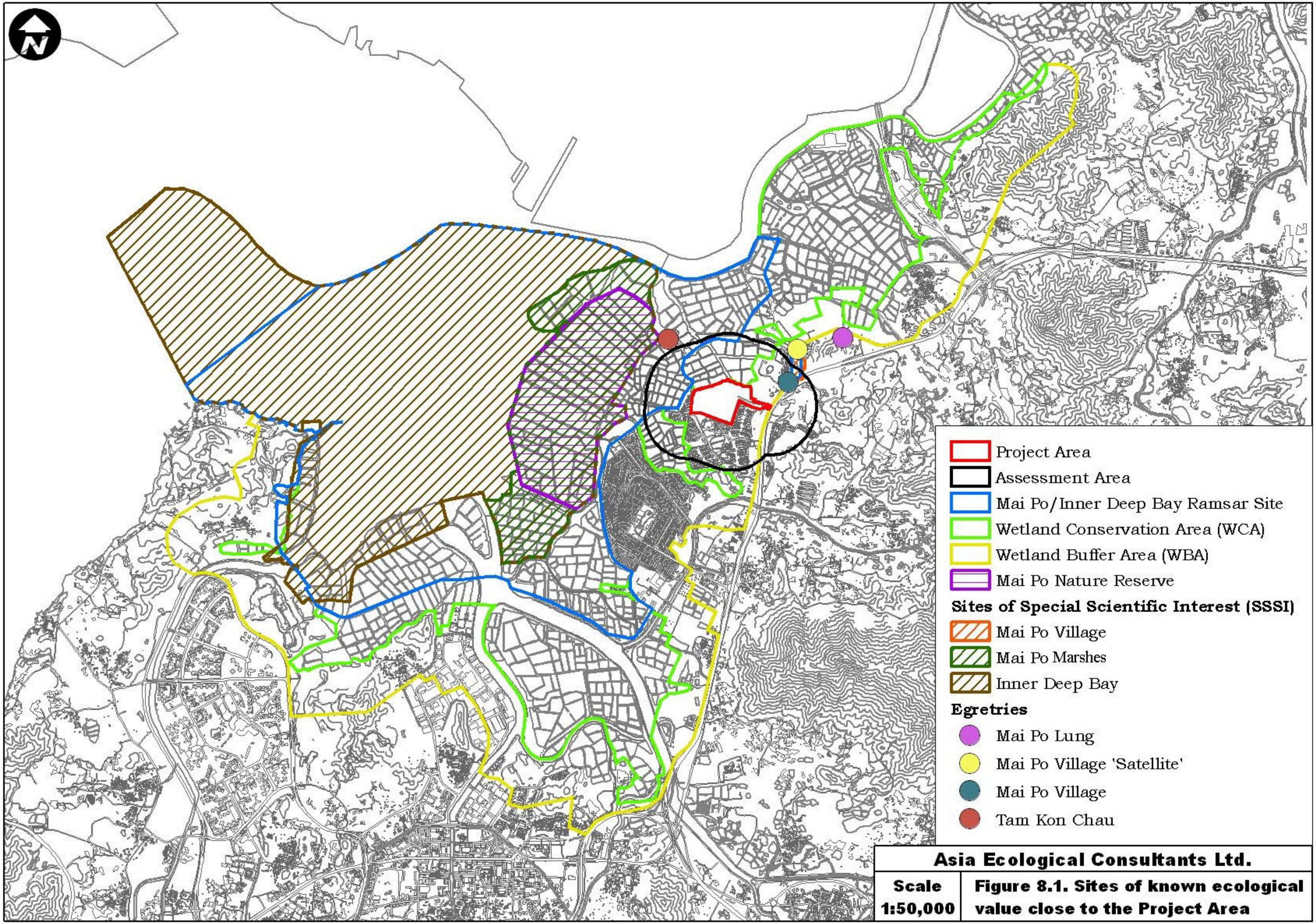
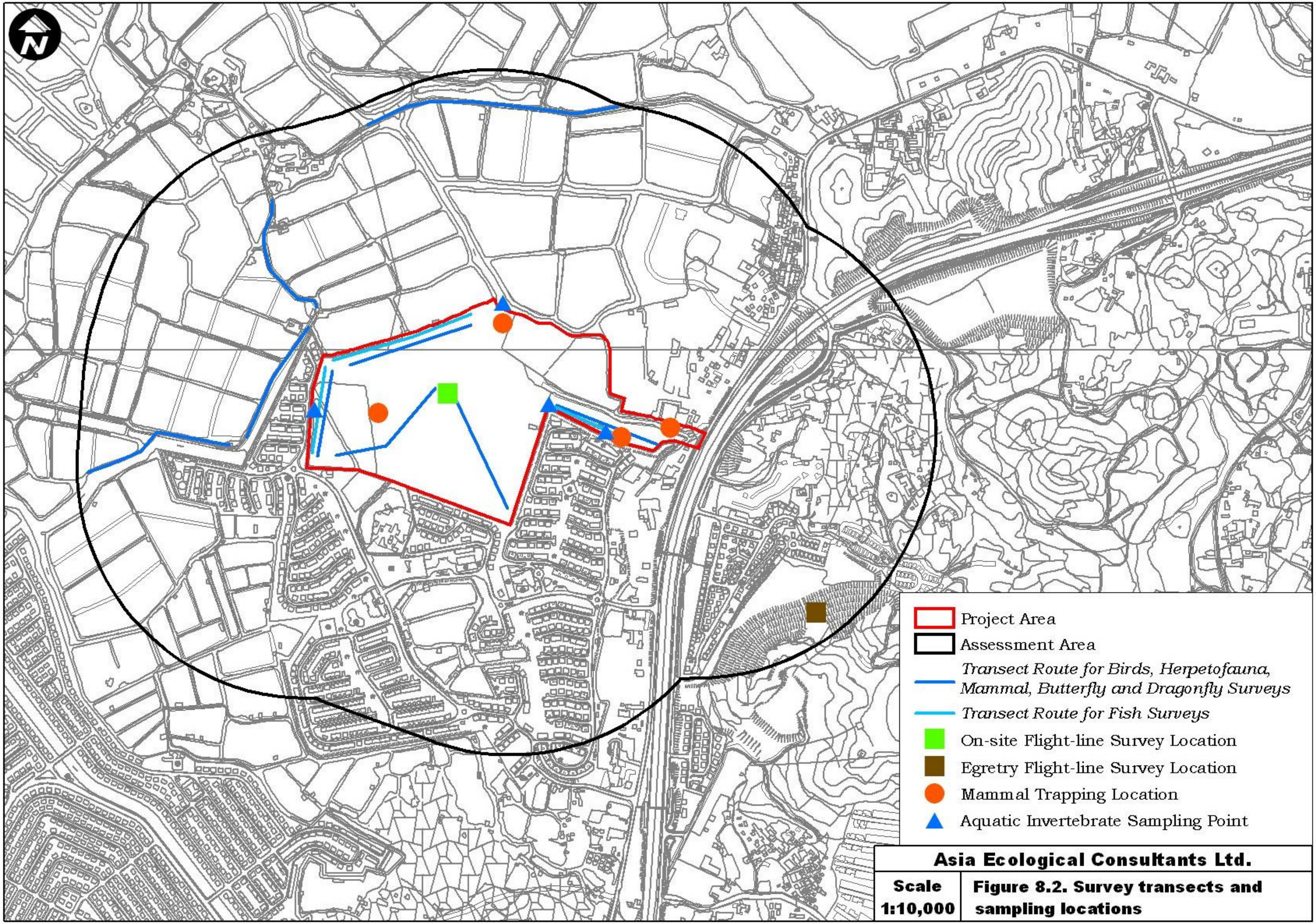


Asia Ecological Consultants Ltd.

Scale 1:50,000

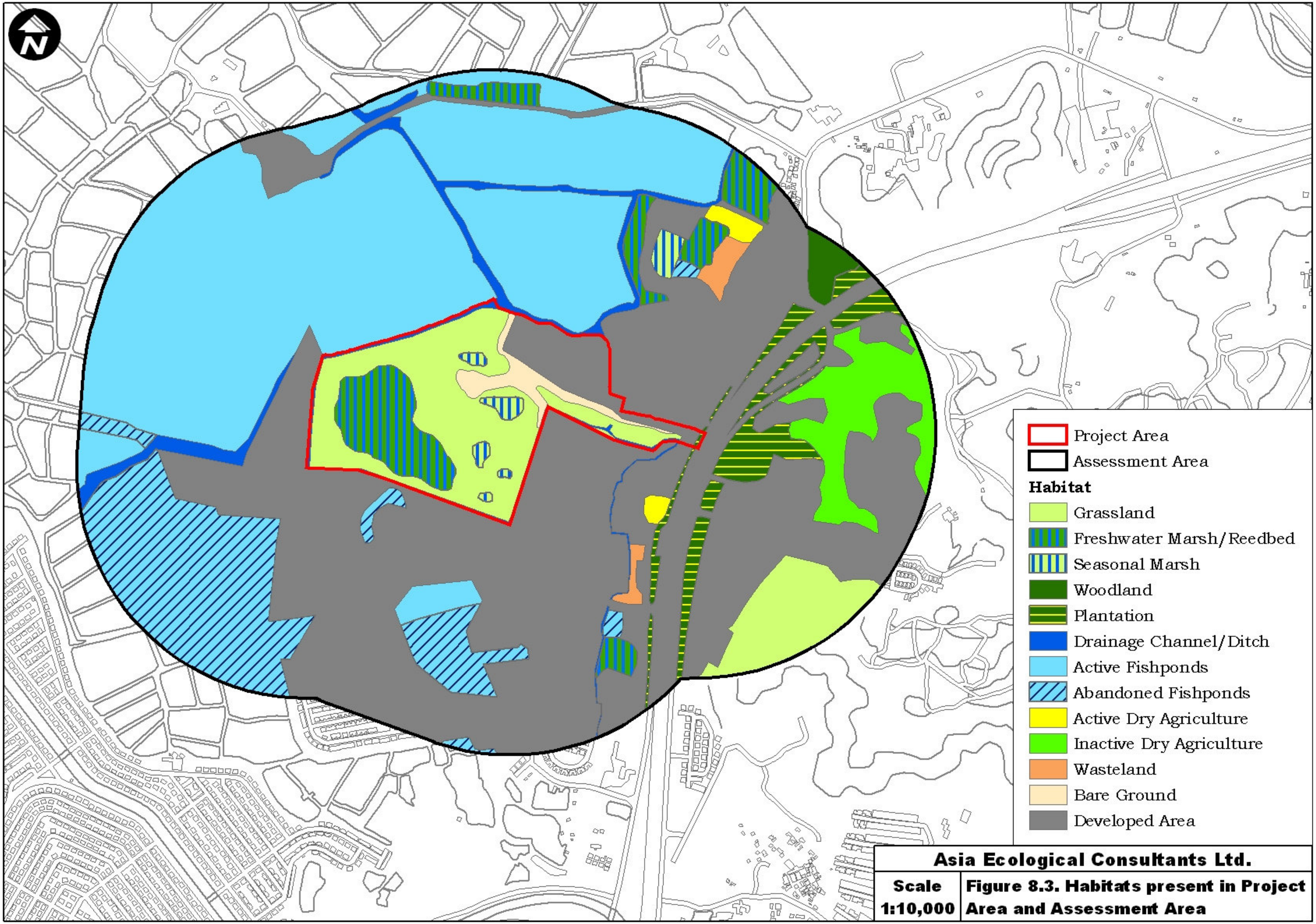
Figure 8.1. Sites of known ecological value close to the Project Area



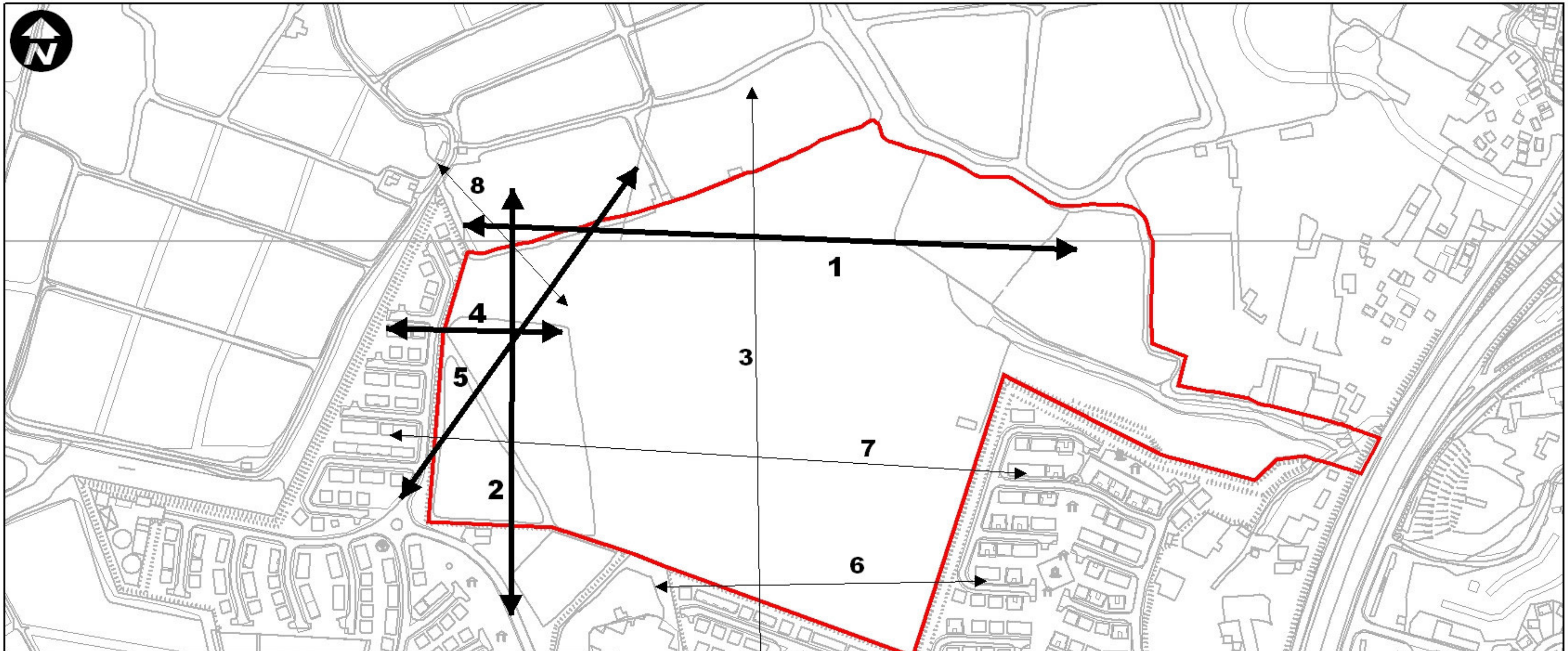
Asia Ecological Consultants Ltd.

Scale 1:10,000

Figure 8.2. Survey transects and sampling locations



Asia Ecological Consultants Ltd.	
Scale 1:10,000	Figure 8.3. Habitats present in Project Area and Assessment Area



Number of Birds recorded on Flight Path
November 2005 - April 2006

Flight Path	5-10m	11-15m	16-20m	21-50m	51-100m	Total
1	40	19	28	9	0	96
2	0	5	0	34	2	41
3	0	0	0	17	0	17
4	0	32	19	31	0	82
5	0	5	9	38	0	52
6	0	0	0	2	0	2
7	0	0	0	0	70	70
8	0	0	0	50	0	50
Total	40	61	56	181	72	410

May - June 2006

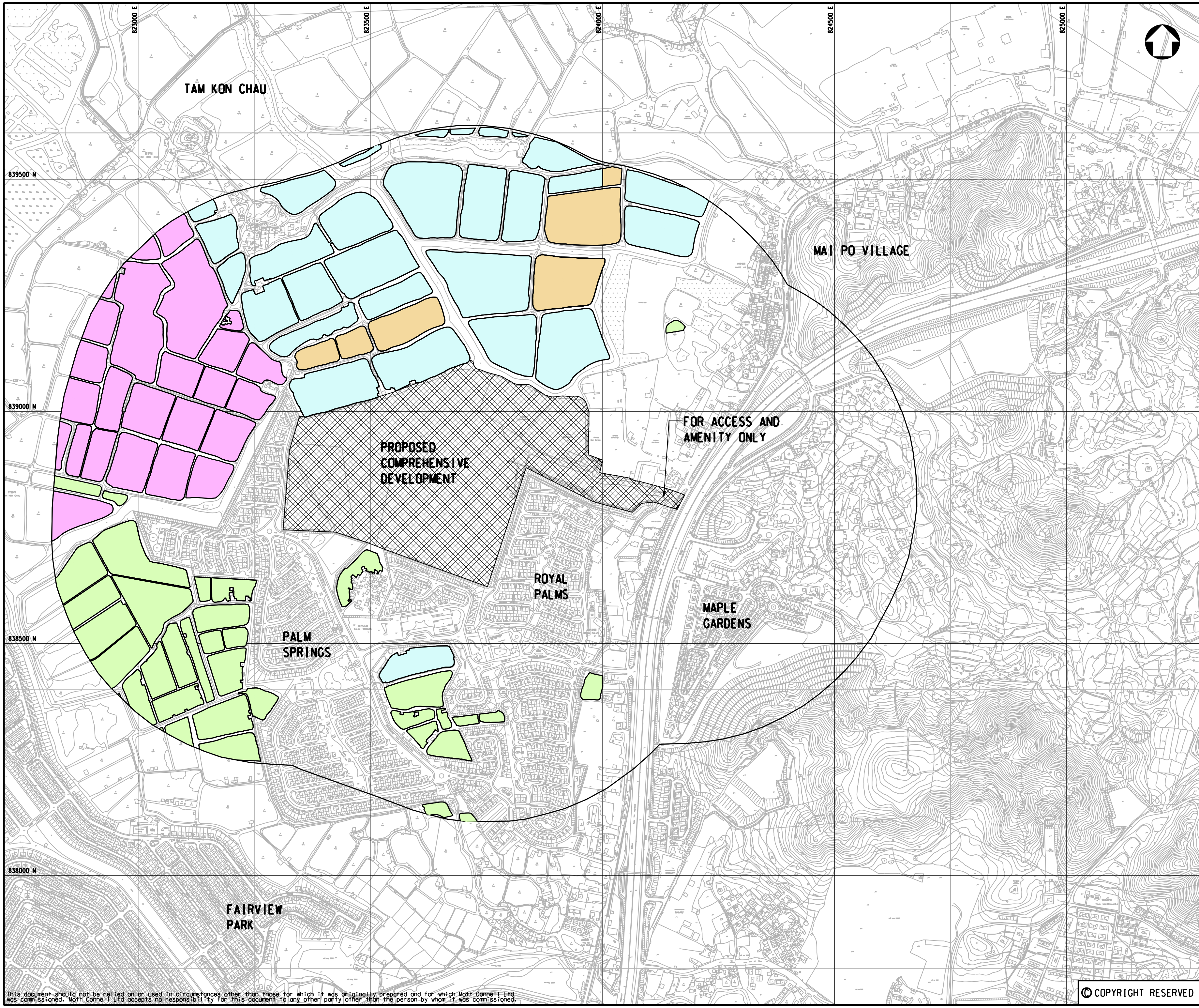
Flight Path	5-10m	11-15m	16-20m	21-50m	51-100m	Total
1	10	0	0	0	0	10
2	7	0	0	0	0	7
3	2	0	0	0	0	2
Total	19	0	0	0	0	19

Regular Flight Path
(regularly used by wetland birds)

Minor Flight Path
(used by small numbers of birds or on a single date)

Asia Ecological Consultants Ltd.

Scale	Figure 8.4. Bird Flight Paths over the Project Area
1:5,000	



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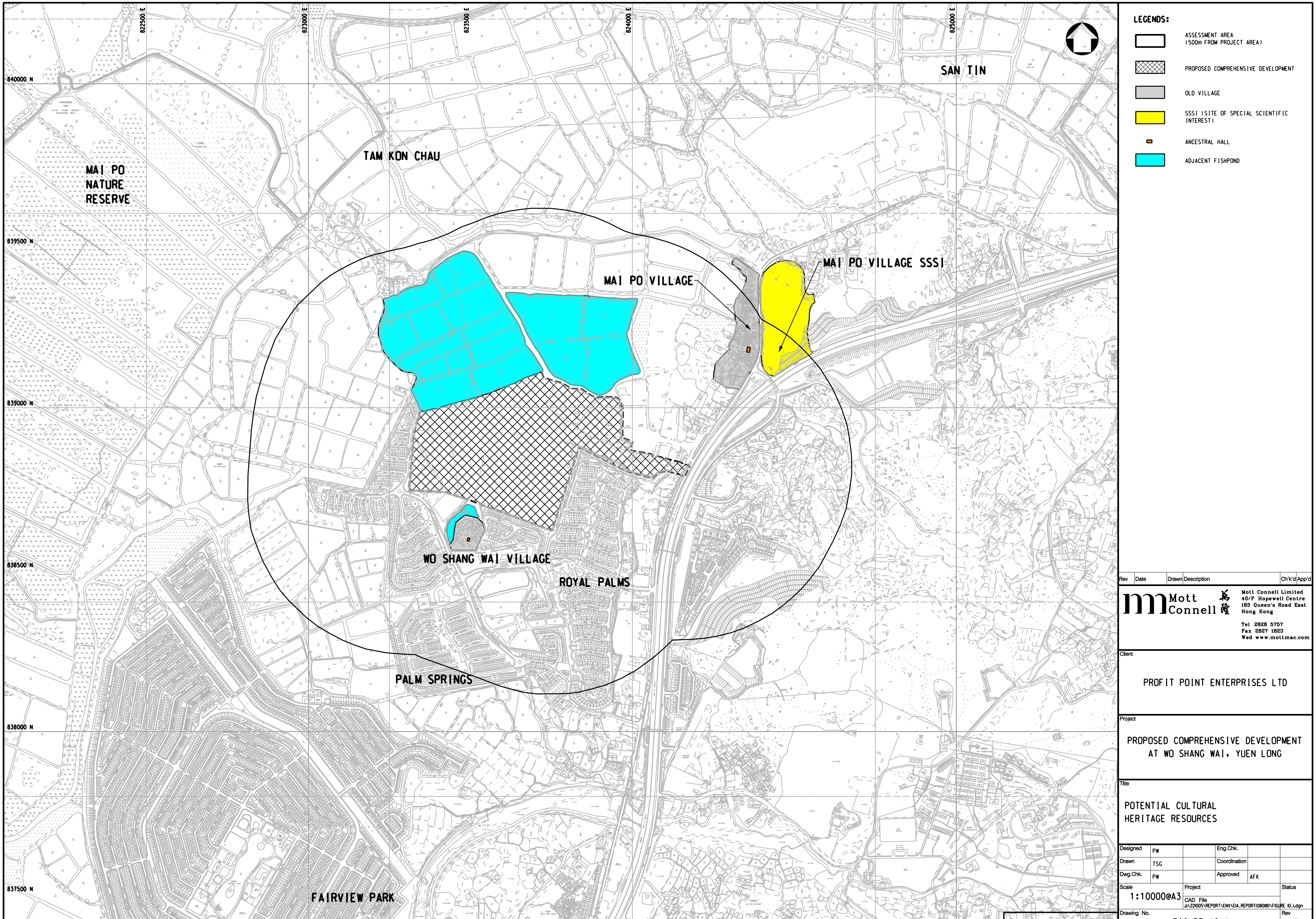
Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

Client: PROFIT POINT ENTERPRISES LTD

Project: PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title: FISHPONDS STATUS AROUND WO SHANG WAI ON 18 NOVEMBER 2005

Designed	JC/PW	Eng.Chk.	
Drawn	TSG	Coordination	
Dwg.Chk.	JC	Approved	AFK
Scale	1:7500@A3	Project	Status
		CAD File j:\221005\report\env\eia_report\080818\FIGURE 9.1.dgn	
Drawing No.	FIGURE 9.1	Rev	2



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40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

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PROFIT POINT ENTERPRISES LTD

Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
POTENTIAL CULTURAL HERITAGE RESOURCES

Designed	PW	Eng.Chk.	
Drawn	TSG	Coordination	
Dwg.Chk.	PW	Approved	AFK
Scale	1:10000@A3	Project	Status
		CAD File J:\22005\REPORT\ENV\EIA_REPORT(080818)\FIGURE 10.1.dgn	
Drawing No.	FIGURE 10.1		Rev 1

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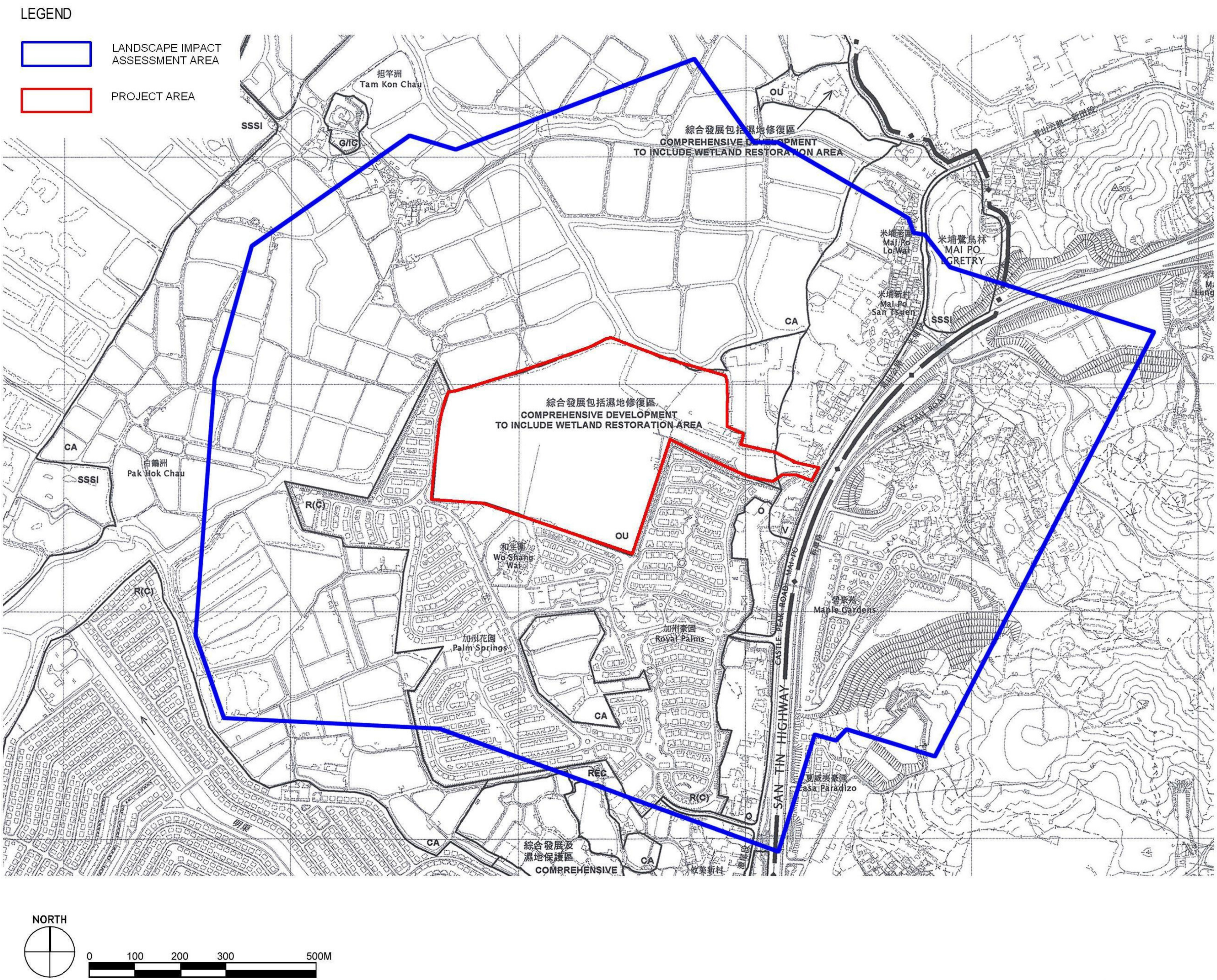

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183 Queen's Road East
Hong Kong
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Fax 2827 1823
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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
EXTRACT OF RELEVANT OZP

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Dwg.Chk.	DM	Approved	DM
Scale	1:8000	Project 221005 / CAD File	Status
Drawing No.	FIGURE 11.1A		Rev

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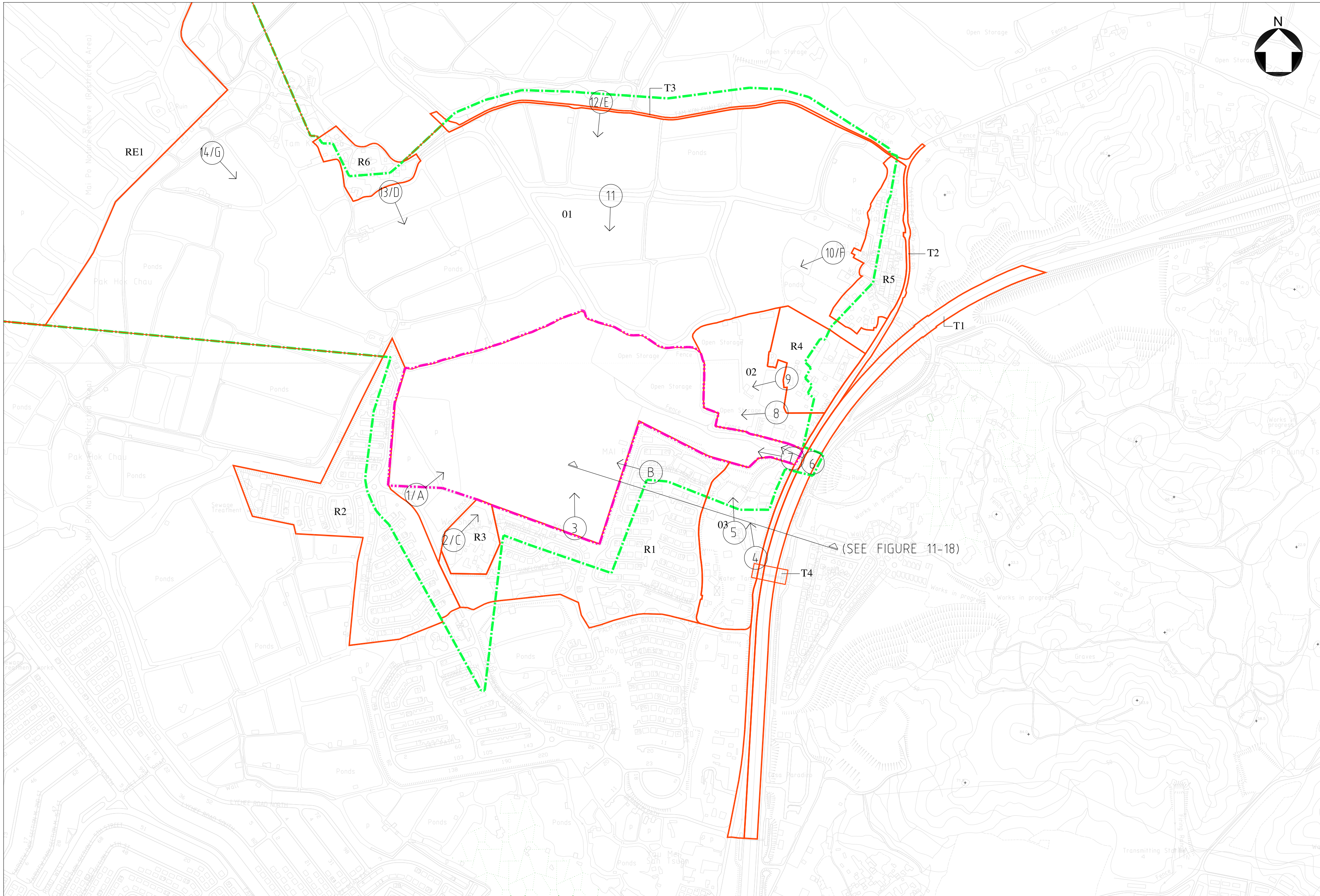

VISUALLY SENSITIVE RECIEVERS (VSRs)

Residential VSRs

R1	Residents in Royal Palms
R2	Residents in Palm Springs
R3	Residents in Wo Shang Wai
R4	Residents in Cottage Area South of Mai Po San Tsuen
R5	Residents in Mai Po San Tsuen and Mai Po Lo Wai
R6	Residents in Tam Kon Chau

Occupational VSRs

O1	Workers in Fishponds around Mai Po
O2	Workers in Industrial / Storage Areas north of Royal Palms
O3	Workers in Industrial / Storage Areas east of Royal Palms

Travelling VSRs

T1	Motorists on San Tin Highway
T2	Motorists on Castle Peak Road
T3	Motorists on Tam Kon Chau Road
T4	Pedestrians on San Tin Highway Footbridge

Recreational VSRs

RE1	Visitors to Mai Po Nature Reserve

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Hong Kong
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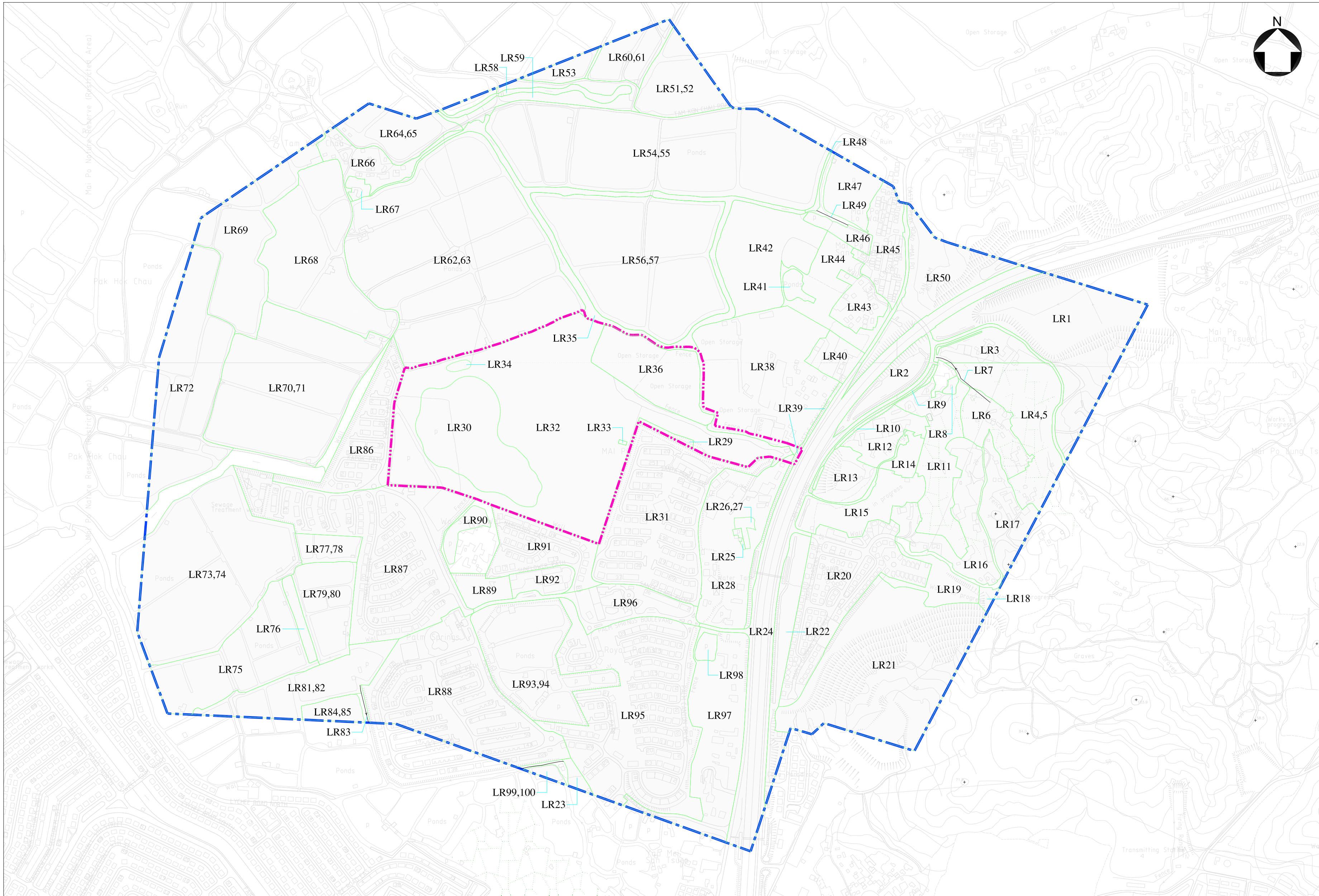
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
PLAN OF ZVI AND VSRs

Designed		Eng.Chk.	
Drawn	TAI	Coordination	
Dwg.Chk.	CD	Approved	CD
Scale 1:4000@A1 1:8000@A3	Project 221005	CAD File Figure-11_1B.dwg	Status
Drawing No.	FIGURE 11-1B		Rev



Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource
LR1	Trees Along East Side of San Tin Highway	LR16	Fruit Trees North of Ki Lung Shan Foothills I	LR31	Trees on northern Boundary of Royal Palms	LR46	Field west of Mai Po Lo Wai	LR61	Trees beside Fishponds north of Tam KonChau Road	LR76	Fish Pond west of Palm Springs	LR91	Trees in northern Palm Springs
LR2	Roadside Trees Surrounding Mai Po Substation	LR17	Woodland North of Ki Lung Shan Foothills II	LR32	Grassland with Seasonal Marsh Patches and Soils on Site	LR47	Pond west of Mai Po San Tsuen	LR62	Fishponds north-west of Site	LR77	Fishponds west of Palm Springs	LR92	Trees at Shopping Mall in Palm Sprin
LR3	Trees Opposite Mai Po San Tsuen	LR18	Trees on Ki Lung Shan Foothills II	LR33	Tree Group on Site	LR48	Channel west of Mai Po San Tsuen	LR63	Trees beside Fishponds north-west of Site	LR78	Trees beside Fishponds west of Palm Springs	LR93	Ponds in Palm Springs
LR4	Field East of San Tam Road	LR19	Trees on Ki Lung Shan Foothills I	LR34	Banana trees on Site	LR49	Channel beside DSD building	LR64	Fishponds north of Tam Kon Chau	LR79	Fishponds west of Palm Springs	LR94	Trees beside Ponds in Palm Springs
LR5	Ponds in Field East of San Tam Road	LR20	Trees in Maple Gardens	LR35	Stream flowing from Tam Kon Chau to the site	LR50	Woodland along Castle Peak Road (Mai Po)	LR65	Trees beside Fishponds north of Tam Kon Chau	LR80	Trees beside Fishponds west of Palm Springs	LR95	Trees in southern Royal Palms
LR6	Trees Behind Field east of San Tam Road	LR21	Grassland on Ki Lung Shan Foothills	LR36	Trees in Open Storage Area	LR51	Fishponds along Tam Kon Chau Road	LR66	Trees in Tam Kon Chau	LR81	Fishponds west of Palm Springs	LR96	Trees around Sports Facilities in Royal Palms
LR7	Stream Next to Field east of San Tam Road	LR22	Trees between San Tin Highway and Maple Gardens	LR37	Not Used	LR52	Trees north of Tam Kon Chau Road	LR67	Pond south of Tam Kon Chau	LR82	Trees beside Fishponds west of Palm Springs	LR97	Trees east of Royal Palms
LR8	Pond East of San Tam Road	LR23	Chunk Kai Horticultural Nursery	LR38	Trees inside Open Storage Area	LR53	Dry Pond north of Tam Kan Chau Road	LR68	Fish Ponds south of Tam Kon Chau	LR83	Stream west of Palm Springs	LR98	Pond south of Palm Springs Boulevard Entrance
LR9	Trees along East Side of San Tam Road	LR24	Trees along San Tin Highway	LR39	Trees along Castle Peak Road (Mai Po)	LR54	Fishponds south of Tam Kon Chau Road	LR69	Fishponds south-west of Tam Kon Chau	LR84	Fishponds west of Palm Springs	LR99	Ponds south of Palm Springs
LR10	Drainage Channel East of San Tam Road	LR25	Pond east of Royal Palms	LR40	Trees in Cottage Area east of Castle Peak Road	LR55	Trees beside Fishponds south of Tam Kon Chau Road	LR70	Fish Pond west of Palm Springs	LR85	Trees beside Fishponds west of Palm Springs	LR100	Trees surrounding Ponds south of Palm Springs
LR11	Grassland East of San Tam Road	LR26	Field east of Royal Palms	LR41	Pond behind Mai Po San Tsuen	LR56	Fish Ponds north-east of Site	LR71	Trees beside Fish Pond west of Palm Springs	LR86	Trees in northern Palm Springs		
LR12	Trees around Cottage Area east of San Tam Road	LR27	Trees east of Royal Palms	LR42	Grassland besides DSD building	LR57	Trees beside Fishponds north-east of Site	LR72	Fishponds north-west of Palm Springs	LR87	Trees in western Palm Springs		
LR13	Slope adjoining San Tam Road	LR28	Trees outside Royal Palms near Palm Canyon Drive	LR43	Trees in Mai Po San Tsuen	LR58	Stream north of Tam Kon Chau Road	LR73	Fishponds west of Palm Springs	LR88	Trees in southern Palm Springs		
LR14	Trees North of Scenic Heights	LR29	Drainage channel at east of site	LR44	Trees behind Mai Po San Tsuen	LR59	Trees beside Stream north of Tam Kon Chau Road	LR74	Trees beside Fishponds west of Palm Springs	LR89	Trees in Car Park in Palm Springs		
LR15	Trees inside Scenic Heights	LR30	Freshwater Marsh	LR45	Trees in Mai Po Lo Wai	LR60	Fishponds north of Tam Kon Chau Road	LR75	Fishponds west of Palm Springs	LR90	Pond in Wo Shang Wai Village		

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Mott Connell
Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

Client
PROFIT POINT ENTERPRISES LTD.

Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE RESOURCES (PLAN)

Designed		Eng.Chk.	
Drawn	TAI	Coordination	
Dwg.Chk.	CD	Approved	CD
Scale 1:4000@A1 1:8000@A3	Project 221005	Status	
	CAD File Figure-11_2.DWG		
Drawing No. FIGURE 11-2		Rev A	

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1. LR001 - Trees along east side of San Tin Highway

2. LR002 - Roadside trees surrounding Mai Po Substation

3. LR003 - Trees opposite Mai Po San Tsuen

4. LR004 - Field east of San Tam Road

5. LR005 - Ponds in field east of San Tam Road

6. LR006 - Trees behind field east of San Tam Road

7. LR007 - Stream next to field east of San Tam Road

8. LR008 - Pond east of San Tam Road

9. LR009 - Trees along east side of San Tam Road

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Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

Client
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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 1 OF 12)

Designed	DC	Eng.Chk.	
Drawn	FD	Coordination	
Dwg.Chk.	DM	Approved	
Scale	N.T.S.	Project 221005	Status
		CAD File	
Drawing No.	Figure 11.3		Rev

10. LR010 - Drainage channel east of San Tam Road

11. LR011 - Grassland east of San Tam Road

12. LR012 - Trees around cottage area east of San Tam Road

13. LR013 - Slope adjoining San Tam Road

14. LR014 - Trees north of Scenic Heights

15. LR015 - Trees inside Scenic Heights

16. LR016 - Fruit trees north of Ki Lung Shan Foothills I

17. LR017 - Woodland north of Ki Lung Shan Foothills II

18. LR018 - Trees on Ki Lung Shan Foothills II

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Fax 2827 1823
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Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 2 OF 12)

Designed	DC	Eng.Chk.	
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Dwg.Chk.	DM	Approved	
Scale	N.T.S.	Project 221005	Status
		CAD File	
Drawing No.	Figure 11.4		Rev

19. LR019 - Trees on Ki Lung Shan Foothills I

20. LR020 - Trees in Maple Gardens

21. LR021 Grassland on Ki Lung Shan Foothills

22. LR022 - Trees between San Tin Highway and Maple Gardens

23. LR023 - Chunk Kai Horticultural Nursery

24. LR024 - Trees along San Tin Highway

25. LR025 - Pond east of Royal Palms
LR026 - Field east of Royal Palms
LR027 - Trees east of Royal Palms

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Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 3 OF 12)

Designed	DC	Eng.Chk.			
Drawn	FD	Coordination			
Dwg.Chk.	DM	Approved			
Scale	N.T.S.	Project	221005	Status	
		CAD File			
Drawing No.	Figure 11.5			Rev	

26. LR028 - Trees outside Royal Palms near Palm Canyon Drive

26a. LR029- Drainage channel at East of Site (on-site)

27. LR030 - Freshwater Marsh (on-site)

28. LR031 - Trees on northern Boundary of Royal Palms

29. LR032 - Grassland with Seasonal Marsh Patches and Soils On Site

30. LR033 - Tree Group on Site (on-site)

31. LR034 - Banana trees on Site (on-site)

32. LR035 - Stream on northern Boundary of Site (off-site)

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Hong Kong
Tel 2828 5757
Fax 2827 1823
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Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 4 OF 12)

Designed	DC	Eng.Chk.	
Drawn	SL	Coordination	
Dwg.Chk.	CD	Approved	CD
Scale	N.T.S.	Project	221005
		CAD File	
Drawing No.	FIGURE 11.6	Rev	A
		Status	

33. LR036 - Trees inside open storage area (on-site)

34. LR037 - Not Used

35. LR038 - Trees inside open storage area

36. LR039 - Trees along Castle Peak Road (Mai Po) (on-site)

37. LR040 - Trees in cottage area east of Castle Peak Road

38. LR041 - Pond behind Mai Po San Tsuen

39. LR042 - Grassland besides DSD building

40. LR043 - Trees in Mai Po San Tsuen

41. LR044 - Trees behind Mai Po San Tsuen

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 5 OF 12)

Designed	DC	Eng.Chk.	
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42. LR045 - Trees in Mai Po Lo Wai

43. LR046 - Field west of Mai Po Lo Wai

44. LR047 - Pond west of Mai Po San Tsuen

45. LR048 - Channel west of Mai Po San Tsuen

46. LR049 - Channel beside DSD building

47. LR050 - Woodland along Castle Peak Road (Mai Po)

48. LR051 - Fishponds along Tam Kon Chau Road;
LR052 - Trees north of Tam Kon Chau Road

49. LR053 - Dry Pond along Tam Kon Chau Road

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Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 6 OF 12)

Designed	DC	Eng.Chk.	
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Scale	N.T.S.	Project 221005 / CAD File	Status
Drawing No.	Figure 11.8		Rev

50. LR054 - Fishponds south of Tam Kon Chau Road;
LR055 - Trees beside fishponds south of Tam Kon Chau Road

51. LR056 - Fishponds north-east of site
LR057 - Trees beside fishponds north-east of Site

52. LR058 - Stream north of Tam Kon Chau Road;
LR059 - Trees beside stream north of Tam Kon Chau Road

53. LR060- Fishponds north of Tam Kon Chau Road;
LR061- Trees beside fishponds north of Tam Kon Chau Road

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Mott Connell Limited
40/F Hopewell Centre
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Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

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ENTERPRISES LTD.

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PROPOSED COMPREHENSIVE DEVELOPMENT
AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE RESOURCES (VIEWS)
(SHEET 7 OF 12)

Designed	DC	Eng.Chk.	
Drawn	FD	Coordination	
Dwg.Chk.	DM	Approved	
Scale	N.T.S.	Project 221005	Status
		CAD File	
Drawing No.	Figure 11.9		Rev

54. LR062 - Fishponds north-west of Site
LR063 - Trees beside fishponds north-west of Site

55. LR064 - Fishponds north of Tam Kon Chau
LR065 - Trees beside fishponds north of Tam Kon Chau

56. LR066 - Trees in Tam Kon Chau

57. LR067 - Pond south of Tam Kon Chau

58. LR068 - Fishponds south of Tam Kon Chau

59. LR069 - Fishponds south-west of Tam Kon Chau

60. LR070 - Fishpond west of Palm Springs;
LR071 - Trees beside fishpond west of Palm Springs

61. LR072 - Fishponds north-west of Palm Springs

62. LR073 - Fishponds west of Palm Springs

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Fax 2827 1823
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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 8 OF 12)

Designed	DC	Eng.Chk.	
Drawn	FD	Coordination	
Dwg.Chk.	DM	Approved	
Scale	N.T.S.	Project 221005 / CAD File	Status
Drawing No.	Figure 11.10		Rev

63. LR074 - Trees beside fishponds west of Palm Springs

64. LR075 - Fishponds west of Palm Springs

65. LR076 - Fishpond west of Palm Springs

66. LR077 - Fishponds west of Palm Springs;
LR078 - Trees beside fishponds west of Palm Springs

67. LR079 - Fishponds west of Palm Springs

68. LR080 - Trees beside fishponds west of Palm Springs

69. LR081 - Fishponds west of Palm Springs

70. LR082 - Trees beside fishponds west of Palm Springs

71. LR083 - Stream west of Palm Springs

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Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

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Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 9 OF 12)

Designed	DC	Eng.Chk.			
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Dwg.Chk.	DM	Approved			
Scale	N.T.S.	Project	221005	Status	
		CAD File			
Drawing No.	Figure 11.11			Rev	

72. LR084 - Fishponds west of Palm Springs

73. LR085 - Trees beside fishponds west of Palm Springs

74. LR086 - Trees in northern Palm Springs

75. LR087 - Trees in western Palm Springs

76. LR088 - Trees in southern Palm Springs

77. LR089 - Trees in car park in Palm Springs

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Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

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Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 10 OF 12)

Designed	DC	Eng.Chk.	
Drawn	FD	Coordination	
Dwg.Chk.	DM	Approved	
Scale	N.T.S.	Project 221005	Status
		CAD File	
Drawing No.	Figure 11.12		Rev

78. LR090 - Pond in Wo Shang Wai Village

79. LR091 - Trees in northern Palm Springs

80. LR092 - Trees at Shopping Mall in Palm Springs

81. LR093 - Ponds in Palm Springs

82. LR094 - Trees beside ponds in Palm Springs

83. LR095 - Trees in southern of Royal Palms

84. LR096 - Trees around sports facilities in Royal Palms

85. LR097 - Trees east of Royal Palms

86. LR098 - Pond south of Palm Springs Boulevard entrance

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Project
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE RESOURCES (VIEWS) (SHEET 11 OF 12)

Designed	DC	Eng.Chk.			
Drawn	FD	Coordination			
Dwg.Chk.	DM	Approved			
Scale	N.T.S.	Project	221005	Status	
		CAD File			
Drawing No.	Figure 11.13			Rev	

87. LR099 - Ponds south of Palm Springs;
LR100 - Trees surround ponds south of Palm Springs

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Title
LANDSCAPE RESOURCES (VIEWS)
(SHEET 12 OF 12)

Designed	DC	Eng.Chk.		
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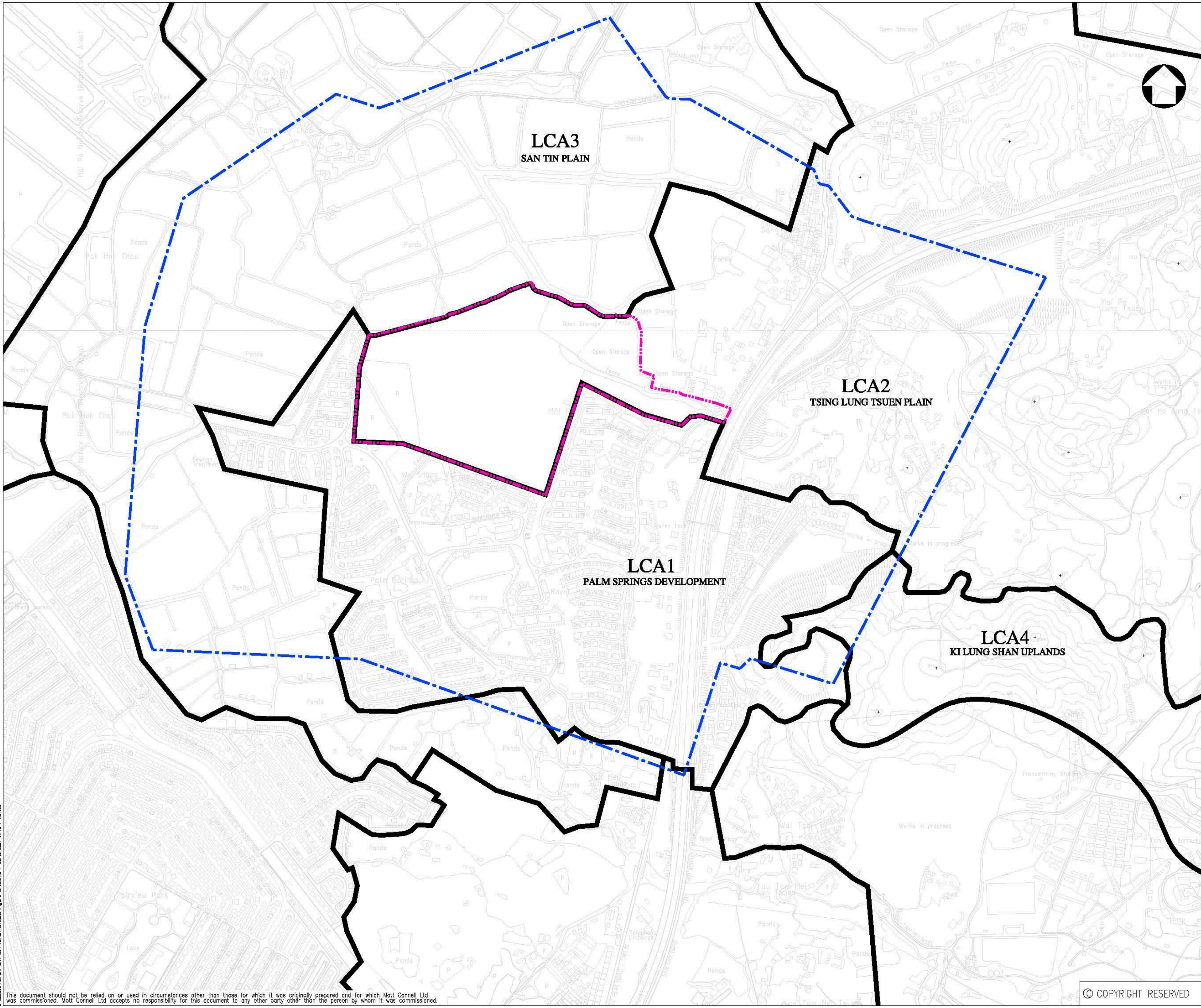

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE CHARCTER AREAS (PLAN)

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Drawn		Coordination	
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Scale 1:4000@A1 1:8000@A3	Project 221005		Status
	CAD File J:\221005\REPORT\ENV\EIA_REPORT(070122)\Figure-11_15.DWG		
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Tsing Lung Tsuen Plain

San Tin Plain

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
PHOTO VIEWS OF LANDSCAPE CHARACTER AREAS (1 OF 2)

Designed		Eng.Chk.	
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Ki Lung Shan Uplands

Palm Springs Development

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Title
PHOTO VIEWS OF LANDSCAPE CHARACTER AREAS (2 OF 2)

Designed		Eng.Chk.	
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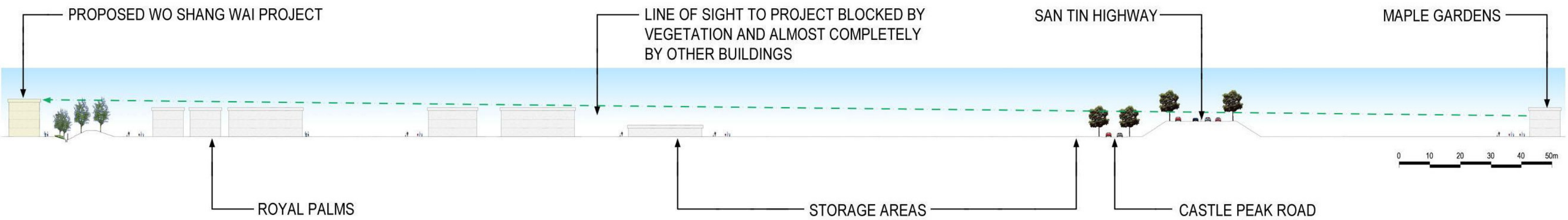
Scale	Project 221005		Status
	CAD File		
Drawing No.	FIGURE 11.17		Rev



SECTION (LOOKING NORTH)

NOTE: REFER TO FIGURE 11.18A FOR LOCATION OF SECTION

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SECTION SHOWING DERIVATION OF ZVI

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Drawing No.	FIGURE 11.18		Rev

View 1 - View from site close to Palm Springs

View 2 - View of Residents in Wo Shang Wai

View 3 - View from site close to Royal Palms

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Title
PHOTOS OF VSR VIEWS (1 OF 5)

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Drawing No.	FIGURE 11.19	Rev	A

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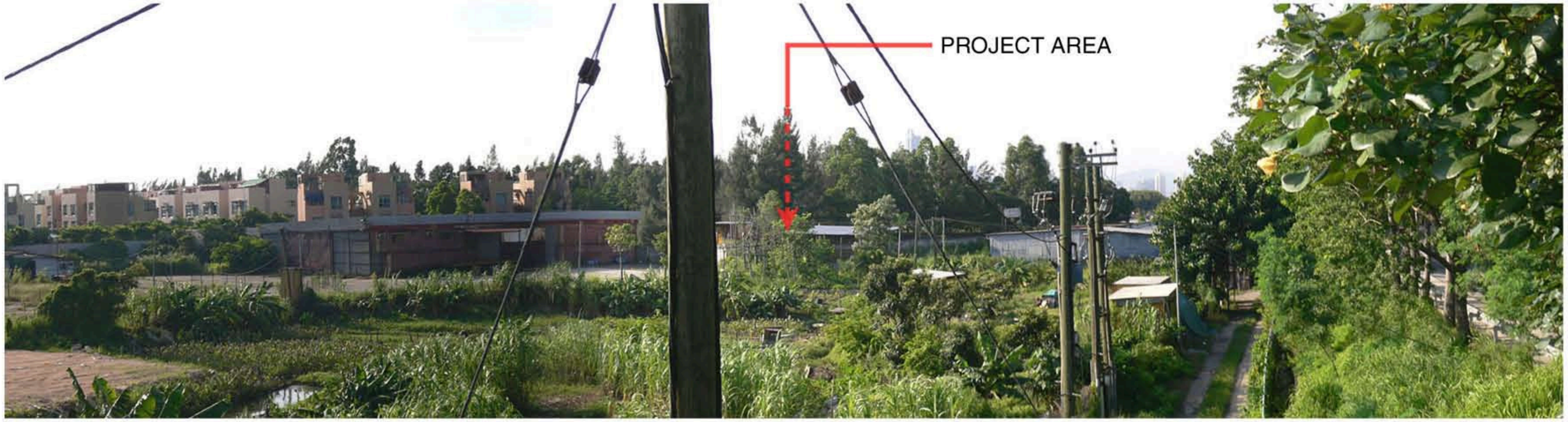

Viewpoint No.4 - View of Pedestrians on San Tin Highway Footbridge (T4)

Viewpoint No.5 - View of Workers in Industrial / Storage Areas east of Royal Palms (O3)

Viewpoint No.6 - View of Motorists on San Tin Highway (T1)

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PHOTOS OF VSR VIEWS (2 OF 5)

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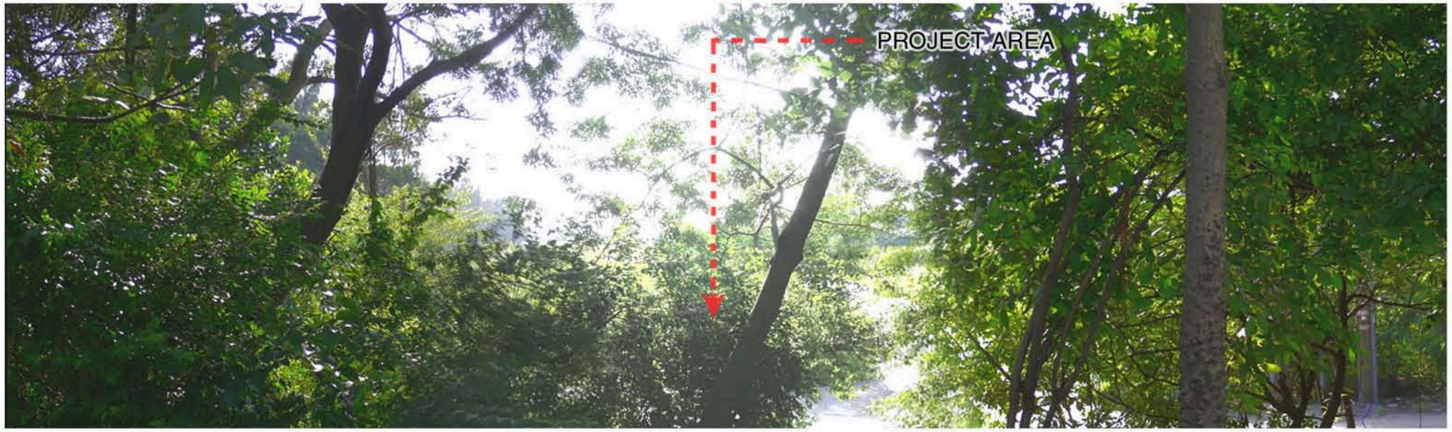
Scale		Project 221005	Status
		CAD File	
Drawing No.	FIGURE 11.20		Rev A



Viewpoint No.7 - View of Motorists on Castle Peak Road (T2)

Viewpoint No.8 - View of Workers in Industrial / Storage Areas north of Royal Palms (O2)

Viewpoint No.9 - View of Residents in Cottage Area South of Mai Po San Tsuen (R4)

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Title
PHOTOS OF VSR VIEWS (3 OF 5)

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Scale		Project 221005	Status
		CAD File	
Drawing No.	FIGURE 11.21	Rev	A

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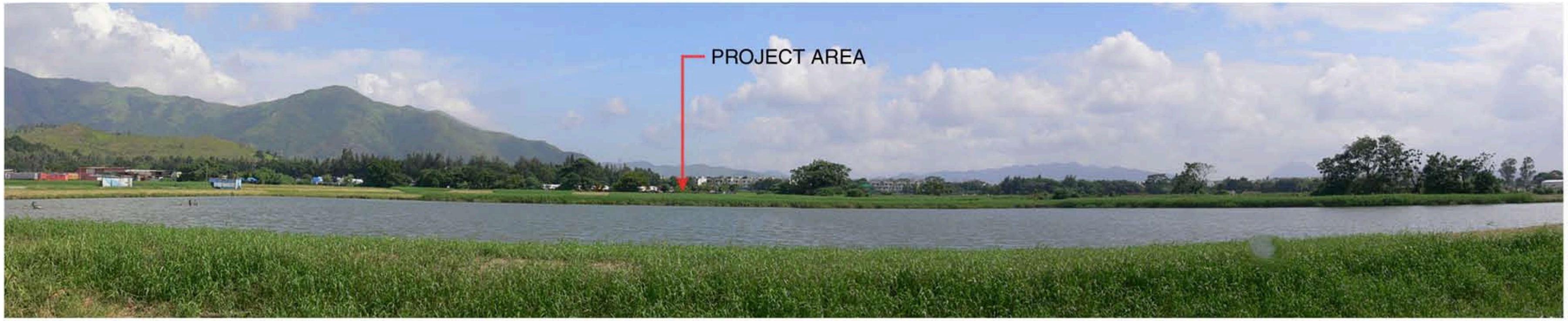
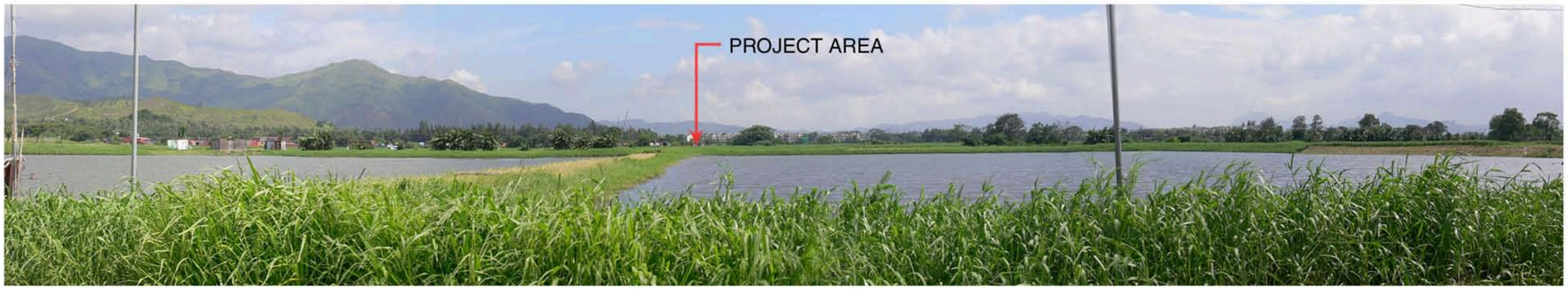
Viewpoint No.10 - View of Residents in Mai Po San Tsuen and Mai Po Lo Wai (R5)



Viewpoint No.11 - View of Workers in Fishponds Around Mai Po (O1)



Viewpoint No.12 - View of Motorists on Tam Kon Chau Road (T3)

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Title
PHOTOS OF VSR VIEWS (4 OF 5)

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Scale		Project	221005	Status	
		CAD File			
Drawing No.	FIGURE 11.22			Rev	A

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Viewpoint No.13 - View of Residents in Tam Kon Chau (R6)

Viewpoint No.14 - Existing View from Mai Po Nature Reserve

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Title: PHOTOS OF VSR VIEWS (5 OF 5)

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Dwg.Chk.	CD	Approved	CD
Scale		Project	221005
		CAD File	
Drawing No.	FIGURE 11.23	Rev	A

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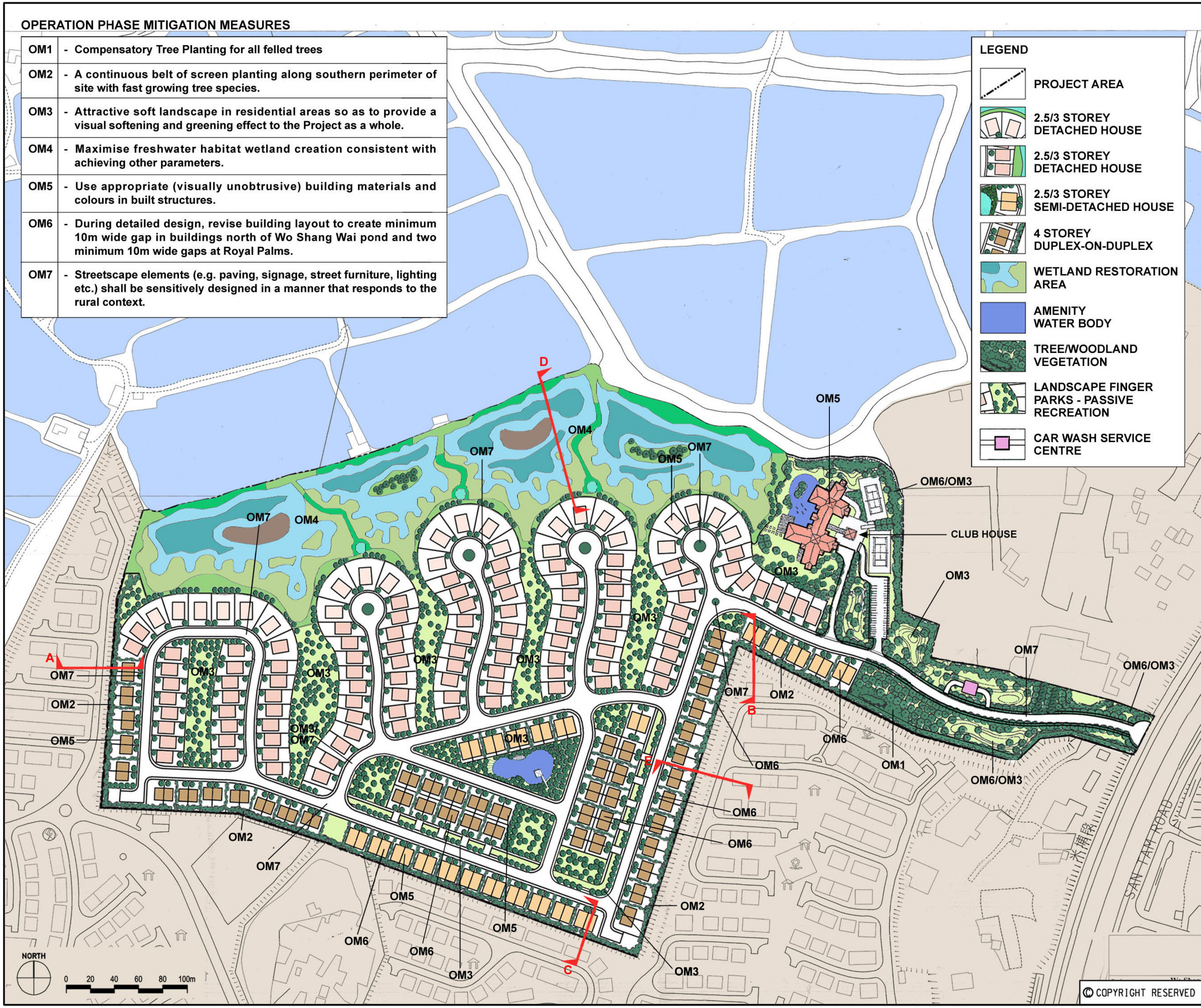
OPERATION PHASE MITIGATION MEASURES

OM1	- Compensatory Tree Planting for all felled trees
OM2	- A continuous belt of screen planting along southern perimeter of site with fast growing tree species.
OM3	- Attractive soft landscape in residential areas so as to provide a visual softening and greening effect to the Project as a whole.
OM4	- Maximise freshwater habitat wetland creation consistent with achieving other parameters.
OM5	- Use appropriate (visually unobtrusive) building materials and colours in built structures.
OM6	- During detailed design, revise building layout to create minimum 10m wide gap in buildings north of Wo Shang Wai pond and two minimum 10m wide gaps at Royal Palms.
OM7	- Streetscape elements (e.g. paving, signage, street furniture, lighting etc.) shall be sensitively designed in a manner that responds to the rural context.



NOTE :
1. FOR WETLAND RESTORATION AREA DESIGN, SEE WETLAND RESTORATION PLAN
2. DESIGN OF BOUNDARY OF SITE ADJACENT TO PALM SPRINGS, WO SHANG WAI AND ROYAL PALMS SUBJECT TO DETAILED DESIGN.

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE AND VISUAL MITIGATION MEASURES (1 OF 7)

Designed		Eng.Chk.	
Drawn	DK	Coordination	
Dwg.Chk.	CD	Approved	CD
Scale	Project 221005	CAD File	Status
Drawing No.	FIGURE 11.24A	Rev	C

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CONSTRUCTION PHASE MITIGATION MEASURES

CM1	- The construction area and contractor' s temporary works areas should be minimised.
CM2	- Screening of construction works by hoarding / noise barriers.
CM3	- Reduction of construction period to practical minimum.
CM4	- Topsoil, where identified, should be stripped and stored for re-use.
CM5	- Hydroseeding or sheeting of soil stockpiles.
CM6	- Advance Screen Planting to Noise Barriers.
CM7	- Control night-time lighting and glare by hooding all lights.
CM8	- Ensure no run-off into streams adjacent to Site.
CM9	- Protection of existing trees on boundary of site.
CM10	- Trees unavoidably affected by the works shall be transplanted where practical.

NOTE :
FOR WETLAND RESTORATION AREA DESIGN, SEE WETLAND RESTORATION PLAN

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183 Queen's Road East
Hong Kong
Tel 2828 5757
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Wed www.mottmac.com

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE AND VISUAL MITIGATION MEASURES (2 OF 7)

Designed		Eng.Chk.	
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Scale	Project 221005	CAD File	Status
Drawing No.	FIGURE 11.24B		Rev A

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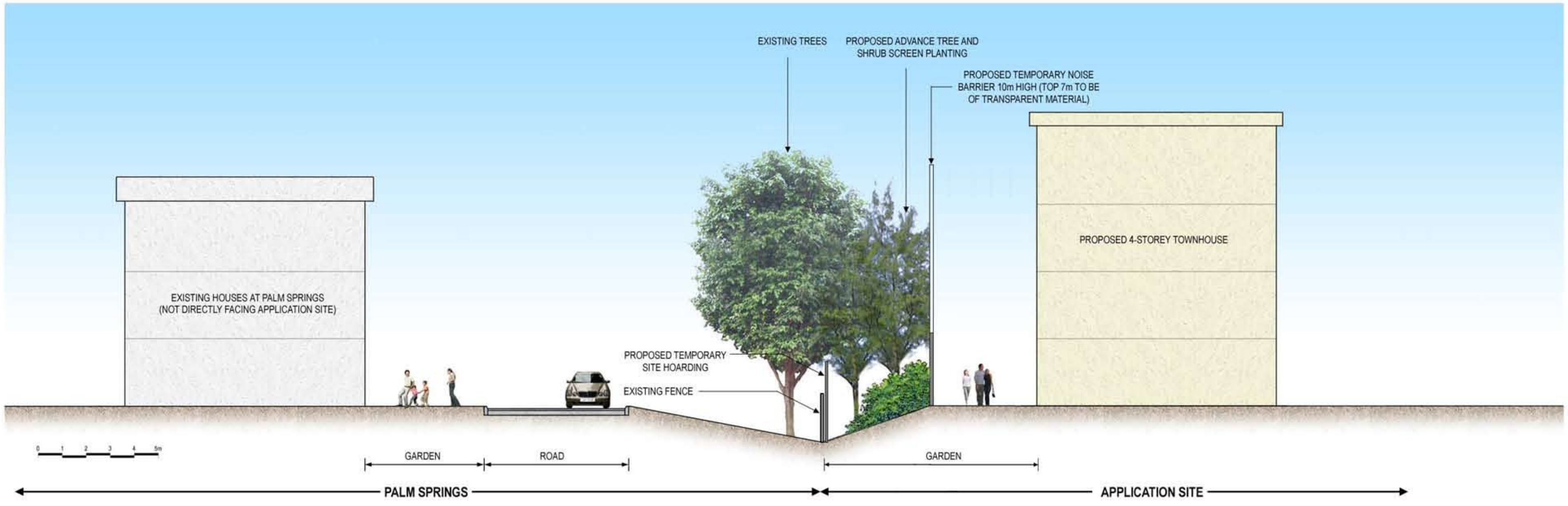

SECTION A - SECTION THROUGH PALM SPRINGS (WEST) / APPLICATION SITE (APPROXIMATE)

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

LANDSCAPE AND VISUAL MITIGATION MEASURES (3 OF 7)

Designed		Eng.Chk.	
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Dwg.Chk.	CD	Approved	CD
Scale	1:200	Project 221005 / CAD File	Status
Drawing No.	FIGURE 11.25A		Rev A

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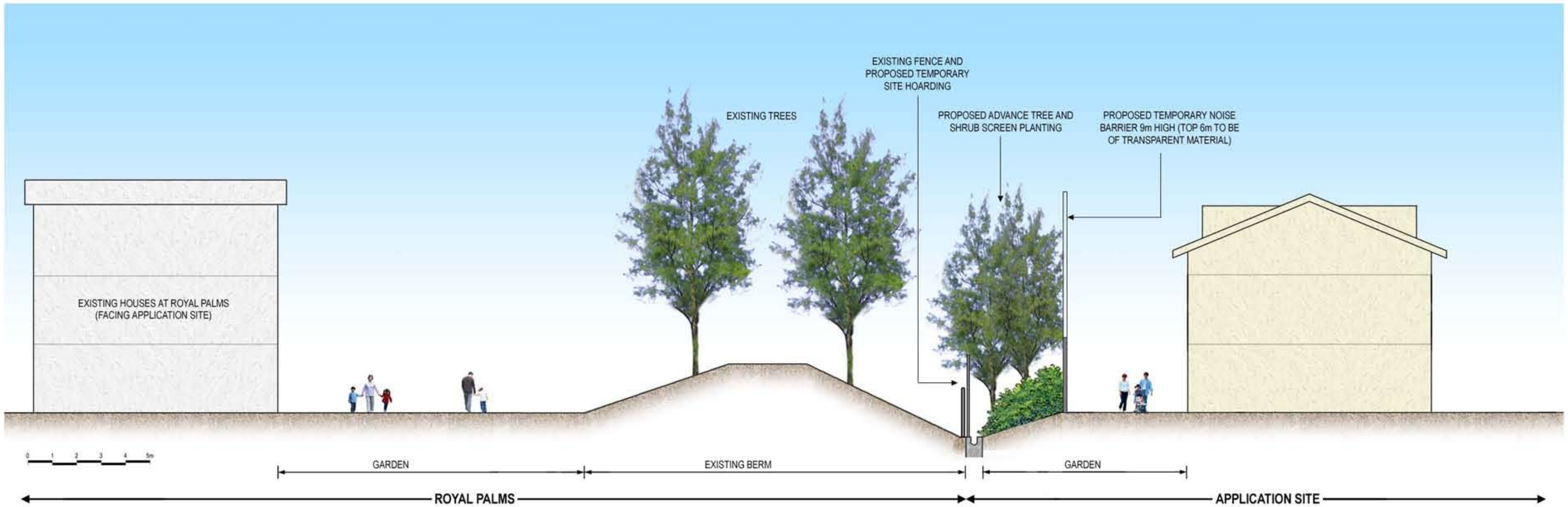

SECTION B - SECTION THROUGH ROYAL PALMS (NORTH) / APPLICATION SITE

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Title

LANDSCAPE AND VISUAL MITIGATION MEASURES (4 OF 7)

Designed		Eng.Chk.	
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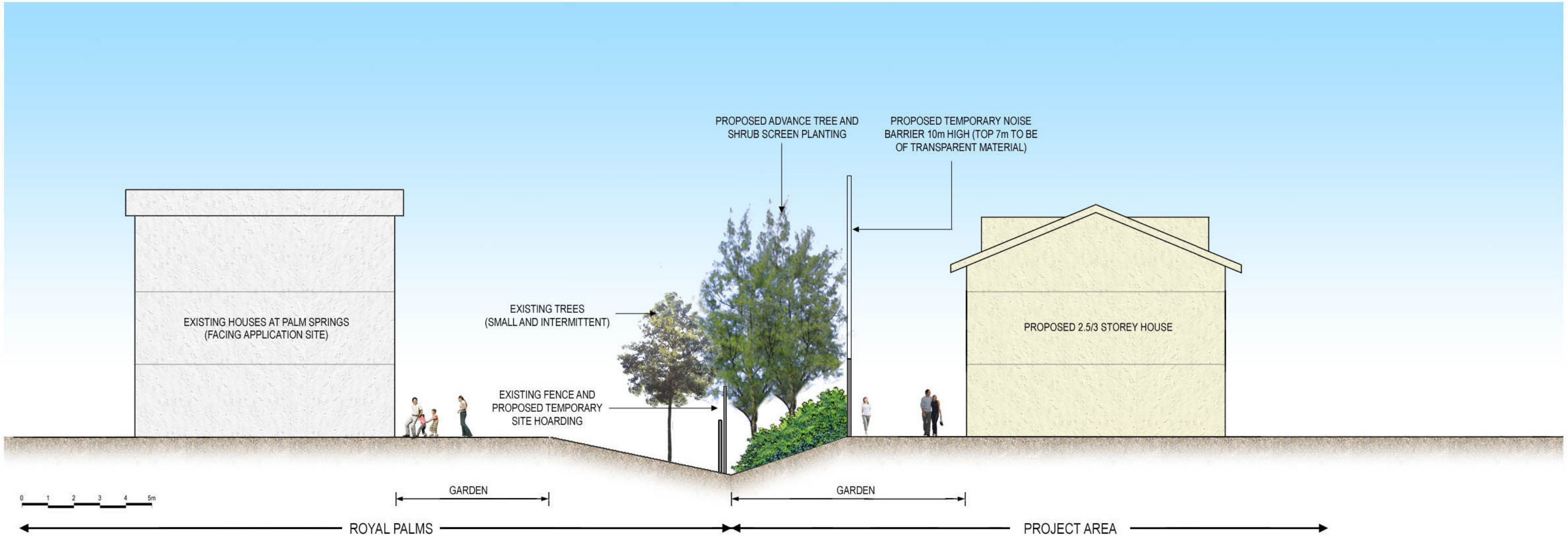

SECTION C - SECTION THROUGH ROYAL PALMS (EAST) / PROJECT AREA (APPROXIMATE)

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE AND VISUAL MITIGATION MEASURES (5 OF 7)

Designed		Eng.Chk.	
Drawn	DK	Coordination	
Dwg.Chk.	CD	Approved	CD
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		CAD File	
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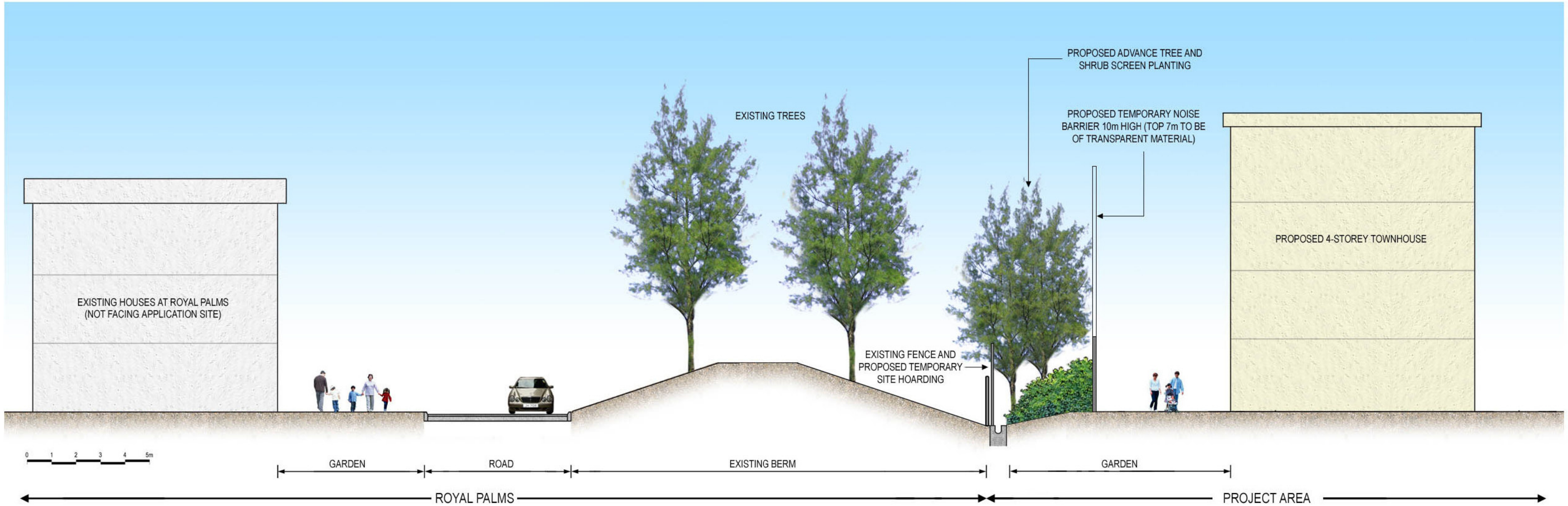

SECTION E - SECTION THROUGH ROYAL PALMS (WEST) / PROJECT AREA (APPROXIMATE)

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Title
LANDSCAPE AND VISUAL MITIGATION MEASURES (6 OF 7)

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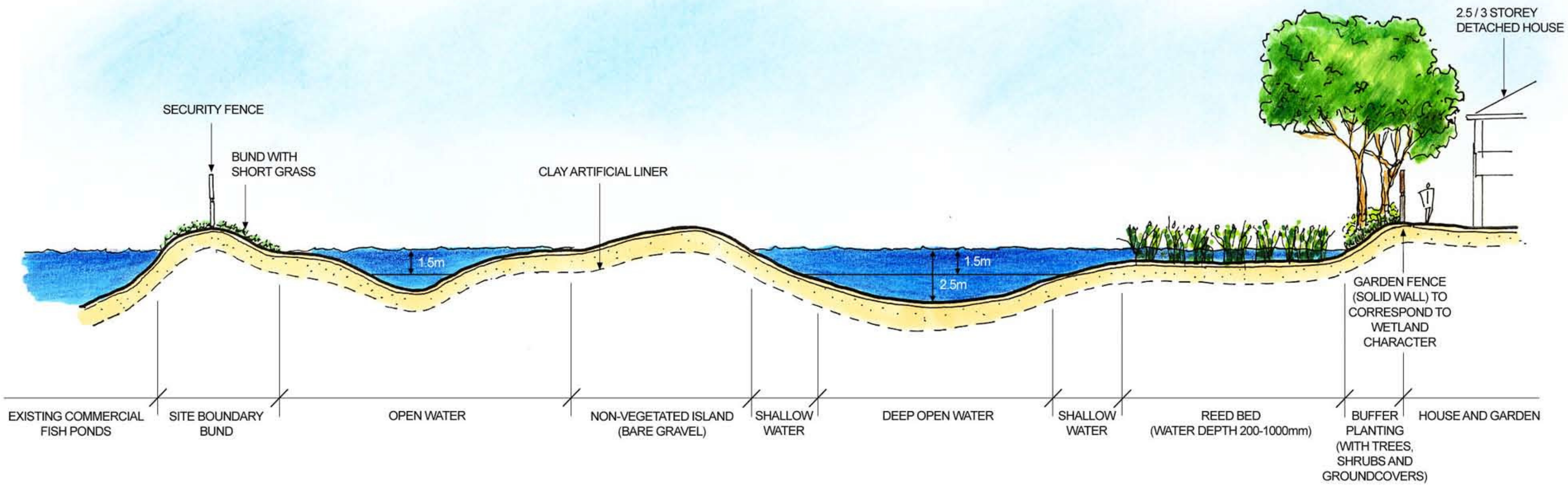

SECTION D - THROUGH INTERFACE OF WETLAND BUFFER AND RESIDENTIAL AREA (TYPICAL)

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
LANDSCAPE AND VISUAL MITIGATION MEASURES (7 OF 7)

Designed		Eng.Chk.	
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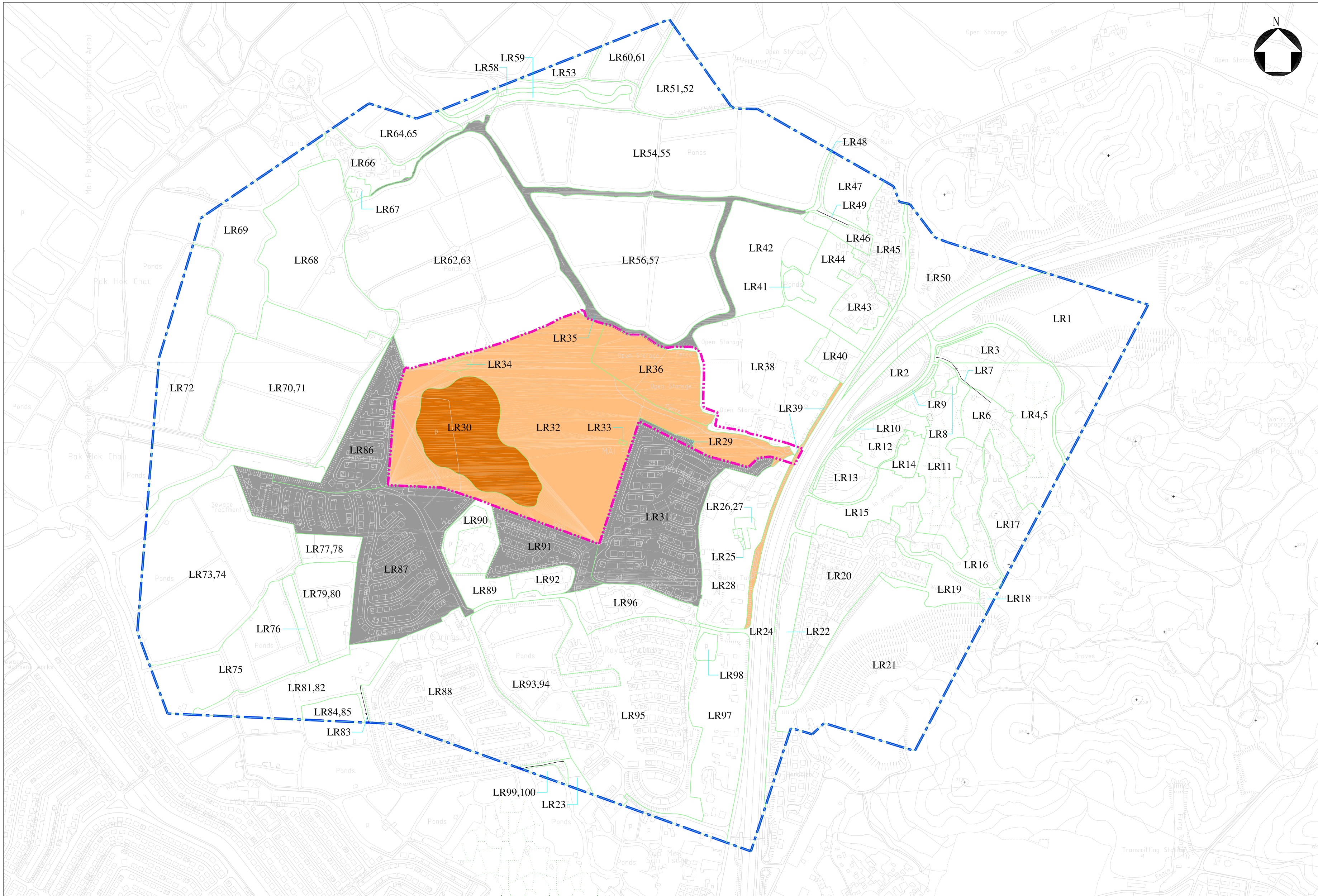

LEGENDS:

- LANDSCAPE IMPACT ASSESSMENT AREA (500m FROM SITE)
- PROJECT AREA
- LANDSCAPE RESOURCE WITH REF. No.

SIGNIFICANCE OF LANDSCAPE IMPACT

- SLIGHT POSITIVE
- INSUBSTANTIAL
- SLIGHT NEGATIVE
- MODERATE NEGATIVE
- SUBSTANTIAL NEGATIVE

Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource
LR1	Trees Along East Side of San Tin Highway	LR16	Fruit Trees North of Ki Lung Shan Foothills I	LR31	Trees on northern Boundary of Royal Palms	LR46	Field west of Mai Po Lo Wai	LR61	Trees beside Fishponds north of Tam KonChau Road	LR76	Fish Pond west of Palm Springs	LR91	Trees in northern Palm Springs
LR2	Roadside Trees Surrounding Mai Po Substation	LR17	Woodland North of Ki Lung Shan Foothills II	LR32	Grassland with Seasonal Marsh Patches and Soils on Site	LR47	Pond west of Mai Po San Tsuen	LR62	Fishponds north-west of Site	LR77	Fishponds west of Palm Springs	LR92	Trees at Shopping Mall in Palm Sprin
LR3	Trees Opposite Mai Po San Tsuen	LR18	Trees on Ki Lung Shan Foothills II	LR33	Tree Group on Site	LR48	Channel west of Mai Po San Tsuen	LR63	Trees beside Fishponds north-west of Site	LR78	Trees beside Fishponds west of Palm Springs	LR93	Ponds in Palm Springs
LR4	Field East of San Tam Road	LR19	Trees on Ki Lung Shan Foothills I	LR34	Banana trees on Site	LR49	Channel beside DSD building	LR64	Fishponds north of Tam Kon Chau	LR79	Fishponds west of Palm Springs	LR94	Trees beside Ponds in Palm Springs
LR5	Ponds in Field East of San Tam Road	LR20	Trees in Maple Gardens	LR35	Stream flowing from Tam Kon Chau to the site	LR50	Woodland along Castle Peak Road (Mai Po)	LR65	Trees beside Fishponds north of Tam Kon Chau	LR80	Trees beside Fishponds west of Palm Springs	LR95	Trees in southern Royal Palms
LR6	Trees Behind Field east of San Tam Road	LR21	Grassland on Ki Lung Shan Foothills	LR36	Trees in Open Storage Area	LR51	Fishponds along Tam Kon Chau Road	LR66	Trees in Tam Kon Chau	LR81	Fishponds west of Palm Springs	LR96	Trees around Sports Facilities in Royal Palms
LR7	Stream Next to Field east of San Tam Road	LR22	Trees between San Tin Highway and Maple Gardens	LR37	Not Used	LR52	Trees north of Tam Kon Chau Road	LR67	Pond south of Tam Kon Chau	LR82	Trees beside Fishponds west of Palm Springs	LR97	Trees east of Royal Palms
LR8	Pond East of San Tam Road	LR23	Chunk Kai Horticultural Nursery	LR38	Trees inside Open Storage Area	LR53	Dry Pond north of Tam Kan Chau Road	LR68	Fish Ponds south of Tam Kon Chau	LR83	Stream west of Palm Springs	LR98	Pond south of Palm Springs Boulevard Entrance
LR9	Trees along East Side of San Tam Road	LR24	Trees along San Tin Highway	LR39	Trees along Castle Peak Road (Mai Po)	LR54	Fishponds south of Tam Kon Chau Road	LR69	Fishponds south-west of Tam Kon Chau	LR84	Fishponds west of Palm Springs	LR99	Ponds south of Palm Springs
LR10	Drainage Channel East of San Tam Road	LR25	Pond east of Royal Palms	LR40	Trees in Cottage Area east of Castle Peak Road	LR55	Trees beside Fishponds south of Tam Kon Chau Road	LR70	Fish Pond west of Palm Springs	LR85	Trees beside Fishponds west of Palm Springs	LR100	Trees surrounding Ponds south of Palm Springs
LR11	Grassland East of San Tam Road	LR26	Field east of Royal Palms	LR41	Pond behind Mai Po San Tsuen	LR56	Fish Ponds north-east of Site	LR71	Trees beside Fish Pond west of Palm Springs	LR86	Trees in northern Palm Springs		
LR12	Trees around Cottage Area east of San Tam Road	LR27	Trees east of Royal Palms	LR42	Grassland besides DSD building	LR57	Trees beside Fishponds north-east of Site	LR72	Fishponds north-west of Palm Springs	LR87	Trees in western Palm Springs		
LR13	Slope adjoining San Tam Road	LR28	Trees outside Royal Palms near Palm Canyon Drive	LR43	Trees in Mai Po San Tsuen	LR58	Stream north of Tam Kon Chau Road	LR73	Fishponds west of Palm Springs	LR88	Trees in southern Palm Springs		
LR14	Trees North of Scenic Heights	LR29	Drainage channel at east of site	LR44	Trees behind Mai Po San Tsuen	LR59	Trees beside Stream north of Tam Kon Chau Road	LR74	Trees beside Fishponds west of Palm Springs	LR89	Trees in Car Park in Palm Springs		
LR15	Trees inside Scenic Heights	LR30	Freshwater Marsh	LR45	Trees in Mai Po Lo Wai	LR60	Fishponds north of Tam Kon Chau Road	LR75	Fishponds west of Palm Springs	LR90	Pond in Wo Shang Wai Village		

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Mott Connell Limited
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Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

LANDSCAPE RESOURCES IMPACTS IN CONSTRUCTION PHASE

Designed		Eng.Chk.	
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Dwg.Chk.	CD	Approved	CD
Scale 1:4000@A1 1:8000@A3	Project 221005	CAD File Figure-11.27.DWG	Status
Drawing No.	FIGURE 11-27	Rev	A

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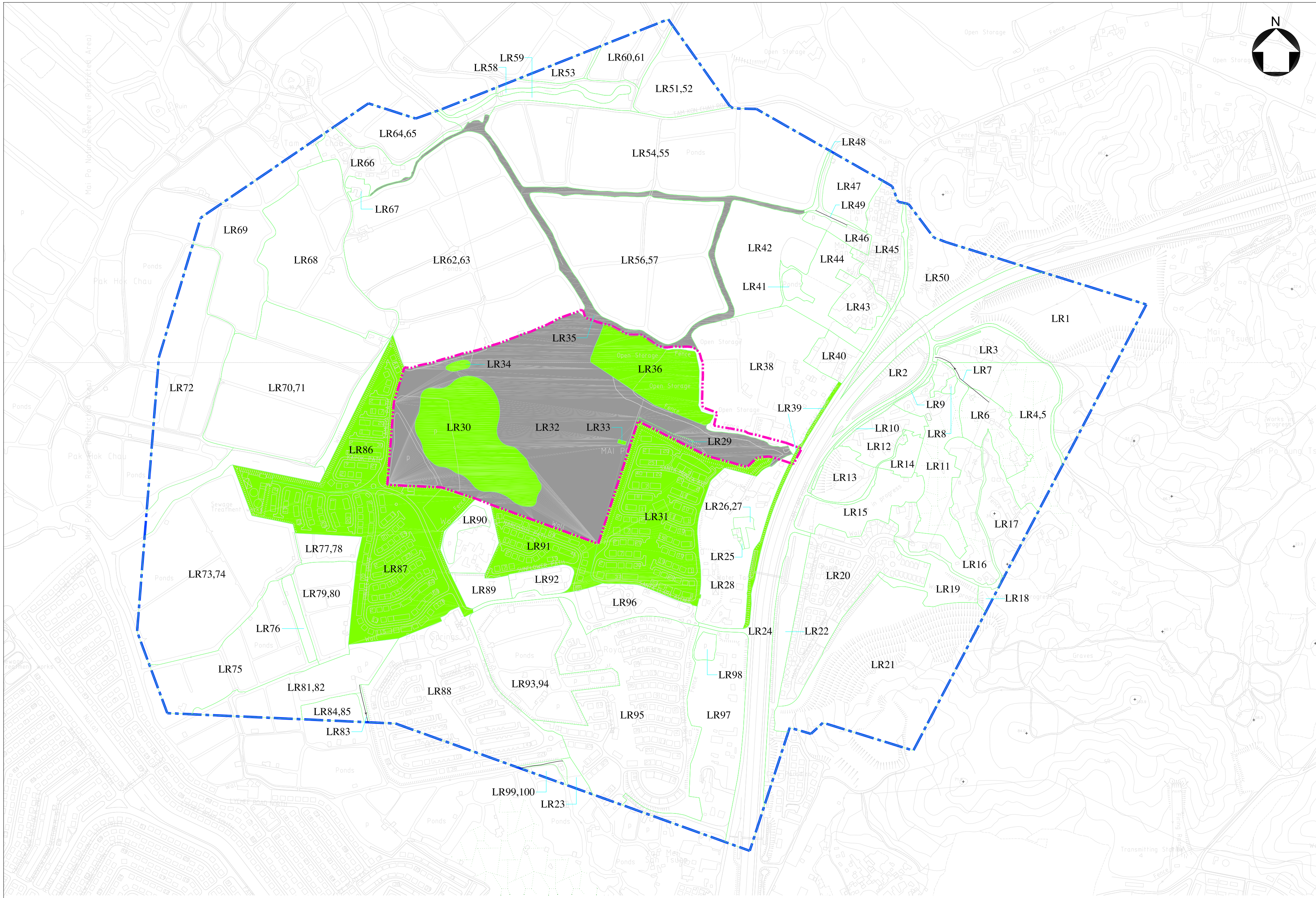

LEGENDS:

LANDSCAPE IMPACT ASSESSMENT AREA (500m FROM SITE)

PROJECT AREA

LANDSCAPE RESOURCE WITH REF. No.

SIGNIFICANCE OF LANDSCAPE IMPACT

SLIGHT POSITIVE

INSUBSTANTIAL

SLIGHT NEGATIVE

MODERATE NEGATIVE

SUBSTANTIAL NEGATIVE

Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource	Identity No.	Landscape Resource
LR1	Trees Along East Side of San Tin Highway	LR16	Fruit Trees North of Ki Lung Shan Foothills I	LR31	Trees on northern Boundary of Royal Palms	LR46	Field west of Mai Po Lo Wai	LR61	Trees beside Fishponds north of Tam KonChau Road	LR76	Fish Pond west of Palm Springs	LR91	Trees in northern Palm Springs
LR2	Roadside Trees Surrounding Mai Po Substation	LR17	Woodland North of Ki Lung Shan Foothills II	LR32	Grassland with Seasonal Marsh Patches and Soils on Site	LR47	Pond west of Mai Po San Tsuen	LR62	Fishponds north-west of Site	LR77	Fishponds west of Palm Springs	LR92	Trees at Shopping Mall in Palm Sprin
LR3	Trees Opposite Mai Po San Tsuen	LR18	Trees on Ki Lung Shan Foothills II	LR33	Tree Group on Site	LR48	Channel west of Mai Po San Tsuen	LR63	Trees beside Fishponds north-west of Site	LR78	Trees beside Fishponds west of Palm Springs	LR93	Ponds in Palm Springs
LR4	Field East of San Tam Road	LR19	Trees on Ki Lung Shan Foothills I	LR34	Banana trees on Site	LR49	Channel beside DSD building	LR64	Fishponds north of Tam Kon Chau	LR79	Fishponds west of Palm Springs	LR94	Trees beside Ponds in Palm Springs
LR5	Ponds in Field East of San Tam Road	LR20	Trees in Maple Gardens	LR35	Stream flowing from Tam Kon Chau to the site	LR50	Woodland along Castle Peak Road (Mai Po)	LR65	Trees beside Fishponds north of Tam Kon Chau	LR80	Trees beside Fishponds west of Palm Springs	LR95	Trees in southern Royal Palms
LR6	Trees Behind Field east of San Tam Road	LR21	Grassland on Ki Lung Shan Foothills	LR36	Trees in Open Storage Area	LR51	Fishponds along Tam Kon Chau Road	LR66	Trees in Tam Kon Chau	LR81	Fishponds west of Palm Springs	LR96	Trees around Sports Facilities in Royal Palms
LR7	Stream Next to Field east of San Tam Road	LR22	Trees between San Tin Highway and Maple Gardens	LR37	Not Used	LR52	Trees north of Tam Kon Chau Road	LR67	Pond south of Tam Kon Chau	LR82	Trees beside Fishponds west of Palm Springs	LR97	Trees east of Royal Palms
LR8	Pond East of San Tam Road	LR23	Chunk Kai Horticultural Nursery	LR38	Trees inside Open Storage Area	LR53	Dry Pond north of Tam Kan Chau Road	LR68	Fish Ponds south of Tam Kon Chau	LR83	Stream west of Palm Springs	LR98	Pond south of Palm Springs Boulevard Entrance
LR9	Trees along East Side of San Tam Road	LR24	Trees along San Tin Highway	LR39	Trees along Castle Peak Road (Mai Po)	LR54	Fishponds south of Tam Kon Chau Road	LR69	Fishponds south-west of Tam Kon Chau	LR84	Fishponds west of Palm Springs	LR99	Ponds south of Palm Springs
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LR15	Trees inside Scenic Heights	LR30	Freshwater Marsh	LR45	Trees in Mai Po Lo Wai	LR60	Fishponds north of Tam Kon Chau Road	LR75	Fishponds west of Palm Springs	LR90	Pond in Wo Shang Wai Village		

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Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong

Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

Client

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

RESIDUAL LANDSCAPE RESOURCES IMPACTS IN OPERATION PHASE

Designed		Eng.Chk.	
Drawn	TAI	Coordination	
Dwg.Chk.	CD	Approved	CD
Scale 1:4000@A1 1:8000@A3	Project 221005	CAD File Figure-11_28.DWG	Status
Drawing No.	FIGURE 11-28		Rev A

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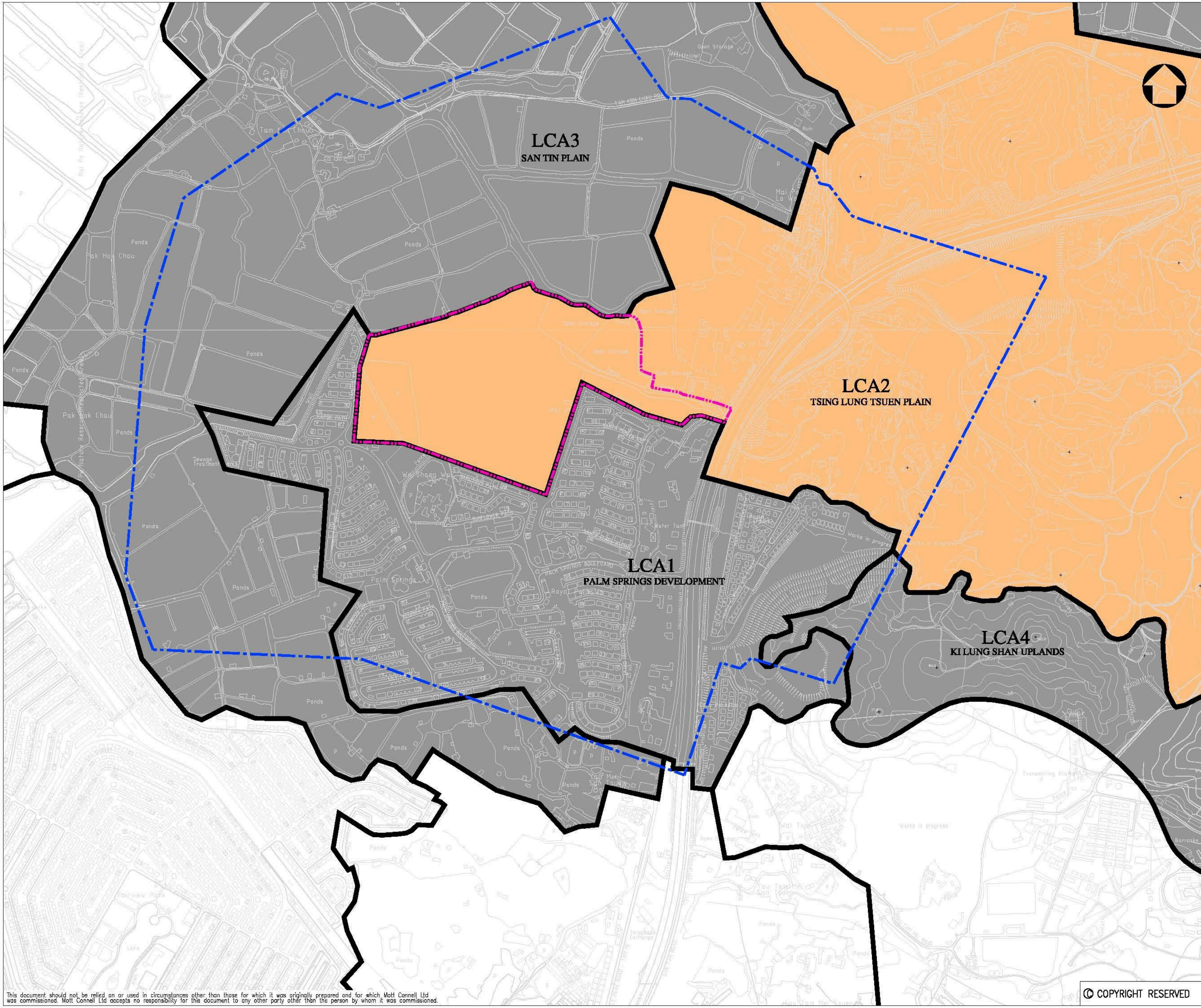

LEGENDS:

- LANDSCAPE IMPACT ASSESSMENT AREA (500m FROM PROJECT AREA)
- PROJECT AREA
- BOUNDARY OF LCA

SIGNIFICANCE OF LANDSCAPE IMPACT

- SLIGHT POSITIVE
- INSUBSTANTIAL
- SLIGHT NEGATIVE
- MODERATE NEGATIVE
- SUBSTANTIAL NEGATIVE

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Tel 2828 5757
Fax 2827 1823
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Project: PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title: RESIDUAL LANDSCAPE CHARACTER IMPACTS IN CONSTRUCTION PHASE

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Dwg.Chk.		Approved	
Scale 1:4000@A1 1:8000@A3	Project 221005		Status
	CAD File		
Drawing No.	FIGURE 11-29		Rev

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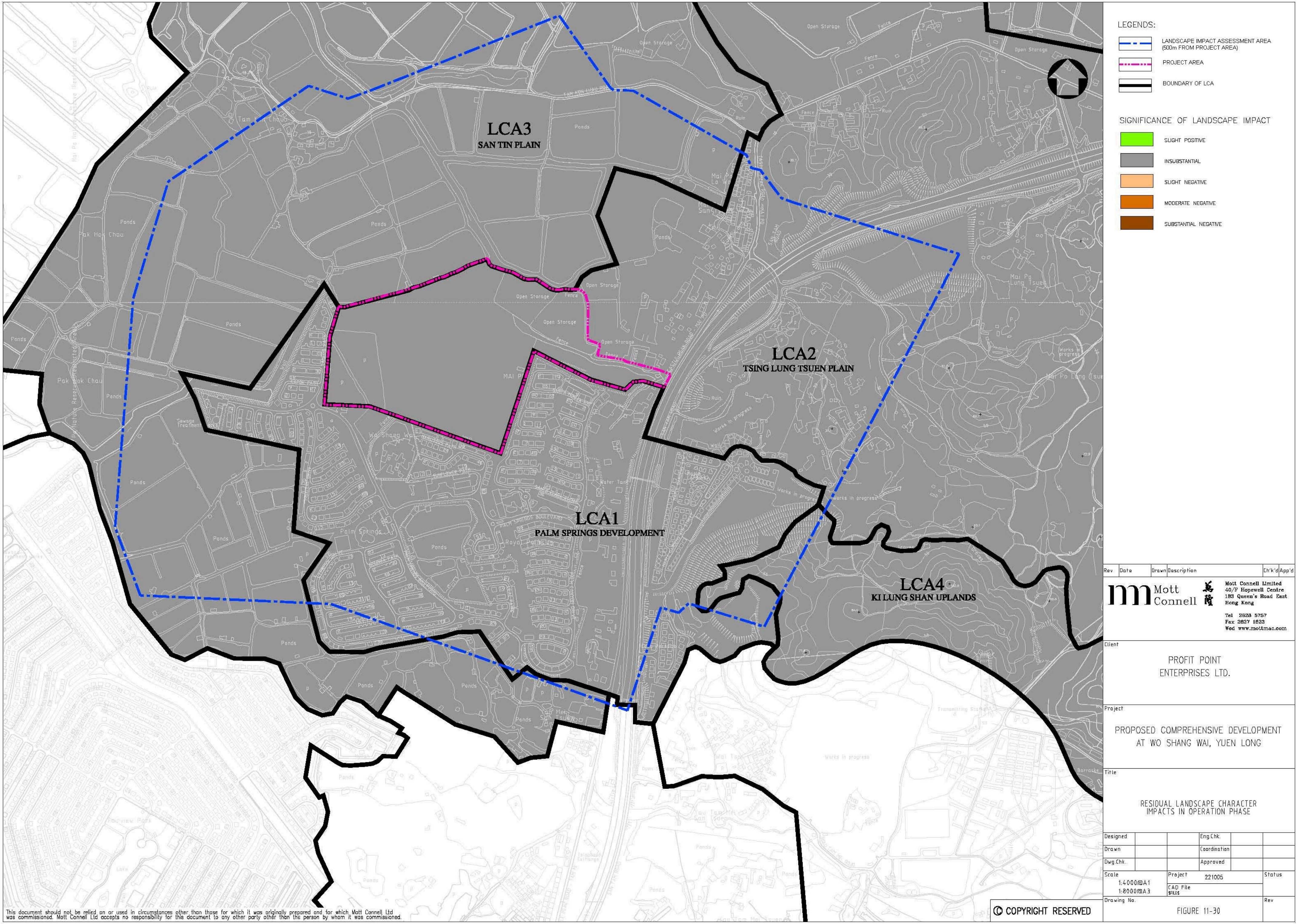

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Hong Kong
Tel 2828 5757
Fax 2827 1823
Wed www.mottmac.com

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Title
RESIDUAL LANDSCAPE CHARACTER IMPACTS IN OPERATION PHASE

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Drawn		Coordination			
Dwg.Chk.		Approved			
Scale 1:4000@A1 1:8000@A3		Project 221005		Status	
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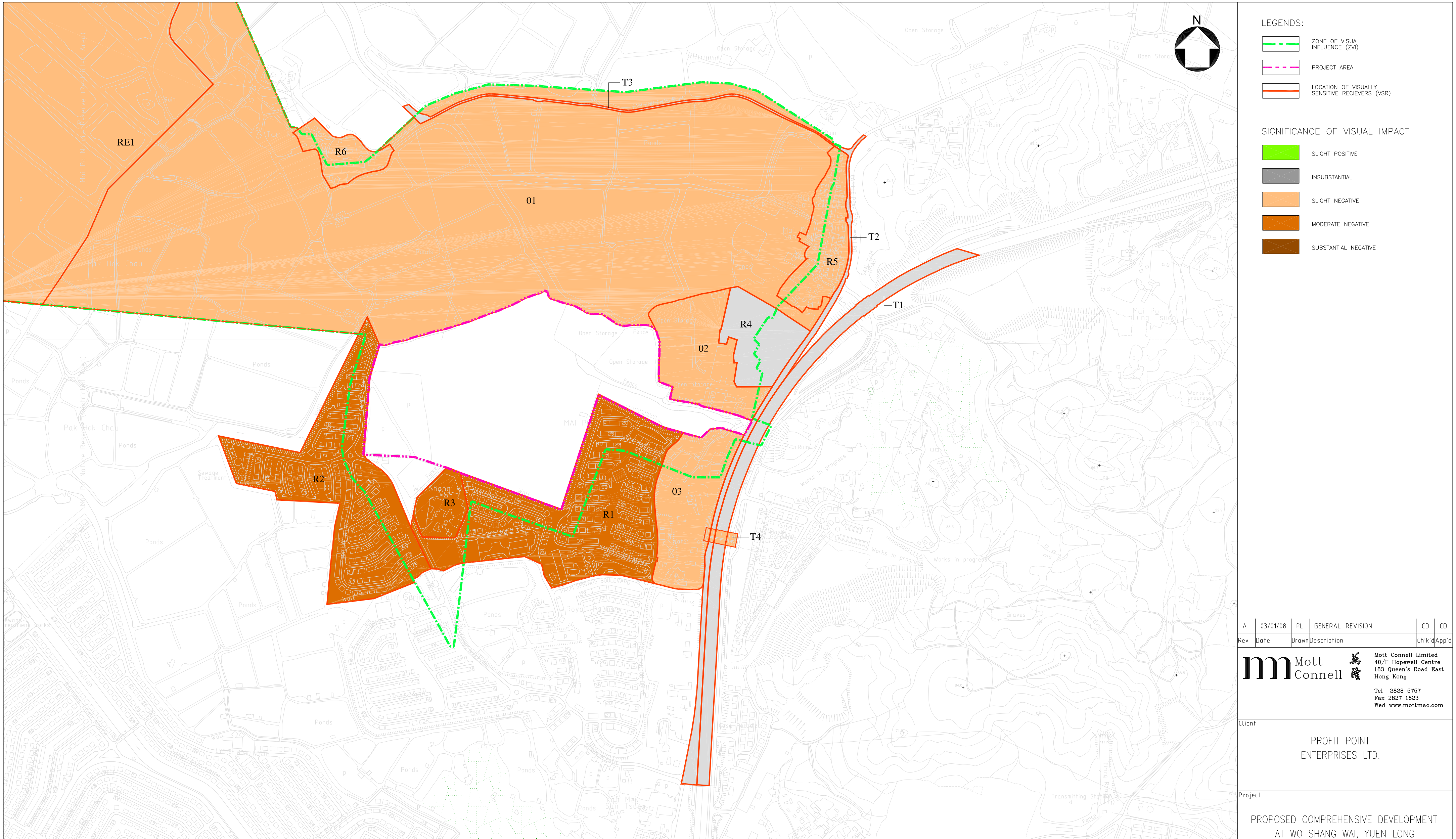

VISUALLY SENSITIVE RECIEVERS (VSRs)

Residential VSRs
R1 Residents in Royal Palms
R2 Residents in Palm Springs
R3 Residents in Wo Shang Wai
R4 Residents in Cottage Area South of Mai Po San Tsuen
R5 Residents in Mai Po San Tsuen and Mai Po Lo Wai
R6 Residents in Tam Kon Chau

Occupational VSRs
O1 Workers in Fishponds around Mai Po
O2 Workers in Industrial / Storage Areas north of Royal Palms
O3 Workers in Industrial / Storage Areas east of Royal Palms

Travelling VSRs
T1 Motorists on San Tin Highway
T2 Motorists on Castle Peak Road
T3 Motorists on Tam Kon Chau Road
T4 Pedestrians on San Tin Highway Footbridge

Recreational VSRs
RE1 Visitors to Mai Po Nature Reserve

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Hong Kong
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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
RESIDUAL VISUAL IMPACTS IN CONSTRUCTION PHASE

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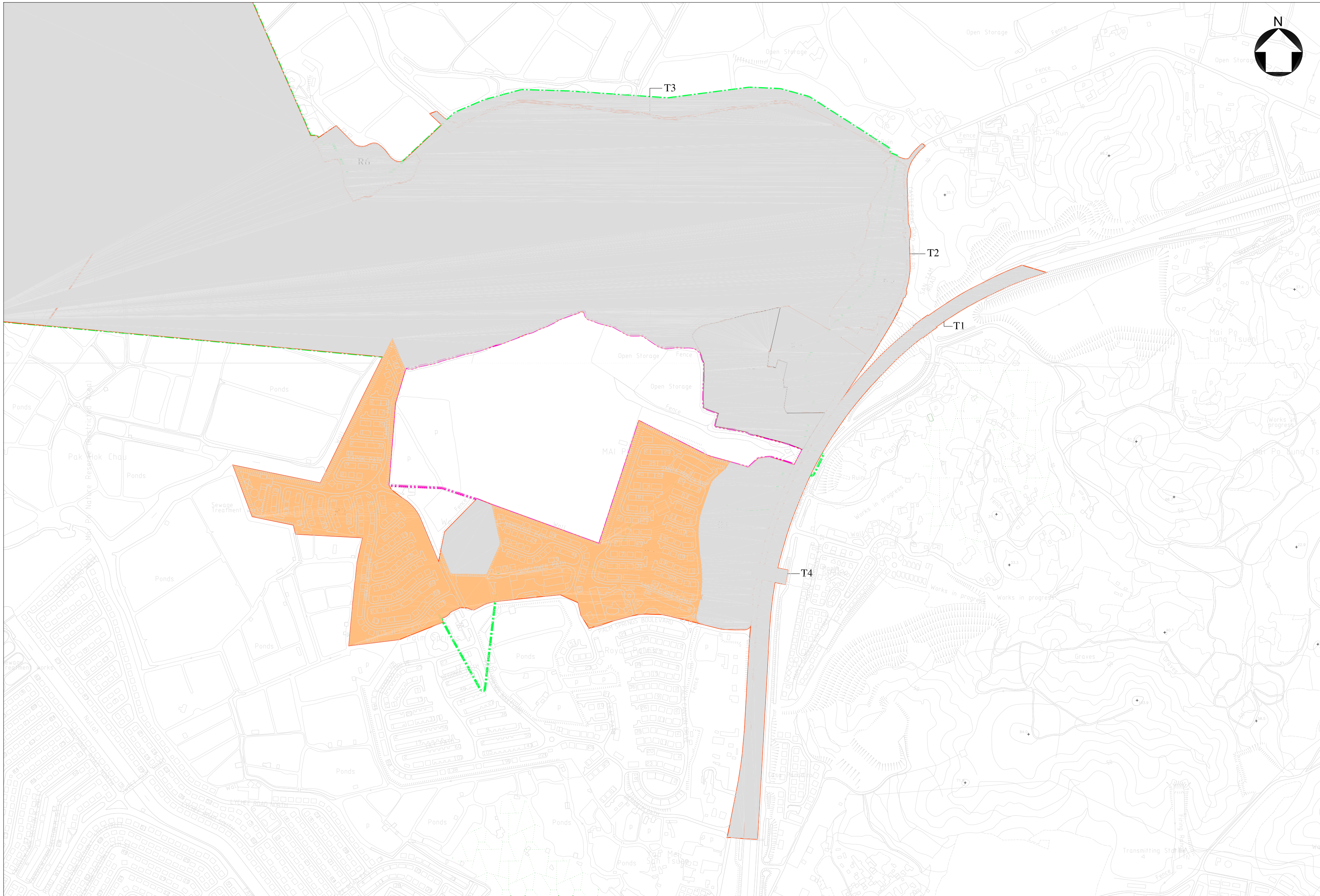
Scale 1:4000@A1 1:8000@A3	Project 221005	CAD File Figure-11_31.DWG	Status
Drawing No.	FIGURE 11-31		Rev A



VISUALLY SENSITIVE RECIEVERS (VSRs)

Residential VSRs
- R1 Residents in Royal Palms
- R2 Residents in Palm Springs
- R3 Residents in Wo Shang Wai
- R4 Residents in Cottage Area South of Mai Po San Tsuen
- R5 Residents in Mai Po San Tsuen and Mai Po Lo Wai
- R6 Residents in Tam Kon Chau

Occupational VSRs
- O1 Workers in Fishponds around Mai Po
- O2 Workers in Industrial / Storage Areas north of Royal Palms
- O3 Workers in Industrial / Storage Areas east of Royal Palms

Travelling VSRs
- T1 Motorists on San Tin Highway
- T2 Motorists on Castle Peak Road
- T3 Motorists on Tam Kon Chau Road
- T4 Pedestrians on San Tin Highway Footbridge

Recreational VSRs
- RE1 Visitors to Mai Po Nature Reserve

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Project: PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title: RESIDUAL VISUAL IMPACTS IN OPERATION PHASE

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Scale	1:4000@A1 1:8000@A3	Project	221005
		CAD File	Figure-11_32.DWG
Drawing No.	FIGURE 11-32	Rev	A
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Existing View from Palm Springs Boulevard, Palm Springs

View from Palm Springs Boulevard at Day 1 without Mitigation

View from Palm Springs Boulevard at Day 1 with Mitigation

View from Palm Springs Boulevard at Year 10 with Mitigation

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title

PHOTOMONTAGE A - VIEW FROM PALM SPRINGS BOULEVARD, PALM SPRINGS

Designed		Eng.Chk.	
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Dwg.Chk.		Approved	
Scale	Project 221005		Status
	CAD File		
Drawing No.	FIGURE 11.33		Rev


Existing View from Santa Monica Avenue, Royal Palms


View from Santa Monica Avenue at Day 1 without Mitigation


View from Santa Monica Avenue at Day 1 with Mitigation


View from Santa Monica Avenue at Year 10 with Mitigation

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Fax 2827 1823
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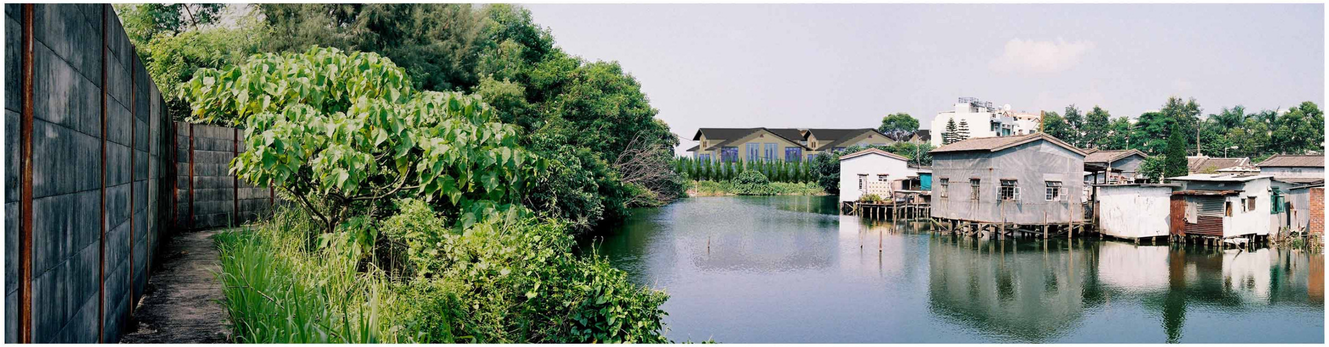
PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
PHOTOMONTAGE B - VIEW FROM SANTA MONICA AVENUE, ROYAL PALMS

Designed		Eng.Chk.		
Drawn		Coordination		
Dwg.Chk.		Approved		
Scale		Project 221005		Status
		CAD File		
Drawing No.	FIGURE 11.34			Rev


Existing View from Wo Shang Wai Village


View from Wo Shang Wai Village at Day 1 without Mitigation


View from Wo Shang Wai Village at Day 1 with Mitigation


View from Wo Shang Wai Village at Year 10 with Mitigation

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PROPOSED COMPREHENSIVE DEVELOPMENT AT WO SHANG WAI, YUEN LONG

Title
PHOTOMONTAGE C - VIEW FROM WO SHANG WAI VILLAGE

Designed		Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.		Approved	
Scale	Project 221005		Status
	CAD File		
Drawing No.	FIGURE 11.35		Rev

Existing View from Tam Kon Chau Village

View from Tam Kon Chau Village at Day 1 without Mitigation

View from Tam Kon Chau Village at Day 1 with Mitigation

View from Tam Kon Chau Village at Year 10 with Mitigation

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Wed www.mottmac.com

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Title
PHOTOMONTAGE D - VIEW FROM TAM KON CHAU VILLAGE

Designed		Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.		Approved	
Scale	Project 221005		Status
	CAD File		
Drawing No.	FIGURE 11.36		Rev


Existing View from Tam Kon Chau Road


View from Tam Kon Chau Road at Day 1 without Mitigation


View from Tam Kon Chau Road at Day 1 with Mitigation


View from Tam Kon Chau Road at Year 10 with Mitigation

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PROPOSED COMPREHENSIVE DEVELOPMENT
AT WO SHANG WAI, YUEN LONG

Title
PHOTOMONTAGE E -VIEW
FROM TAM KON CHAU ROAD

Designed			Eng.Chk.		
Drawn			Coordination		
Dwg.Chk.			Approved		
Scale		Project	221005		Status
		CAD File			
Drawing No.		FIGURE 11.37			Rev

Existing View from Mai Po Lo Wai

View from Mai Po Lo Wai at Day 1 without Mitigation

View from Mai Po Lo Wai at Day 1 with Mitigation

View from Mai Po Lo Wai at Year 10 with Mitigation

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Mott Connell 萬隆

Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong

Tel 2828 5757
Fax 2827 1823
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PROPOSED COMPREHENSIVE DEVELOPMENT
AT WO SHANG WAI, YUEN LONG

Title

PHOTOMONTAGE F - VIEW
FROM MAI PO LO WAI

Designed		Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.		Approved	
Scale	Project 221005		Status
	CAD File		
Drawing No.	FIGURE 11.38		Rev

Existing View from Mai Po Nature Reserve

View from Mai Po Nature Reserve at Day 1 without Mitigation

View from Mai Po Nature Reserve at Day 1 with Mitigation

View from Mai Po Nature Reserve at Year 10 with Mitigation

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Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Hong Kong

Tel 2828 5757
Fax 2827 1823
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PROPOSED COMPREHENSIVE DEVELOPMENT
AT WO SHANG WAI, YUEN LONG

Title
PHOTOMONTAGE G - VIEW
FROM MAI PO NATURE RESERVE

Designed		Eng.Chk.	
Drawn		Coordination	
Dwg.Chk.		Approved	
Scale	Project 221005		Status
	CAD File		
Drawing No.	FIGURE 11.39		Rev

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long

Environmental Impact Assessment

Appendices

(Volume 3 of 3)

March 2008

Mott Connell Ltd
7th Floor, West Wing Office Building
New World Centre
20 Salisbury Road
Tsim Sha Tsui, Kowloon
Hong Kong

Tel: 2828 5757

Fax: 2827 1823

Anne.Kerr@mottconnell.com.hk

in association with

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Appendices

APPENDICES

APPENDIX A

EIA Study Brief No. ESB - 131/2005

Environmental Impact Assessment Ordinance (Cap. 499), Section 5(7)

Environmental Impact Assessment Study Brief No. ESB - 131/2005

Project Title: Proposed Comprehensive Development at Wo Shang Wai, Yuen Long (hereafter known as the Project)

Name of Applicant: Profit Point Enterprises Limited (hereinafter known as the "Applicant")

1. BACKGROUND

1.1 An application (No. ESB-131/2005) for an Environmental Impact Assessment (EIA) study brief under section 5(1)(a) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by the captioned Applicant on 5 August 2005 with a project profile (No. PP-257/2005).

1.2 The Applicant proposes to develop the site into two major uses: residential development and associated infrastructure and wetland restoration. The project site occupies about 21 ha site area. The proposed domestic Gross Floor Area on the Project is about 82,960m^2 (with a maximum height of 6 storeys including car park). The location plan of the Project showing the approximate project boundary is given as Figure 1.

1.3 The following elements of the Project addressed in this Project Profile are classified as Designated Projects under the *Environmental Impact Assessment Ordinance (Cap. 499) (EIAO).*

- proposed residential development, other than New Territories exempted houses within Deep Bay Buffer Zone 2 (item *P1 of Part I of Schedule 2 of EIAO*)

- an activity for the reuse of treated sewage effluent from a treatment plant (item *F.4 of Part I of Schedule 2 of EIAO*)

- engineering feasibility study of urban development projects with a study area covering more than 20 ha (item *1 of Schedule 3 of EIAO*)

1.4 Pursuant to section 5(7)(a) of the EIAO, the Director of Environmental Protection (the Director) issues this EIA study brief to the Applicant to carry out an EIA study.

1.5 The purpose of this EIA study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and related activities taking place concurrently. This information will contribute to decisions by the Director on:

(i) the overall acceptability of any adverse environmental consequences that are likely to arise as a result of the Project;

(ii) the conditions and requirements for the detailed design, construction and operation of the Project to mitigate against adverse environmental consequences wherever practicable; and

(iii) the acceptability of residual impacts after the proposed mitigation measures are implemented.

2. OBJECTIVES OF THE EIA STUDY

2.1 The objectives of the EIA study are as follows:

(i) to describe the Project and associated works together with the requirements for carrying out the Project;

(ii) to identify and describe the elements of the 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;

(iii) to identify and quantify all environmental sensitive receivers, emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;

(iv) to identify and quantify any potential losses or damage to flora, fauna and wildlife habitats;

(v) to identify any negative impacts on sites of cultural heritage and to propose measures to mitigate these impacts;

(vi) to identify and quantify any potential landscape and visual impacts and to propose measures to mitigate these impacts;

(vii) 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;

(viii) 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;

(ix) 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;

(x) 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;

(xi) to identify, 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

(xii) 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.

3. DETAILED REQUIREMENTS OF THE EIA STUDY

3.1 The purpose of this study brief is to scope the key issues of the EIA study. The Applicant has to demonstrate in the EIA report that the criteria in the relevant sections of the Technical Memorandum on the Environmental Impact Assessment Process of the Environmental Impact Assessment Ordinance (hereinafter referred to as the TM) are fully complied with.

The Scope

3.2 The scope of this EIA study shall cover the Project and associated works mentioned in section 1.2 above. The EIA study shall cover the combined impacts of all the Project and the cumulative impacts of the existing, committed and planned developments in the vicinity of the Project in accordance with the requirements laid down in section 3.4 of the TM. The environmental impacts of on-site and off-site works and facilities associated with the Project shall be addressed. The EIA study shall address the likely key issues described below, together with any issues identified during the course of the EIA study:

(i) noise impacts arising from construction and operation of the Project to the nearby village areas;

(ii) dust impact arising from construction of the Project to the nearby air sensitive receivers (ASRs) and odor impact from the existing and planned sewage treatment plants to the development and nearby ASRs;

(iii) landscape and visual impacts during construction and operation of the Project;

(iv) the potential water quality impacts caused by site formation, pond draining and filling, drainage diversion, and any other works activities during construction; the potential water quality impacts caused by the operation of the Project;

(v) potential impacts on historical buildings/architectures and monuments;

(vi) terrestrial and aquatic ecological impacts, in particular the potential impacts of disturbance and fragmentation to the adjacent recognized sites of conservation importance 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, Inner Deep Bay SSSI, Wetland Conservation Area and Wetland Buffer Area (both were defined under Town Planning Board Guidelines TPB PG-No. 12B) and important habitats such as fishponds and egretries, due to the construction and operation of the Project;

(vii) fisheries impacts during construction and operation of the Project;

(viii) collection and disposal of potentially contaminated dredged spoil arising from the Project; and

(ix) the short term and long term management of the proposed wetland restoration within the project area including trust and financial arrangement.

Consideration of Alternatives

3.3 <u>The Need of the Project</u>

The Applicant shall study and review the need of the Project as mentioned in sub-section 1.2 above, and provide information to justify the need. The Applicant shall explain clearly the purpose and objectives of the Project and describe the scenarios with and without the Project.

3.4 <u>Consideration of Alternative Layout Options and Building Height Profiles</u>

The Applicant shall consider alternative layout options and building height profiles (below 6 storeys including car park) for the Project, provide justification regarding how the proposed layout option and building height profiles are arrived at, including the descriptions of the environmental factors considered in the option selection. A comparison of the environmental benefits and dis-benefits of alternative layout options and building height profiles shall be made with a view to recommending the preferred option to avoid/minimize adverse environmental effects to the maximum practicable extent. In particular, consideration shall be given to avoid or minimize the disturbance to the adjacent recognized sites of conservation importance and important habitats during the construction and operation of the Project.

3.5 <u>Consideration of Alternative Construction Methods and Sequences of Works</u>

Taking into consideration the combined effect with respect to the severity and duration of the construction impacts to the affected sensitive receivers, the EIA study shall explore alternative construction methods and sequences of works for the Project, with a view to avoid prolonged adverse environmental impacts to the maximum practicable extent. A comparison of the environmental benefits and dis-benefits of applying different construction methods and sequence of works shall be made.

3.6 <u>Selection of Preferred Scenario</u>

Taking into consideration of the findings in sub-section 3.4 and 3.5 above, the Applicant shall recommend/justify the adoption of the preferred scenario will avoid or minimize adverse environmental effects arising from the Project, and adequately describe the part that environmental factors played in arriving at the final selection.

Technical Requirements

3.7 The Applicant shall conduct the EIA study to address all environmental aspects of the works and activities as described in the scope set out above.

3.8 The EIA study shall take into consideration and compare clearly and objectively the environmental impacts of different development options considered in the study. In formulating the preferred development option, the Applicant shall seek to avoid adverse environmental effects to the maximum practice extent. It is important to describe adequately in the report the part environmental factors played in the selection of the preferred option(s).

3.9 The EIA study shall include the following technical requirements on specific impacts.

3.9.1 Air Quality Impact

3.9.1.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing air quality impact as stated in section 1 of Annex 4 and Annex 12 of the TM respectively. The assessment shall be based on the best available information at the time of the assessment.

3.8.1.2 3.9.1.2 The study area for air quality impact assessment shall generally be defined by a distance of 500 m from the boundary of the project site (including the access road) as shown in Figure 1, yet it may be extended depending on the circumstances and the scale of the project. In particular, the assessment for the operational stage shall take into account the impacts of major emission sources such as the existing and planned sewage treatment plants, San Tin Highways and Castle Peak Road, whereas the assessment for the constructional stage shall take into account the impacts of major emission sources from other concurrent construction projects.

3.9.1.3 The Applicant shall assess the air pollutant concentrations with reference to the Guidelines for Local-Scale Air Quality Assessment Using Models given in Appendices 1 to 3 or other methodology as agreed by the Director.

3.9.1.4 The air quality impact assessment shall include the following:

(i) <u>Background and Analysis of Activities</u>

(a) Provide background information relating to air quality issues relevant to the project.

(b) Give an account, where appropriate, of the consideration/ measures that had been taken into consideration in the planning of the project to abate the air pollution impact. That is, the Applicant should consider alternative construction methods/phasing programmes and alternative modes of operation to minimize the constructional and operational air quality impact respectively.

(c) Present the background air quality levels in the assessment area for the purpose of evaluating the cumulative constructional and operational air quality impacts.

(ii) <u>Identification of ASRs and Examination of Emission/Dispersion Characteristics</u>

(a) Identify and describe representative existing and planned/ committed air sensitive receivers (ASRs) that would likely be affected by the project, including those earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans. The Applicant shall select the assessment points of the identified ASRs such that they represent the worst impact point of these ASRs. A map showing the location and description including the name of the buildings, their uses and height of the selected assessment points shall be given. The separation distances of these ASRs from the nearest emission sources shall also be given. For phased development, the Applicant should review the development programme, and where appropriate, to include occupiers of early phases as ASRs if they may be affected by works of later phases.

(b) Provide an exhaustive list of air pollutant emission sources, including any nearby emission sources which are likely to have impact on the project based on the analysis of the constructional and operational activities of the project in 3.9.1.4 i above. Examples of constructional stage emission sources include stock piling, blasting, concrete batching and vehicular movements on unpaved haul roads on site, etc. Examples of operational stage emission sources include exhaust emissions from sewage treatment works and vehicles, etc. Confirmation of the validity of the assumptions and the magnitude of the activities (e.g. volume of construction materials handled etc.) shall be obtained from the relevant government department/authorities and documented.

(iii) Constructional Phase Air Quality Impact

(a) The Applicant shall follow the requirements of the Air Pollution Control (Construction Dust) Regulation to ensure constructional dust impacts are controlled within the relevant standards as stipulated in section 1 of Annex 4 of the TM. An audit and monitoring program during constructional stage shall be devised to verify the effectiveness of the control measures and to ensure that the construction dust levels be brought under proper control.

(b) If the Applicant anticipates a significant construction dust impact that will likely cause exceedance of the recommended limits in the TM at the ASRs despite incorporation of the dust control measures stated in 3.9.1.4 iii a above, a quantitative assessment shall be carried out to evaluate the constructional dust impact at the identified ASRs. The Applicant shall follow the methodology set out in subsection 3.9.1.4 v below when carrying out the quantitative assessment.

(iv) Operational Phase Air Quality Impact

The Applicant shall assess the expected air pollutant impacts at the identified ASRs based on an assumed reasonably worst-case scenario under normal operating conditions. If the assessment indicates likely exceedances of the recommended limits in the TM at the development and the nearby ASRs, a quantitative impact evaluation following the methodology in 3.9.1.4 v below shall be carried out.

(v) Quantitative Assessment Methodology

(a) The Applicant shall conduct the quantitative assessment with reference to relevant sections of the modeling guidelines stated in 3.9.1.3 above or any other methodology as agreed with the Director. The specific methodology must be documented in such level of details (preferably with tables and diagrams) to allow the readers of the assessment report to grasp how the model is set up to simulate the situation at hand without referring to the model input files. Detailed calculations of the pollutant emission rates and a map showing all the road links for input to the modeling shall be presented in the EIA report. The Applicant must ensure consistency between the text description and the model files at every stage of submission. In case of doubt, prior agreement between the Applicant and the Director on the specific modeling details shall be sought.

(b) The Applicant shall identify the key/representative air pollutant parameters (types of pollutants and the averaging time concentrations) to be evaluated and provide explanation for choosing these parameters for the assessment of the impact of the project

(c) The Applicant shall calculate the cumulative air pollutant concentrations at the identified ASRs and compare these results against the criteria set out in section 1 of Annex 4 in the TM. The predicted air quality impacts (both unmitigated and mitigated) shall be presented in the form of summary table and pollution contours, to be evaluated against the relevant air quality standards and examination of the land use implications of these impacts. Plans of suitable scale should be used for presentation of pollution contour to allow proper determination of buffer distance requirements.

(vi) Mitigating measures for non-compliance

The Applicant shall propose remedies and mitigating measures where the predicted air quality impact exceeds the criteria set in section 1 of Annex 4 in the TM. These measures and any constraints on future land use planning shall be agreed with the relevant government departments/authorities and documented. The Applicant shall demonstrate quantitatively that the resultant impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in section 1 of Annex 4 in the TM.

(vii) Submission of model files

(i) All input and output file(s) of the model run(s) shall be submitted to the Director in electronic format.

3.9.2 Noise Impacts

3.9.2.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing noise impact as stated in Annexes 5 and 13 of the TM respectively.

3.9.2.2 The noise impact assessment shall include the following:

(i) Determination of Assessment Area

The "Assessment Area" for the noise impact assessment shall include all areas within 300m from the boundary of the Project (including the access road) as shown in Figure 1. Subject to the agreement of the Director, the assessment area could be reduced accordingly if the first layer of noise sensitive receivers, closer than 300m from the boundary of the Project (including the access road) as shown in Figure 1, provides acoustic shielding to those receivers at further distance behind. Subject to the agreement of the Director, the area shall be expanded to include NSRs at larger distance, which would be affected by the construction and operation of the Project.

(ii) Provision of Background Information and Existing Noise Levels

The Applicant shall provide all background information relevant to the Project, e.g. relevant previous or current studies. Unless involved in the planning standards, no existing noise levels are particular required.

(iii) Identification of Noise Sensitive Receivers

(a) The Applicant shall refer to Annex 13 of the TM when identifying the noise sensitive receivers (NSRs). The NSRs shall include all existing NSRs and all planned/committed noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans (OZP), Outline Development Plans and Layout Plans and other relevant published land use plans.

(b) The Applicant shall select assessment points to represent all identified NSRs for carrying out quantitative noise assessment described below. The assessment points shall be agreed with the Director prior to the quantitative noise assessment. A map showing the location and description such as name of building, use, and floors of each and every selected assessment point shall be given. For planned noise sensitive land uses without committed site layouts, the Applicant should use the relevant planning parameters to work out site layouts for operational noise assessment purpose.

(iv) Provision of an Emission Inventory of the Noise Sources

The Applicant shall provide an inventory of noise sources including representative construction equipment for construction noise assessment, and traffic flow/fixed plant equipment, as appropriate, for operational noise assessment. Confirmation of the validity of the inventory shall be obtained from the relevant government departments/authorities and documented in the EIA report.

(v) Construction Noise Assessment

(a) The Applicant shall carry out assessment of noise impact from all construction (excluding percussive piling) works of all the concurrent projects in the area during day time, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology stipulated in paragraphs 5.3. and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of the TM shall be adopted in the assessment.

(b) To minimise the construction noise impact, alternative construction methods to replace percussive piling shall be proposed as far as practicable.

(c) If the unmitigated construction noise levels are found exceeding the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including movable barriers, enclosures, quieter alternative methods, re-scheduling and restricting hours of operation of noisy task) to minimise the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance shall be given.

(d) In case the Applicant would like to evaluate whether construction works in restricted hours as defined under the Noise Control Ordinance (NCO) are feasible or not in the context of programming construction works, reference should be made to the relevant technical memoranda issued under the NCO. Regardless of the results of the construction noise impact assessment for restricted hours, the Noise Control Authority will process the Construction Noise Permit (CNP) application, if necessary, based on the NCO, the relevant technical memoranda issued under the NCO, and the contemporary conditions/situations. This aspect should be explicitly stated in the noise chapter and the conclusions and recommendations chapter in the EIA report.

(vi) <u>Operational Noise Assessment</u>

(a) <u>Road Traffic Noise</u>

The Applicant shall assess any adverse traffic noise impact on the development of the Project. The following assessment requirements shall be followed.

(a1) Calculation of Noise Levels

The Applicant shall calculate the expected road traffic noise using methods described in the U.K. Department of Transport's “Calculation of Road Traffic Noise” (1988). Calculations of future road traffic noise shall be based on the peak hour traffic flow in respect of the maximum traffic projection within the expected operation years of the Project.

The EIA shall contain sample calculations as considered necessary and requested by the Director, and drawings of appropriate scale to show the road segments, topographic barriers (if any) and assessment points input into the traffic noise model. The Applicant shall provide input data sets of traffic noise prediction model adopted in the EIA study.

The data shall be in electronic text file (ASCII format) containing road segments, barriers (if any) and NSRs' information. The data structure of the above file shall be agreed with the Director. CD-ROM(s) containing the above data shall be attached in the EIA report.

(a2) Presentation of Noise Levels

The Applicant shall present the future noise levels in L_{10} (1 hour) at the NSRs on tables and plans of suitable scale for the scenarios for the Project.

A quantitative assessment at the NSRs shall be carried out and compared against the criteria set out in Table 1A of Annex 5 of the TM. The potential noise impact of the Project shall be quantified by estimating the total number of dwellings and other noise sensitive elements that will be exposed to noise levels exceeding the criteria set in Table 1A of Annex 5 in the Technical Memorandum.

(a3) Proposals for Noise Mitigation Measures

After rounding of the predicted noise levels according to the U.K. Department of Transport's "Calculation of Road Traffic Noise" (1988), the Applicant shall propose noise mitigation measures in all situations where the predicted traffic noise level exceeds the criteria set in Table 1A of Annex 5 in the TM. Specific reasons for not adopting certain noise mitigation measures in the design to reduce the traffic noise to a level meeting the criteria in the TM or to maximize the protection for the NSRs as far as possible should be clearly quantified and laid down.

The total number of dwellings and other noise sensitive element that will be benefited by the provision of noise mitigation measures should be provided. In order to clearly present the extents/locations of the recommended noise mitigation measures, plans prepared from 1:1,000 or 1:2,000 survey maps showing the mitigation measures (e.g. barriers) shall be included in the EIA report. The total number of dwellings and other noise sensitive elements that will still be exposed to noise above the criteria with the implementation of all recommended noise mitigation measures shall be quantified.

(b) <u>Fixed Noise Sources</u>

(b1) The Applicant shall identify any fixed noise sources within the "Assessment Area", including all activities within the residential development, any sewage collection, sewage treatment plant, pumping stations, any pump houses, electricity sub-station etc. The Applicant shall calculate the expected noise using standard acoustics principles. Calculations for the expected noise shall be based on assumed plant inventories and utilization schedule for the worst case scenario. The Applicant shall calculate the noise levels taking into account of correction of tonality, impulsiveness and intermittence in accordance with the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites.

(b2) The Applicant shall present the noise levels in Leq(30min) or other unit(s) as agreed by the Director, at the NSRs at various representative floor levels (in m P.D.) on tables and plans of suitable scale.

(b3) A quantitative assessment at the NSRs for the fixed noise source(s) shall be carried out and compared against the criteria set out in Table 1A of Annex 5 of the TM.

(b4) The Applicant shall propose direct mitigation measures within the project limits in all situations where the predicted noise level exceeds the criteria set out in Table 1A of Annex 5 of the TM to protect the affected NSRs.

(vii) Assessment of Side Effects and Constraints

The Applicant shall identify, assess and propose means to minimize any side effects and to resolve any potential constraints due to the inclusion of any recommended direct technical remedies.

(viii) Evaluation of Constraints on Planned Noise Sensitive Developments/Land Uses

For planned noise sensitive uses which will still be affected even with all practicable direct technical remedies in place, the Applicant shall propose, evaluate and confirm the practicality of additional measures within the planned noise sensitive uses and shall make recommendations on how these noise sensitive uses will be designed for the information of relevant parties.

The Applicant shall take into account agreed environmental requirements / constraints identified by the study to assess the development potential of concerned sites which shall be made known to the relevant parties.

3.9.3 Water Quality Impact

3.9.3.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing water quality impact during the construction and operation phases as stated in Annexes 6 and 14 of the TM respectively.

3.9.3.2 The Applicant shall conduct the following detailed water quality assessment.

Water Quality Impact Assessment

3.9.3.3 The Study Area for the water quality impact assessment hall cover all relevant sensitive receivers in Wo Shang Wai and the surrounding areas, in particular the fishponds surrounding the study area and in the larger Deep Bay Catchment Area of the Deep Bay Water Control Zone (WCZ), the Ramsar Site, and Mai Po Nature Reserve. This study area could be extended to cover other areas if they are found also being impacted during the course of EIA study and have a bearing on the environmental acceptability of the Project.

3.9.3.4 The Applicant shall identify and analyze all physical, chemical and biological disruptions of water system(s) arising during the construction and operation of the Project (including the impacts arising from emergency discharge from sewage pumping stations and sewer bursting discharge). The Applicant shall address the following:

General

(i) collection and review of background information on the existing water system(s) and the respective catchment(s);

(ii) characterization of water and sediment quality of the natural/artificial water courses and manmade fishponds based on existing information or site surveys/ tests as appropriate;

(iii) identification and analysis of all existing and planned future activities and beneficial uses related to the water system(s) and identification of all water sensitive receivers including inshore water protection/recreation areas, in particular the fishponds surrounding the study area, the Mai Po Inner Deep Bay Ramsar Site and Mai Po Nature Reserve;

(iv) identification of pertinent water quality objectives and establishment of other appropriate water quality and sediment criteria or standards for the water system(s) and all sensitive receivers affected by the Project;

(v) identification of any alteration of natural/artificial water course, manmade fishponds, wetlands, change of water courses/drainage channel, change of water holding/flow regimes; change of ground water levels, change of catchment types or areas;

(vi) identification, analysis and quantification of all existing and likely future water and sediment pollution sources, including point discharges and non-point sources to surface water runoff, storm water effluent and pond water discharges. Field investigation and laboratory tests shall be conducted as appropriate;

(vii) establishment and provision of an emission inventory on the quantities and characteristics of all these pollution sources;

Impact Predictions

(viii) prediction and quantification by mathematical modelling or other technique approved by the Director, of the impacts on the water system(s) and the sensitive receivers due to those alterations and changes identified in (v) and the pollution sources identified in (vi) above. Possible impacts include changes in hydrology, flow regime, sediment erosion or deposition, water and sediment quality and the effects on the aquatic organism due to such changes. The prediction shall take into account and include different construction stages or sequences, different operation stages. Cumulative impacts due to other related concurrent and planned project(s), activities or pollution sources within a boundary around the Study Area to be agreed by the Director shall also be predicted and quantified;

(ix) assessment and evaluation of water quality impacts on the sensitive receivers due to the operation of the Project and the wetland restorations. Among other receivers, the impact on the operation of the wetland habitats on or near the northern part of Wo Shang Wai, the Mai Po Inner Deep Bay Ramsar Site, Mai Po Nature Reserve and the Deep Bay Wetland Conservation Area/Buffer Area shall be included.

<u>Waste Water Pollution</u>

(x) analysis on the adequacy of existing and planned future sewerage infrastructure to receive point discharges of waste water identified in (vi) above;

(xi) analysis on the provision and adequacy of existing and planned future facilities to reduce pollution arising from the non-point sources identified in (vi) above;

(xii) identification and quantification of the residual pollution load from the proposed treatment facilities for treating all point/non-point sources of waste water;

(xiii) identification of the alignment, volume and possible pollutants contained in pond water and storm water discharges;

(xiv) analysis on the characteristics of sewage nature;

(xv) identification and quantification of the pond water, stormwater, treated effluent discharge and other point/non-point sources pollution loads to the wetlands in the study site, the Mai Po Inner Deep Bay Ramsar Site, Mai Po Nature Reserve and the other surrounding water courses/bodies;

(xvi) evaluation and quantification of residual impacts on the water system(s) and the sensitive receivers with regard to the appropriate water and sediment quality criteria, standards and guidelines; and

(xvii) analysis and assessment of the impacts due to additional sewage discharge from the Project to the existing/planning sewerage system and sewage treatment works in North West New territories ;

(xviii) assessment on the impacts of using ozone or chlorine as disinfectants in the Project, in particular on the potential of generation of carcinogenic and toxic organic chlorides; and

(xix) identification and assessment of the residual impacts of any fertilizer, pesticides and/or herbicides (if applied) on the drainage channel, groundwater, or other inland water courses/bodies.

Dredging and Pond Draining and Filling

(xx) identification and quantification of all dredging, pond draining and filling, site leveling, sediment/ mud transportation and disposal activities and requirements. Potential fill source, if required and dumping ground to be involved shall also be identified. Field investigation, sampling and laboratory tests to characterize the pond water quality and sediment/mud concerned shall be conducted as appropriate. The ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test method to be used shall be subject to the approval of the Director. The categories of sediments which are to be disposed of in accordance with a permit granted under the Dumping at Sea Ordinance shall be identified by both chemical and biological tests, and their quantities estimated. If the presence of any seriously contaminated sediment which requires special treatment or disposal is confirmed, the Applicant shall identify the most appropriate treatment and/or disposal arrangement and demonstrate its feasibility;

(xxi) prediction, quantification and assessment of impacts on the physical regime, water and sediment quality of the water systems(s) and the nearby sensitive receivers due to the activities identified in section (xx) above. The prediction and quantification of impacts caused by sediment re-suspension and contaminants release shall be carried out by mathematical modelling or other techniques approved by the Director;

(xxii) identification and evaluation of the best practicable dredging and pond filling methods to minimize dredging and dumping requirements and demand for fill sources based on the criterion that existing pond mud/stream sediment shall be left in place and not be disturbed as far as possible;

(xxiii) evaluation of the impacts due to release of the interstitial water and associated contaminants to the water column, if wick drain installation is employed to speed up consolidation of mud;

(xxiv) prediction and quantification of cumulative impacts due to other dredging, filling or dumping activities within a boundary around the study area to be agreed by the Director; and

(xxv) among other sensitive receivers, impact on the habitats and ecological mitigation measures of the nearby Mai Po Inner Deep Bay Ramsar Site, Wetland Conservation Area, Wetland Buffer Area, Mai Po Nature Reserve and the fishponds surrounding the study area shall be addressed.

Potential Problem of Biogas on Reclamation (Pond Filling)

(xxvi) Investigation of the potential biogas problem arising from leaving pond mud in place, including:

(a) a proposal on collection and analysis of representative samples in various depths for the agreement of the Director;

(b) carrying out the actual sampling and testing as agreed by the Director; and

(c) a proposal, with justifications, on monitoring, mitigation and precautionary measures on the Project, if found necessary.

Mitigation

(xxvii) proposal of effective infrastructure upgrading or provision, water pollution prevention and mitigation measures to be implemented during the construction, operation stages so as to reduce the water and sediment quality impacts to within acceptable levels of standards. Best management practices to reduce pond water, storm water, pesticides and herbicides and non-point source pollution shall be investigated and proposed as appropriate;

(xxviii)formulate the mitigation measures to offset the residual pollution load identified in section (xii) above in order to achieve the requirement of no net increase of pollution load to Deep Bay from the Project; and

(xxix) provide adequate monitoring programme to assess the effectiveness of the proposed offsetting measures identified in section (xxviii).

3.9.4 Sewerage and Sewage Treatment Implications

3.9.4.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing impacts on the downstream public sewerage, sewage treatment and disposal facilities as stated in section 6.5 in Annex 14 of the TM.

3.9.4.2 The Applicant shall investigate and determine the need and the feasibility of having central pre-treatment facilities and/or a separate sewage treatment plant within the study area.

3.9.4.3 The Applicant shall study and assess the need and impacts of discharging sewage to the existing/planning sewerage systems in North West New Territories. The assessment shall include the following:

(i) investigate and review the adequacy of the existing/planned sewerage and treatment facilities for absorbing part or all of the sewage discharge from the Project within the scope of EIA study as defined in section 3.2 above. The Applicant shall confirm in the EIA report that whether the existing/planning sewerage systems and sewage treatment works in North West New Territories will provide adequate capacity for the Project. The appropriate treatment level of interim discharge, if required, shall be assessed;

(ii) the assessment should take into account any additional sewage flows and flow projections from other existing/planned developments to be connected to the existing/planning sewerage systems and sewage treatment works in North West New Territories. The water quality impacts arising from the interim and ultimate effluent discharge, if any, shall be assessed in accordance with section 3.5.3 above.

(iii) based on the above items (i) and (ii), if the existing/planned sewerage layout or capacities cannot cope with the maximum discharges, the Applicant shall propose an optimal and cost-effective upgrading works to improve the existing/planned sewerage and sewage treatment facilities or to provide new sewerage and sewage treatment facilities to receive and transport the sewage arising during the construction and operation of the Project. Any proposed sewerage system and/or on-site sewage treatment facility should be designed to meet the current government standards and requirements. Computerised analysis techniques such as HYDRO WORKS/INFORWORKS may be used in the preliminary design if necessary.

(iv) identify and quantify the water quality and ecological impacts due to the emergency discharge from on-site sewage treatment plant/pumping stations and sewer bursting discharge, and to propose measures to mitigate these impacts;

(v) identify the appropriate alignment and layouts of the new sewerage to connect to the existing/planned/future sewerage system in North West New Territories; investigate and assess the technical feasibility of connection (e.g. technical feasibility and details for direct connection to public sewer and sewage pumping station);

(vi) set out the design, operation and maintenance requirements and identify the party responsible for the construction and maintenance of any proposed sewerage and sewage treatment facilities, such as pumping station(s) and central pre-treatment facilities for food catering effluent (if recommended), including electrical and mechanical components to eliminate the problem of septicity incurred in long rising main(s) during low flows and to facilitate maintenance. The above shall be agreed by DSD and EPD (Twin rising mains for each pumping station should be provided to make sure that the proposed sewage rising mains are maintainable without shutting down and discharging untreated sewage into the natural stream/drainage channel directly).

3.9.5 Waste Management Implications

3.9.5.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing waste management implications as stated in Annexes 7 and 15 of the TM, respectively.

3.9.5.2 The assessment of waste management implications shall cover the following:

(i) <u>Analysis of Activities and Waste Generation</u>

The Applicant shall identify the quantity, quality and timing of the waste arising as a result of the construction and operational activities, based on the sequence and duration of these activities.

(ii) <u>Proposal for Waste Management</u>

(a) Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation and on-site or off-site re-use shall be fully evaluated. Measures which can be taken in the planning and design stages e.g. by modifying the design approach and in the construction stage for maximising waste reduction shall be separately considered.

(b) Having taken into account all the opportunities for reducing waste generation and maximising reuse, the types and quantities of the wastes required to be disposed of as a consequence including potentially contaminated materials shall be estimated and the disposal options for each type of waste described in detail. The disposal method recommended for each type of wastes shall take into account the result of the assessment in (c) below.

(c) The impact caused by handling (including labelling, packaging & storage), collection, and disposal of wastes shall be addressed in detail and appropriate mitigation measures proposed including the prevention of flytipping during construction. This assessment shall cover but not limited to the following areas :

- potential hazard;
- air and odour emission;
- noise;
- wastewater discharge; and
- public transport.

(iii) Land Contamination

(a) The Application shall identify all land lots/sites within the Project boundary which, due to their past or present land uses, are potentially contaminated sites. A detailed account for the present activities and past land use history in relation to possible land contamination shall be provided.

(b) The list of potential contaminants which are anticipated to be found in these potentially contaminated sites shall be provided and the possible remediation options shall be discussed.

3.9.6 Ecological Impact (Terrestrial and Aquatic)

3.9.6.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM respectively during the construction and operational phases. The assessment shall include the ecological survey of the "Assessment Area" as defined in section 3.9.6.2 below

3.9.6.2 The "Assessment Area" for the purpose of terrestrial ecological assessment shall include all areas within 500m distance from the boundary of the Project (including the access road) as shown in Figure 1, or the area likely to be impacted by the Project.

3.9.6.3 In the ecological impact assessment, the Applicant shall examine the flora, fauna and other components of the ecological habitats within the "Assessment Area". The aim shall be to protect, maintain or rehabilitate the natural environment. In particular, the Project shall avoid impacts on recognized sites of conservation importance and other ecological sensitive areas. The assessment shall identify and quantify as far as possible the potential ecological impacts associated with the Project.

3.9.6.4 The assessment shall include the following major tasks:

(i) review and incorporate the findings of relevant studies and collate all the available information regarding the ecological characters of the "Assessment Area";

(ii) identify any information gap relating to the assessment of potential ecological impacts to the terrestrial and aquatic environment;

(iii) carry out any necessary field surveys, the duration of which shall be at least 12 months covering the winter migratory bird season from October to March and the ardeid breeding season from March to August, and investigations to fill in the information gap, if any, and to fulfil the objectives of the EIA study;

(iv) establish the general ecological profile and describe the characteristics of each habitat found within the study boundary, committed ecological measures including those under the EIA Ordinance or the Town Planning Ordinance (such as the restoration of fishponds) should be taken into consideration; major information to be provided shall include:

(a) description of the physical environment;
(b) habitat maps of suitable scale (1:1000 to 1:5000) showing the types and locations of habitats in the "Assessment Area";
(c) ecological characteristics of each habitat type such as size, vegetation type, species present, dominant species found, species diversity, community structure, inter-dependence of the habitats and species, and presence of any features of ecological importance;
(d) representative colour photographs of each habitat type and any important ecological features identified; and
(e) species found that are rare, endangered and/or listed under local legislation or international conventions for conservation of wildlife/habitats or red data books;

(v) investigate and describe the existing wildlife uses of various habitats with special attention to:

(a) wetlands including fish ponds, wet agricultural land and marsh;
(b) roosting, breeding and feeding sites for wetland birds;
(c) natural steam courses and man made drainage channels; and
(d) any other habitats identified as having special conservation interests by this study.

(vi) describe all recognized sites of conservation importance in particular the Wetland Conservation Area, Wetland Buffer Area, Mai Po Inner Deep Bay Ramsar Site, Mai Po Nature Reserve, Mai Po Village SSSI, Mai Po Marshes SSSI and Inner Deep Bay SSSI in the Project site and its vicinity, and assess whether these sites will be affected by the Project or not;

(vii) investigate the impact of residential buildings in the project area on the bird's flight path taking into account of daily and seasonal patterns;

(viii) using suitable methodology, identify and quantify as far as possible any direct, indirect, on-site, off-site, primary, secondary and cumulative ecological impacts such as destruction of habitats, reduction of species abundance/diversity, loss of feeding grounds, reduction of ecological carrying capacity, loss in ecological linkage and function, habitat fragmentation and other possible disturbances caused by the Project and the activities of the residents;

(ix) evaluate the significance and acceptability of the ecological impacts identified using well-defined criteria;

(x) recommend all possible alternatives (such as modifications of layout and design) and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified;

(xi) evaluate the feasibility and effectiveness of the recommended mitigation measures and define the scope, type, location, implementation arrangement, subsequent management, resources requirement and maintenance of such measures;

(xii) determine and quantify as far as possible the residual ecological impacts after implementation of the proposed mitigation measures;

(xiii) evaluate the severity and acceptability of the residual ecological impacts using well-defined criteria. If off-site mitigation measures are considered necessary to mitigate the residual impacts, the guidelines and requirements laid down in the TM shall be followed;

(xiv) review the need for and recommend any ecological monitoring programme required; and

(xv) propose a management package for the wetland restoration in the project area with particular attention to :

(a) the proposed design and layout of the restored wetland and rationales for such proposed design;
(b) the habitat management plan and specification of resources requirement for its implementation;
(c) the long-term trust management system with management guidelines;
(d) the financial arrangement to sustain the management of the restored wetland;
(e) the management agents and their responsibility; and
(f) a contingency plan for the management of the restored wetland before the

well establishment of trust management.

3.9.7 Fisheries Impacts

3.9.7.1 Fisheries Impact Assessment shall follow the criteria and guidelines as specified in Annexes 9 and 17 of the TM respectively. The "Assessment Area" for the purpose of the fisheries impact assessment shall include the area within the boundary of the Project (including the access road) as shown in Figure 1, and especially the adjacent areas of potential impact. The assessment shall review and collate existing information to provide adequate and accurate data for prediction and evaluation of impacts of the Project on fisheries. The assessment shall include the following:

(i) description of the physical environmental background;

(ii) description and quantification as far as possible of the existing pond culture activities, with special attention on fishponds in the vicinity and around Mai Po;

(iii) description and quantification as far as possible of the existing pond culture resources;

(iv) identification of parameters (eg. water quality parameters) and area that are important to pond culture activities;

(v) identification and quantification as far as possible of any direct/indirect and on-site/off-site impacts to pond culture, including permanent loss and temporary occupation of fishponds and those impacts on pond culture activities due to sewer bursting and emergency discharge from sewage pumping stations;

(vi) evaluation of impacts on pond culture activities during construction and operation stages in areas around Wo Shang Wai, Mai Po and other affected areas; and

(vii) evaluation of cumulative impacts of loss of fishponds in the North West New Territories.

(viii) identify practical mitigation measures to avoid/minimize the potential impacts on the pond culture activities;

(ix) identify and present an adequate package of measures fully compensate all the losses due to the Project with details on justification, description of scope and programme feasibility as well as staff and financial implications including those related to subsequent management and maintenance requirements of the proposals. Among others measures, the need to reinstate temporarily occupied and permanently lost fishponds should be covered; and

(x) determine the need, if necessary, make appropriate recommendation for a monitoring and audit programme during construction and operation phases of the Project.

3.9.8 Impact on Cultural Heritage

3.9.8.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing impacts on cultural heritage as stated in section 2 of both Annexes 10 and 19 of the TM respectively.

3.9.8.2 The heritage impact assessment shall focus on:

(i) identification of landscape features include sites of historical events, historical field patterns, tracks and fishponds and cultural elements such as *fung shui* woodlands and clan grave sites which will be affected by the Project;

(ii) evaluation of impacts on cultural heritage and proposals for any mitigation measures with detailed elaboration on scope of work.

3.9.8.3 Direct and indirect impacts on the nearby historic buildings and structures should also be identified. The impacts include visual impact, impacts on the *fung shui* / visual corridor of the historic buildings and structures, potential damage to historic buildings and structures through change of water-table, vibration caused by the Project. Assessment of impacts on cultural heritage shall also take full account of, and allow where appropriate, the Guidelines for Landscape and Visual Impact Assessment of Annex 18 of the TM.

3.9.9 Landscape and Visual Impact

3.9.9.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing landscape and visual impacts as stated in Annexes 10 and 18 of the Technical Memorandum and EIAO Guidance Note No. 8/2002.

3.9.9.2 The assessment area for the landscape impact assessment shall include all areas within a 500m distance from the boundary of the Project (including the access road) as shown in Figure 1. The assessment area for the visual impact assessment shall be defined by visual envelope of the proposed project and associated works. The defined visual envelope should be shown on plan.

3.9.9.3 The Applicant shall review relevant outline development plans, outline zoning plans, layout plans, planning briefs and studies which may identify areas of high landscape value and recommend conservation area, green belt, recreation, open space and other specified use. Any guidelines on urban design concept, landscape framework, building height profiles, designated view corridors that may affect the appreciation of the Project should also be reviewed. The aim is to gain an insight to the future outlook of the area so that the Project can fit into surrounding setting. Any conflict with statutory town plan(s) and any published land use plans should be highlighted and appropriate follow-up action should be recommended.

3.9.9.4 The Applicant shall describe, appraise and analyse the existing landscape resources and character of the assessment area. The sensitivity of the landscape framework and its ability to accommodate change shall be particularly focused on. A system should be derived for judging impact significance. The Applicant shall identify the degree of compatibility of the Project with the existing landscape. The assessment shall quantify the potential landscape impacts as far as possible, so as to illustrate the significance of such impacts arising from the Project. Clear mapping of the landscape impact is required.

3.9.9.5 The Applicant shall assess the visual impacts of the Project. A system should be derived for judging the visual impact significance. Clear illustrations in support of the visual impact assessment are required. The assessment shall include the following:

(i) identification and plotting of visual envelop of the Project;

(ii) identification of the key groups of visually sensitive receivers (including planned sensitive receivers if any) within the visual envelope and their views at ground level and elevated vantage points;

(iii) description of the visual compatibility of the Project with the surrounding, and the planned setting and its obstruction and interference with the key views of the adjacent areas;

the severity of visual impacts in terms of distance, nature and number of sensitive receivers. Nighttime glare shall be considered in the assessment. The visual impacts of the Project with and without mitigation measures shall also be included so as to demonstrate the effectiveness of the proposed mitigation measures; and

(iv) alternative layouts and building height profiles (below 6 storeys including car park) options should be examined with a view to selecting the best option to minimize any adverse visual impact.

3.9.9.6 The Applicant shall evaluate the merits of preservation in totality, in parts or total destruction of existing landscape and the establishment of a new landscape character of the area. In addition, alternative design that would avoid or reduce the identified landscape and visual impacts shall be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The Applicant shall recommend mitigation measures to minimize the adverse effects identified above, including provision of a landscape design. The mitigation measures shall include provision of screen planting and road side berms, revegetation of disturbed land, compensatory planting, provisioning of amenity areas and open spaces, provision of finishes to structures, deposition of buildings, colour scheme and texture of material used and any measures to mitigate the impact on existing and planned land use. Parties shall be identified for the on going management and maintenance of the proposed mitigation works to ensure their effectiveness throughout the operation phase of the Project. The mitigation measures proposed shall not only be concerned with damage reduction but should also include consideration of potential enhancement of existing landscape and visual quality. A practical programme and funding proposal for the implementation of the recommended measures shall be provided.

3.9.9.7 Annotated illustration materials such as coloured perspective drawings, plans and section/elevation diagrams, annotated oblique aerial photographs, photo-retouching and computer-generated photomontage shall be adopted to fully illustrate the landscape and visual impacts of the Project to the satisfaction of the Director. In particular, the landscape and visual impacts of the Project with and without mitigation measures shall also be properly illustrated in existing and planned setting by computer-generated photomontage so as to demonstrate the effectiveness of the proposed mitigation measures. All computer graphics shall be compatible with Microstation DGN file format. The Applicant shall record the technical details such as system set-up, software, data files and function in preparing the illustration which may need to be submitted for verification of the accuracy of the illustrations.

3.9.10 Impacts Summary

To facilitate easy retrieval of important information, an impacts summary in the form of a table, or any other form approved by the Director, showing the assessment points, results of impact predictions, relevant standard or criteria, extent of exceedance predicted, if any, mitigation measures proposed and residual impacts, if any, after mitigation measures are implemented, etc., should be given at the end of each chapter on individual impact in the EIA report as well as the Executive Summary.

3.9.11 Summary of Environmental Outcomes

The EIA report shall contain a summary of the key environmental outcomes arising from the EIA study, including the population and environmentally sensitive areas protected, environmentally friendly designs recommended, key environmental problems avoided, compensation areas included and the environmental benefits of environmental protection measures recommended.

3.9.12 Environmental Monitoring and Audit (EM&A) Requirements

3.9.12.1 The Applicant shall identify and justify in the EIA study whether there is any need for EM&A and environmental management system (EMS) activities during the construction and operation phases of the Project and, if affirmative, to define the scope of the EM&A requirements for the Project in the EIA study.

3.9.12.2 Subject to the confirmation of EIA study findings, the Applicant shall comply with the requirements as stipulated in Annex 21 of the TM. The Applicant shall also propose real-time reporting of monitoring data for the Project through a dedicated internet website.

3.9.12.3 The Applicant shall prepare a Project Implementation Schedule (in the form of a checklist as shown in Appendix 3 or as approved by the Director) containing all the EIA study recommendations and mitigation measures with reference to the implementation programme. The Project Implementation Schedule shall include the explicit agreement reached between the Applicant and relevant parties on the responsibility for funding, implementation, management and maintenance of mitigation measures. Alternatively, the Project Implementation Schedule shall include an undertaking from the Applicant to assume the responsibility of all those mitigation measures until an agreement is reached between the Applicant and relevant parties on the funding, implementation, management and maintenance of mitigation measures. To facilitate issue of Environmental Permits (EPs) in future, the implementation schedules shall be grouped under individual works packages in separate DPs where applicable.

3.9.13 Monitoring and Audit Requirement of the Project

The Applicant should note the monitoring and audit requirement stipulated in paragraph 8.1 of the TM. The Proponent shall propose an environmental monitoring and audit programme in the EIA report to verify the predictions and the effectiveness of mitigation measures including audit on compliance during the operation phase of the Project.

4. DURATION OF VALIDITY

The Applicant shall notify the Director of the commencement of the EIA study. If the EIA study does not commence within 36 months after the date of issue of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief afresh before commencement of the EIA study.

5. REPORT REQUIREMENTS

5.1 In preparing the EIA report, the Applicant shall refer to Annex 11 of the TM for the contents of an EIA report. The Applicant shall also refer to Annex 20 of the TM which stipulates the guidelines for the review of an EIA report.

5.2 The Applicant shall supply the Director with the following number of hard copies of the EIA report and the Executive Summary:

(i) 50 hard copies of the EIA report in English and 80 hard copies of the Executive Summary (each bilingual in both English and Chinese) as required under section 6(2) of the EIAO to be supplied at the time of application for approval of the EIA report, unless advised otherwise by the Director;

(ii) where necessary, addendum to each copy of the EIA report and the Executive Summary submitted in sub-section 5.2 (i) above as required under Section 7(1) of the EIAO, to be supplied upon advice by the Director for public inspection.

(iii) 20 hard copies of the EIA report in English and 50 hard copies of the Executive Summary (each bilingual in both English and Chinese), with or without Addendum as required under section 7(5) of the EIAO, to be supplied upon advice by the Director for consultation with the Advisory Council on the Environment.

5.3 The Applicant shall make additional hard copies of the above documents available to the public, subject to payment by the interested parties of full costs of printing.

5.4 In addition, to facilitate public inspection of the EIA Report via the EIAO Internet Website, the Applicant shall provide electronic copies of both the EIA Report and the Executive Summary Report prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 4.0 or later), unless otherwise agreed by the Director. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of the EIA Report and the Executive Summary Report shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in the EIA Report and Executive Summary shall be provided in the main text from where the respective references are made. All graphics in the report shall be in interlaced GIF format unless otherwise agreed by the Director.

5.5 The electronic copies of the EIA report and the Executive Summary shall be submitted to the Director at the time of application for approval of the EIA Report.

5.6 When the EIA Report and the Executive Summary are made available for public inspection under section 7(1) of the EIA Ordinance, the content of the electronic copies of the EIA Report and the Executive Summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.

5.7 To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required and their format shall be agreed by the Director.

5.8 To facilitate public involvement in the EIA process, the applicant shall produce 3-dimensional electronic visualisations of the major findings and elements of the EIA report, including baseline environmental information, the environmental situations with and without the Project, key mitigated and unmitigated environmental impacts, and key recommended environmental mitigation measures so that the public can understand the Project and the associated environmental issues. The visualisations shall be based on the EIA report and released to the public. The visualisations shall be submitted in CD-ROM or other suitable means agreed with the Director in commonly readable formats. Unless otherwise advised or agreed by the Director, the number of copies of CD-ROM required shall be the same as that for EIA reports under Section 5.2.

6. OTHER PROCEDURAL REQUIREMENTS

6.1 During the EIA study, if there is any change in the name of Applicant for this EIA study brief, the Applicant in this study brief must notify the Director immediately.

6.2 If there is any key change in the scope of the Project mentioned in section 1.2 of this EIA study brief and in Project Profile No. PP-257/2005, the Applicant must seek confirmation from the Director in writing on whether or not the scope of issues covered by this EIA study brief can still cover the key changes, and the additional issues, if any, that the EIA study must also address. If the changes to the Project fundamentally alter the key scope of the EIA study brief, the Applicant shall apply to the Director for another EIA study brief afresh.

--- END OF EIA STUDY BRIEF ---

September 2005
Environmental Assessment Division,
Environmental Protection Department

Appendix 1

Guidelines on Choice of Models and Model Parameters

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Introduction

1.1 To expedite the review process by the Authority and to assist project proponents or environmental consultants with the conduct of air quality modelling exercise which are frequently called for as part of environmental impact assessment studies, this paper describes the usage and requirements of a few commonly used air quality models.

2. Choice of Models

2.1 The models which have been most commonly used in air quality impact assessments, due partly to their ease of use and partly to the quick turn-around time for results, are of Gaussian type and designed for use in simple terrain under uniform wind flow. There are circumstances when these models are not suitable for ambient concentration estimates and other types of models such as physical, numerical or mesoscale models will have to be used. In situations where topographic, terrain or obstruction effects are minimal between source and receptor, the following Gaussian models can be used to estimate the near-field impacts of a number of source types including dust, traffic and industrial emissions.

Model	Applications
FDM	for evaluating fugitive and open dust source impacts (point, line and area sources)
CALINE4	for evaluating mobile traffic emission impacts (line sources)
ISCST3	for evaluating industrial chimney releases as well as area and volumetric sources (point, area and volume sources); line sources can be approximated by a number of volume sources.

These frequently used models are also referred to as Schedule 1 models (see attached list).

2.2 Note that both FDM and CALINE4 have a height limit on elevated sources (20 m and 10m, respectively). Source of elevation above these limits will have to be modelled using the ISCST3 model or suitable alternative models. In using the latter, reference should be made to the 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' in Appendix B-3.

2.3 The models can be used to estimate both short-term (hourly and daily average) and long-term (annual average) ambient concentrations of air pollutants. The model results, obtained using appropriate model parameters (refer to Section 3) and assumptions, allow direct comparison with the relevant air quality standards such as the Air Quality Objectives (AQOs) for the relevant pollutant and time averaging period.

3. Model Input Requirements

3.1 Meteorological Data

3.1.1 At least 1 year of recent meteorological data (including wind speed, wind direction, stability class, ambient temperature and mixing height) from a weather station either closest to or having similar characteristics as the study site should be used to determine the highest short-term (hourly, daily) and long-term (annual) impacts at identified air sensitive receivers in that period. The amount of valid data for the period should be no less than 90 percent.

3.1.2 Alternatively, the meteorological conditions as listed below can be used to examine the worst case short-term impacts:

Day time: stability class D; wind speed 1 m/s (at 10m height); worst-case wind angle; mixing height 500 m

Night time: stability class F; wind speed 1 m/s (at 10m height); worst case wind angle; mixing height 500 m

This is a common practice with using the CALINE4 model due to its inability to handle lengthy data set.

3.1.3 For situations where, for example, (i) the model (such as CALINE4) does not allow easy handling of one full year of meteorological data; or (ii) model run time is a concern, the followings can be adopted in order to determine the daily and annual average impacts:

(i) perform a frequency occurrence analysis of one year of meteorological data to determine the actual wind speed (to the nearest unit of m/s), wind direction (to the nearest 10^o) and stability (classes A to F) combinations and their frequency of occurrence;
(ii) determine the short term hourly impact under all of the identified wind speed, wind direction and stability combinations; and
(iii) apply the frequency data with the short term results to determine the long term (daily / annual) impacts.

Apart from the above, any alternative approach that will capture the worst possible impact values (both short term and long term) may also be considered.

3.1.4 Note that the anemometer height (relative to a datum same for the sources and receptors) at which wind speed measurements were taken at a selected station should be correctly entered in the model. These measuring positions can vary greatly from station to station and the vertical wind profile employed in the model can be grossly distorted from the real case if incorrect anemometer height is used. This will lead to unreliable concentration estimates.

3.1.5 An additional parameter, namely, the standard deviation of wind direction, , needs to be provided as input to the CALINE4 model. Typical values of range from 12^o for rural areas to 24^o for highly urbanised areas under 'D' class stability. For semi-rural such as new development areas, 18^o is more appropriate under the same stability condition. The following reference can be consulted for typical ranges of standard deviation of wind direction under different stability categories and surface roughness conditions.

Ref.(1): Guideline On Air Quality Models (Revised), EPA-450/2-78-027R, United States Environmental Protection Agency, July 1986.

3.2 Emission Sources

All the identified sources relevant to a process plant or a study site should be entered in the model and the emission estimated based on emission factors compiled in the AP-42 (Ref. 2) or other suitable references. The relevant sections of AP-42 and any parameters or assumptions used in deriving the emission rates (in units g/s, g/s/m or g/s/m^2) as required by the model should be clearly stated for verification. The physical dimensions, location, release height and any other emission characteristics such as efflux conditions and emission pattern of the sources input to the model should also correspond to site data.

If the emission of a source varies with wind speed, the wind speed-dependent factor should be entered.

Ref.(2): Compilation of Air Pollutant Emission Factors, AP-42, 5th Edition, United States Environmental Protection Agency, January 1995.

3.3 Urban/Rural Classification

Emission sources may be located in a variety of settings. For modelling purposes these are classed as either rural or urban so as to reflect the enhanced mixing that occurs over urban areas due to the presence of buildings and urban heat effects. The selection of either rural or urban dispersion coefficients in a specific application should follow a land use classification procedure. If the land use types including industrial, commercial and residential uses account for 50% or more of an area within 3 km radius from the source, the site is classified as urban; otherwise, it is classed as rural.

3.4 Surface Roughness Height

This parameter is closely related to the land use characteristics of a study area and associated with the roughness element height. As a first approximation, the surface roughness can be estimated as 3 to 10 percent of the average height of physical structures. Typical values used for urban and new development areas are 370 cm and 100 cm, respectively.

3.5 Receptors

These include discrete receptors representing all the identified air sensitive receivers at their appropriate locations and elevations and any other discrete or grid receptors for supplementary information. A receptor grid, whether Cartesian or Polar, may be used to generate results for contour outputs.

3.6 Particle Size Classes

In evaluating the impacts of dust-emitting activities, suitable dust size categories relevant to the dust sources concerned with reasonable breakdown in TSP (< 30 m) and RSP (< 10 m) compositions should be used.

3.7 NO_2 to NO_x Ratio

The conversion of NO_x to NO_2 is a result of a series of complex photochemical reactions and has implications on the prediction of near field impacts of traffic emissions. Until further data are available, three approaches are currently acceptable in the determination of NO_2:

(a) Ambient Ratio Method (ARM) - assuming 20% of NO_x to be NO_2; or
(b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
(c) Ozone Limiting Method (OLM) - assuming the tailpipe NO_2 emission to be 7.5% of NO_x and the background ozone concentration to be in the range of 57 to 68 g/m^3 depending on the land use type (see also the EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B-2).

3.8 Odour Impact

In assessing odour impacts, a much shorter time-averaging period of 5 seconds is required due to the shorter exposure period tolerable by human receptors. Conversion of model computed hourly average results to 5-second values is therefore necessary to enable comparison against recommended standard. The hourly concentration is first converted to 3-minute average value according to a power law relationship which is stability dependent (Ref. 3) and a result of the statistical nature of atmospheric turbulence. Another conversion factor (10 for unstable conditions and 5 for neutral to stable conditions) is then applied to convert the 3-minute average to 5-second average (Ref. 4). In summary, to convert the hourly results to 5-second averages, the following factors can be applied:

Stability Category	1-hour to 5-sec Conversion Factor
A & B	45
C	27
D	9
E & F	8

Under 'D' class stability, the 5-second concentration is approximately 10 times the hourly average result. Note, however, that the combined use of such conversion factors together with the ISCST results may not be suitable for assessing the extreme close-up impacts of odour sources.

Ref.(3): Richard A. Duffee, Martha A. O'Brien and Ned Ostojic, 'Odor Modeling – Why and How', Recent Developments and Current Practices in Odor Regulations, Controls and Technology, Air & Waste Management Association, 1991.

Ref.(4): A.W.C. Keddie, 'Dispersion of Odours', Odour Control – A Concise Guide, Warren Spring Laboratory, 1980.

3.9 Plume Rise Options

The ISCST3 model provides by default a list of the U.S. regulatory options for concentration calculations. These are all applicable to the Hong Kong situations except for the 'Final Plume Rise' option. As the distance between sources and receptors are generally fairly close, the non-regulatory option of 'Gradual Plume Rise' should be used instead to give more accurate estimate of near-field impacts due to plume emission. However, the 'Final Plume Rise' option may still be used for assessing the impacts of distant sources.

3.10 Portal Emissions

These include traffic emissions from tunnel portals and any other similar openings and are generally modelled as volume sources according to the PIARC 91 (or more up-to-date version) recommendations (Ref. 5, section III.2). For emissions arising from underpasses or any horizontal openings of the like, these are treated as area or point sources depending on the source physical dimensions. In all these situations, the ISCST3 model or more sophisticated models will have to be used instead of the CALINE4 model. In the case of portal emissions with significant horizontal exit velocity which cannot be handled by the ISCST3 model, the impacts may be estimated by the TOP model (Ref. 6) or any other suitable models subject to prior agreement with EPD. The EPD's 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' should also be referred to in Appendix B-3.

Ref.(5): XIXth World Road Congress Report, Permanent International Association of Road Congresses (PIARC), 1991.

Ref.(6): N. Ukegunchi, H. Okamoto and Y. Ide "Prediction of vehicular emission pollution around a tunnel mouth", Proceedings 4th International Clean Air Congress, pp. 205-207, Tokyo, 1977.

3.11 Background Concentrations

Background concentrations are required to account for far-field sources which cannot be estimated by the model. These values, to be used in conjunction with model results for assessing the total impacts, should be based on long term average of monitoring data at location representative of the study site. Please make reference to the paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B-2 for further information.

3.12 Output

The highest short-term and long-term averages of pollutant concentrations at prescribed receptor locations are output by the model and to be compared against the relevant air quality standards specified for the relevant pollutant. Contours of pollutant concentration are also required for indicating the general impacts of emissions over a study area. Copies of model files in electronic format should also be provided for EPD's reference.

Schedule 1

Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department for Regulatory Applications as at 1 July 1998*

Industrial Source Complex Dispersion Model - Short Term Version 3 (ISCST3) or the latest version developed by U.S. Environmental Protection Agency

California Line Source Dispersion Model Version 4 (CALINE4) or the latest version developed by Department of Transportation, State of California, U.S.A.

Fugitive Dust Model (FDM) or the latest version developed by U.S. Environmental Protection Agency

*EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.

Appendix 2

Guidelines on Assessing the 'TOTAL' Air Quality Impacts

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Total Impacts - 3 Major Contributions

1.1 In evaluating the air quality impacts of a proposed project upon air sensitive receivers, contributions from three classes of emission sources depending on their distance from the site should be considered. These are:

Primary contributions:	project induced
Secondary contributions:	pollutant-emitting activities in the immediate neighbourhood
Other contributions: (Background contributions)	pollution not accounted for by the previous two

2. Nature of Emissions

2.1 Primary contributions

In most cases, the project-induced emissions are fairly well defined and quite often (but not necessarily) the major contributor to local air quality impacts. Examples include those due to traffic network, building or road construction projects.

2.2 Secondary contributions

Within the immediate neighbourhood of the project site, there are usually pollutant emitting activities contributing further to local air quality impacts. For most local scale projects, any emission sources in an area within 500m radius of the project site with notable impacts should be identified and included in an air quality assessment to cover the short-range contributions. In the exceptional cases where there is one or more significant sources nearby, the study area may have to be extended or alternative estimation approach employed to ensure these impacts are reasonably accounted for.

2.3 Background contributions

The above two types of emission contributions should account for, to a great extent, the air quality impacts upon local air sensitive receivers, which are often amenable to estimation by the 'Gaussian Dispersion' type of models. However, a background air quality level should be prescribed to indicate the baseline air quality in the region of the project site, which would account for any pollution not covered by the two preceding contributions. The emission sources contributing to the background air quality would be located further afield and not easy to identify. In addition, the transport mechanism by which pollutants are carried over long distances (ranging from 1km up to tens or hundreds of kms) is rather complex and cannot be adequately estimated by the 'Gaussian' type of models.

3. Background Air Quality - Estimation Approach

3.1 The approach

In view of the difficulties in estimating background air quality using the air quality models currently available, an alternative approach based on monitored data is suggested. The essence of this approach is to adopt the long-term (5-year) averages of the most recent monitored air quality data obtained by EPD. These background data would be reviewed yearly or biennially depending on the availability of the monitored data. The approach is a first attempt to provide a reasonable estimate of the background air quality level for use in conjunction with EIA air quality assessment to address the cumulative impacts upon a locality. This approach may be replaced or supplemented by superior modelling efforts such as that entailed in PATH (Pollutants in the Atmosphere and their Transport over Hong Kong), a comprehensive territory-wide air quality modelling system currently being developed for Hong Kong. Notwithstanding this, the present approach is based on measured data and their long term regional averages; the background values so derived should therefore be indicative of the present background air quality. In the absence of any other meaningful way to estimate a background air quality for the future, this present background estimate should also be applied to future projects as a first attempt at a comprehensive estimate until a better approach is formulated.

3.2 Categorisation

The monitored air quality data, by 'district-averaging' are further divided into three categories, viz, Urban, Industrial and Rural/New Development. The background pollutant concentrations to be adopted for a project site would depend on the geographical constituency to which the site belongs. The categorisation of these constituencies is given in Section 3.4. The monitoring stations suggested for the 'district-averaging'(arithmetic means) to derive averages for the three background air quality categories are listed as follows:

Urban:	Kwun Tong, Sham Shui Po, Tsim Sha Tsui and Central/Western
Industrial:	Kwun Tong, Tsuen Wan and Kwai Chung
Rural/New Development:	Sha Tin, Tai Po, Junk Bay, Hong Kong South and Yuen Long

The averaging would make use of data from the above stations wherever available. The majority of the monitoring stations are located some 20m above ground.

3.3 Background pollutant values

Based on the above approach, background values for the 3 categories have been obtained for a few major air pollutants as follows:

POLLUTANT	URBAN	INDUSTRIAL	RURAL / NEW DEVELOPMENT
NO_2	59	57	39
SO_2	21	26	13
O_3	62	68	57
TSP	98	96	87
RSP	60	58	51

All units are in micrograms per cubic metre. The above values are derived from 1992 to 1996 annual averages with the exception of ozone which represent annual average of daily hourly maximum values for year 1996.

In cases where suitable air quality monitoring data representative of the study site such as those obtained from a nearby monitoring station or on-site sampling are not available for the prescription of background air pollution levels, the above tabulated values can be adopted instead. Strictly speaking, the suggested values are only appropriate for long term assessment. However, as an interim measure and until a better approach is formulated, the same values can also be used for short term assessment. This implies that the short term background values will be somewhat under-estimated, which compensates for the fact that some of the monitoring data are inherently influenced by secondary sources because of the monitoring station location.

Indeed, if good quality on-site sampling data which cover at least one year period are available, these can be used to derive both the long term (annual) and short term (daily / hourly) background values, the latter are usually applied on an hour to hour, day to day basis.

3.4 Site categories

The categories to which the 19 geographical constituencies belong are listed as follows:

DISTRICT	AIR QUALITY CATEGORY
Islands	Rural / New Development
Southern	Rural / New Development
Eastern	Urban
Wan Chai	Urban
Central & Western	Urban
Sai Kung	Rural / New Development
Kwun Tong	Industrial
Wong Tai Sin	Urban
Kowloon City	Urban
Yau Tsim	Urban
Mong Kok	Urban
Sham Shui Po	Urban
Kwai Tsing	Industrial
Sha Tin	Rural / New Development
Tsuen Wan	Industrial
Tuen Mun	Rural / New Development
Tai Po	Rural / New Development
Yuen Long	Rural / New Development
Northern	Rural / New Development

3.5 Provisions for 'double-counting'

The current approach is, by no means, a rigorous treatment of background air quality but aims to provide an as-realistic-as-possible approximation based on limited field data. 'Double-counting' of 'secondary contributions' may be apparent through the use of such 'monitoring-based' background data as some of the monitoring stations are of close proximity to existing emission sources. 'Primary contributions' due to a proposed project (which is yet to be realized) will not be double-counted by such an approach. In order to avoid over-estimation of background pollutant concentrations, an adjustment to the values given in Section 3.3 is possible and optional by multiplying the following factor:

$$(1.0 - E_{\text{Secondary contributions}}/E_{\text{Territory}})$$

where E stands for emission.

The significance of this factor is to eliminate the fractional contribution to background pollutant level of emissions due to 'secondary contributions' out of those from the entire territory. In most cases, this fractional contribution to background pollutant levels by the secondary contributions is minimal.

4. Conclusions

4.1 The above described approach to estimating the total air quality impacts of a proposed project, in particular the background pollutant concentrations for air quality assessment, should be adopted with immediate effect. Use of short term monitoring data to prescribe the background concentrations is no longer acceptable.

Appendix 3

Guidelines on the Use of Alternative Computer Models in Air Quality Assessment

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Background

1.1 In Hong Kong, a number of Gaussian plume models are commonly employed in regulatory applications such as application for specified process licences and environmental impact assessments (EIAs). These frequently used models (as listed in Schedule 1 attached; hereafter referred to as Schedule 1 models) have no regulatory status but form the basic set of tools for local-scale air quality assessment in Hong Kong.

1.2 However, no single model is sufficient to cover all situations encountered in regulatory applications. In order to ensure that the best model available is used for each regulatory application and that a model is not arbitrarily applied, the project proponent (and/or its environmental consultants) should assess the capabilities of various models available and adopt one that is most suitable for the project concerned.

1.3 Examples of situations where the use of an alternative model is warranted include:

(i) the complexity of the situation to be modelled far exceeds the capability of the Schedule 1 models; and
(ii) the performance of an alternative model is comparable or better than the Schedule 1 models.

1.4 This paper outlines the demonstration / submission required in order to support the use of an alternative air quality model for regulatory applications for Hong Kong.

2. Required Demonstration / Submission

2.1 Any model that is proposed for air quality applications and not listed amongst the Schedule 1 models will be considered by EPD on a case-by-case basis. In such cases, the proponent will have to provide the followings for EPD's review:

(i) Technical details of the proposed model; and
(ii) Performance evaluation of the proposed model

Based on the above information, EPD will determine the acceptability of the proposed model for a specific or general applications. The onus of providing adequate supporting materials rests entirely with the proponent.

2.2 To provide technical details of the proposed model, the proponent should submit documents containing at least the following information:

(i) mathematical formulation and data requirements of the model;
(ii) any previous performance evaluation of the model; and
(iii) a complete set of model input and output file(s) in commonly used electronic format.

2.2.1 On performance evaluation, the required approach and extent of demonstration varies depending on whether a Schedule 1 model is already available and suitable in simulating the situation under consideration. In cases where no Schedule 1 model is found applicable, the proponent must demonstrate that the proposed model passes the screening test as set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).

Ref.(1): William M. Cox, 'Protocol for Determining the Best Performing Model'; Publication No. EPA-454/R-92-025; U.S. Environmental Protection Agency, Research Triangle Park, NC.

2.2.2 For cases where a Schedule 1 model is applicable to the project under consideration but an alternative model is proposed for use instead, the proponent must demonstrate either that

(i) the highest and second highest concentrations predicted by the proposed model are within 2 percent of the estimates obtained from an applicable Schedule 1 model (with appropriate options chosen) for all receptors for the project under consideration; or

(ii) the proposed model has superior performance against an applicable Schedule 1 model based on the evaluation procedure set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).

2.2.3 Should EPD find the information on technical details alone sufficient to indicate the acceptability of the proposed model, information on further performance evaluation as specified in Sections 2.3 and 2.4 above would not be necessary.

2.2.4 If the proposed model is an older version of one of the Schedule 1 models or was previously included in Schedule 1, the technical documents mentioned in Section 2.2 are normally not required. However, a performance demonstration of equivalence as stated in Section 2.4 (i) would become necessary.

2.2.5 If EPD is already in possession of some of the documents that describe the technical details of the proposed model, submission of the same by the proponent is not necessary. The proponent may check with EPD to avoid sending in duplicate information.

Schedule 1

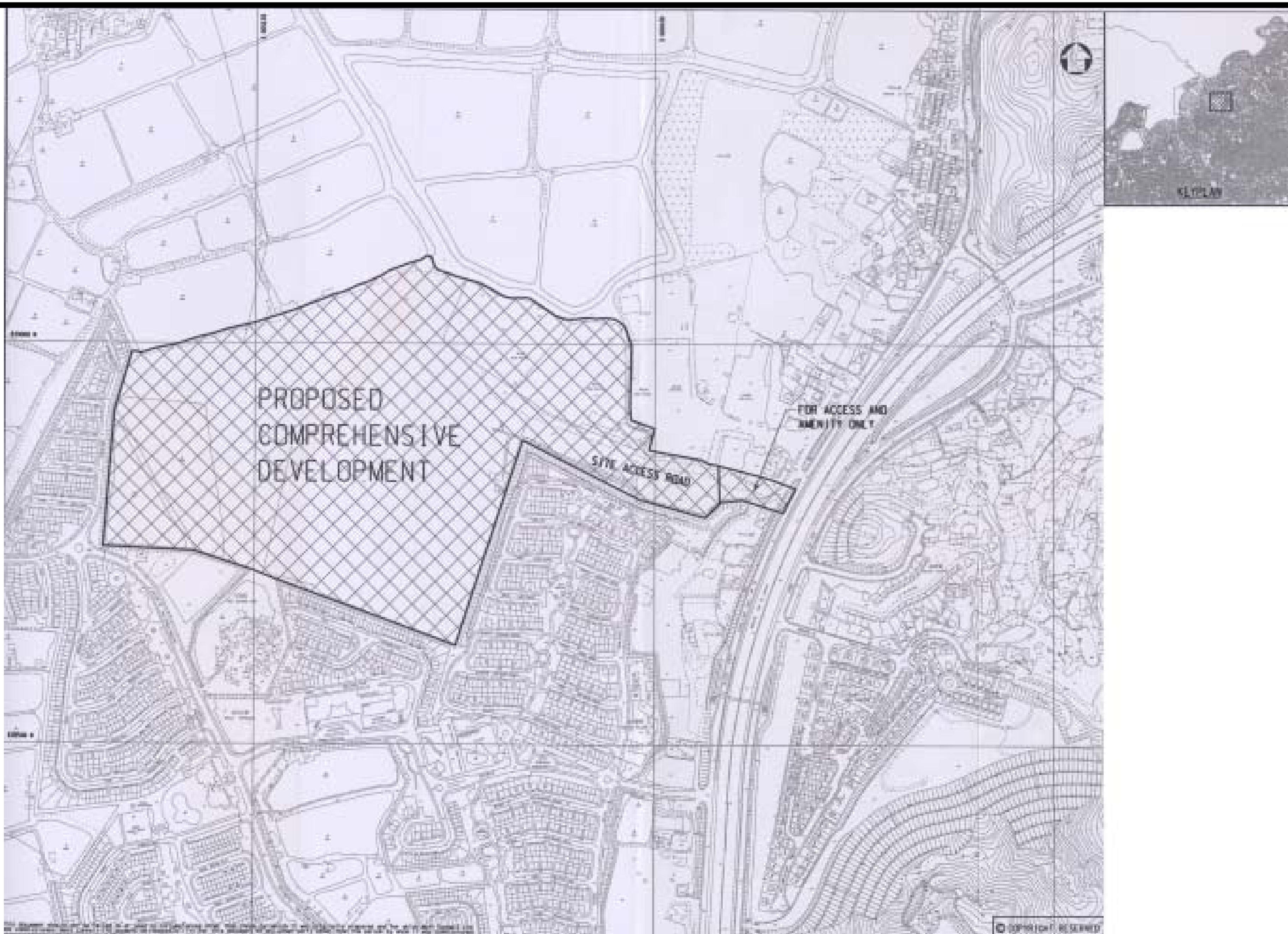
Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department for Regulatory applications as at 1 July 1998*

Industrial Source Complex Dispersion Model - Short Term Version 3 (ISCST3) or the latest version developed by U.S. Environmental Protection Agency

California Line Source Dispersion Model Version 4 (CALINE4) or the latest version developed by Department of Transportation, State of California, U.S.A.

Fugitive Dust Model (FDM) or the latest version developed by U.S. Environmental Protection Agency

*EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.



Project Title - Proposed Comprehensive Development at Wo Shang Wai, Yuen Long

EIA Study Brief No. : ESB-131/2005

Figure 1 - Location Plan

APPENDIX B

B-1 Application for Planning Permission at OU(CDWRA) Zoning

B-2 Construction Programme

Appendix B.1

Results are grouped by following categories:

Application for Planning Permission 5 records

Sort by: ◉ Case No. Tuen Mun and Yuen Long - Mai Po & Fairview Park

Application for Planning Permission search result - Page 1

A/YL-MP/097 - applied for Temporary Open Storage of Electrical Appliances and Office Equipment with ancillary facilities for 3 years *located at Mai Po, Yuen Long*
A/YL-NSW/145 - applied for Temporary Flower Market for a Period of 3 Years *located at Pok Wai Village, Yuen Long*
A/YL-NSW/155 - applied for Temporary Flower Market for a Period of 3 Years *located at Pok Wai Tsuen, Yuen Long*
A/YL-ST/172 - applied for Proposed Comprehensive Residential Development with Wetland Restoration/Enhancement *located at Lin Barn Tsuen, Yuen Long*
A/YL-ST/287 - applied for Comprehensive Residential Development to include Wetland Restoration Area *located at Lin Barn Tsuen, San Tin, Yuen Long*

Appendix B.1

Results are grouped by following categories:

Application for Planning Permission 31 records

Sort by: Case No.
Application for Planning Permission search result - Page 1
1 2 3 4
A/YL-NSW/090 - applied for Temporary open storage of construction materials for 12 months *located at Wing Kei Tsuen, Nam Sang Wai, Yuen Long*
A/YL-NSW/091 - applied for Temporary open storage of PVC pipes for a period of 12 months *located at Near Fairview Park, Nam Sang Wai, Yuen ...*
A/YL-NSW/093 - applied for Temporary Warehouse for Storage of Building Materials (Plywood) for a Period of 3 Years *located at Tai Sang Wai, Yuen Long*
A/YL-NSW/097 - applied for Proposed Temporary Racing Tracks for Radio-controlled Model Cars with Ancillary Facilities for a Period of 3 Years *located at Near Fairview Park, Yuen Long*
A/YL-NSW/102 - applied for Temporary Car/Lorry Park for a Period of 12 Months *located at Near Wing Kei Tsuen, Yuen Long*
A/YL-NSW/107 - applied for Temporary warehouse for storage of stainless steel sheets and coils for a Period of 3 Years *located at Tai Sang Wai, Yuen Long*
A/YL-NSW/108 - applied for Temporary Parking Area for Applicant's Own Private Cars/Vans for a Period of 3 Years *located at Tai Sang Wai, Yuen Long*
A/YL-NSW/110 - applied for Temporary Racing Tracks for Radio-controlled Model Cars with Ancillary Facilities for a Period of 3 Years *located at Near Fairview Park, Yuen Long*
A/YL-NSW/111 - applied for Restaurant Use *located at Tai Sang Wai, Yuen Long*
A/YL-NSW/113 - applied for Temporary Container Trailer and Lorry Park for a period of 3 years *located at Tai Sang Wai, Yuen Long*
1 2 3 4

Appendix B.1

Results are grouped by following categories:

Application for Planning Permission 31 records

Sort by: Case No.

Application for Planning Permission search result - Page 2

1 2 3 4

A/YL-NSW/119 - applied for Temporary Car/Lorry Park for a Period of 3 Years *located at Near Wing Kei Tsuen, Yuen Long*

A/YL-NSW/121 - applied for Temporary warehouse for storage of stainless steel sheets and coils for a Period of 3 Years *located at Tai Sang Wai, Yuen Long*

A/YL-NSW/124 - applied for Temporary Open Storage of light building Materials for a Period of 3 Years *located at Nam Sang Wai, Yuen Long*

A/YL-NSW/133 - applied for Temporary Open Storage of Construction vehicles for a Period of 3 Years *located at Wing Kei Tsuen, Yuen Long*

A/YL-NSW/134 - applied for Temporary open storage of tracks for a Period of 3 Years *located at Wing Kei Tsuen, Nam Sang Wai, Yuen Long*

A/YL-NSW/139 - applied for Proposed Temporary Car Show and Car Sale Office for a Period of 3 Years *located at Tai Sang Wai, Yuen Long*

A/YL-NSW/140 - applied for Temporary open storage of new private cars for a Period of 2 Year *located at Wing Kei Tsuen, Nam Sang Wai, Yuen Long*

A/YL-NSW/143 - applied for Temporary Container trailer/tractor park for a Period of 3 Years *located at Tai Sang Wai, Yuen Long*

A/YL-NSW/145 - applied for Temporary Flower Market for a Period of 3 Years *located at Pok Wai Village, Yuen Long*

A/YL-NSW/149 - applied for Temporary Open Storage of New and Unlicensed Vehicles for a Period of 2 Years *located at Wing Kei Tsuen, Nam Sang Wai, Yuen Long*

1 2 3 4

Appendix B.1

Results are grouped by following categories:

Application for Planning Permission 31 records

Sort by: ◉ Case No.

Application for Planning Permission search result - Page 3

1 2 3 4

A/YL-NSW/153 - applied for Temporary Open Storage of Construction Materials and Ancillary Site Office for a Period of 2 Years *located at Nam Sang Wai, Yuen Long*
A/YL-NSW/155 - applied for Temporary Flower Market for a Period of 3 Years *located at Pok Wai Tsuen, Yuen Long*
A/YL-NSW/156 - applied for Comprehensive Residential Development including Wetland Restoration and Management Proposal (and minor relaxation of building height restriction up to 7 storeys including carports) *located at Wing Kei Tsuen, Yuen Long*
A/YL-NSW/157 - applied for Temporary Relocation of Loading/Unloading Area of Warehouse and Installation of Small Scale Water Tank for Tree Irrigation Purpose for a Period of 3 Years *located at Tai Sang Wai, Yuen Long*
A/YL-NSW/159 - applied for Temporary Open Storage of New and Unlicensed Vehicles for a Period of 2 Years *located at Wing Kei Tsuen, Nam Sang Wai, Yuen Long*
A/YL-NSW/161 - applied for Temporary Vehicle Park (Container Vehicles, Goods Vehicles and Private Cars) for a Period of 3 Years *located at Tai Sang Wai, Yuen Long*
A/YL-NSW/162 - applied for Temporary Open Storage of Timber Materials for a Period of 3 Years *located at Nam Sang Wai, Yuen Long*
A/YL-NSW/166 - applied for Temporary Open Vehicle Park (Including Container Vehicles and Private Cars) for a Period of 3 Years *located at Nam Sang Wai, Yuen Long*
A/YL-NSW/167 - applied for Low Density Residential Development *located at Tai Sang Wai, Yuen Long*
A/YL-NSW/169 - applied for Temporary Open Vehicle Park (including Container Vehicles and Private Cars) for a Period of 3 Years *located at Nam Sang Wai, Yuen Long*

1 2 3 4

Appendix B.1

Results are grouped by following categories:

Application for Planning Permission 31 records

Sort by: Case No.
Application for Planning Permission search result - Page 4
1 2 3 4
A/YL-NSW/174 - applied for Temporary Eating Place (Restaurant) for a Period of 5 Years *located at Nam Sang Wai, Yuen Long*
1 2 3 4

Appendix B.1

Results are grouped by following categories:

Application for Planning Permission 37 records

Sort by: ⦿ Case No.	Tuen Mun and Yuen Long - San Tin

Application for Planning Permission search result - Page 1
1 2 3 4
A/YL-ST/109 - applied for Proposed Temporary Private Vehcle, Lorry and Container Trailer Park for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/132 - applied for Temporary Open Storage for Precast Facade Units for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/137 - applied for Proposed Temporary Extension of an "Existing Use" of Container Trailer Park for a Period of 3 Years. *located at San Tin, Yuen Long*
A/YL-ST/145 - applied for Proposed Temporary Extension of an "Existing Use" of Storage and Workshop for Construction Machinery for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/149 - applied for Temporary Container Tractor/Trailer Park and Open Storage of Building Materials for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/161 - applied for Temporary Container Tractor/Trailer Park with Tyre Repair Workshop for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/166 - applied for Temporary Container Tractor/Trailer Park for a Period of 3 years *located at San Tin, Yuen Long*
A/YL-ST/171 - applied for Temporary Container Tractor/Trailer Park for a period of 3 years *located at San Tin, Yuen Long*
A/YL-ST/172 - applied for Proposed Comprehensive Residential Development with Wetland Restoration/Enhancement *located at Lin Barn Tsuen, Yuen Long*
A/YL-ST/176 - applied for Temporary Open Storage for Precast Facade Units for a Period of 3 Years *located at San Tin, Yuen Long*
1 2 3 4

Appendix B.1

Results are grouped by following categories:

Application for Planning Permission 37 records

Sort by: ⦿ Case No. Tuen Mun and Yuen Long - San Tin

Application for Planning Permission search result - Page 2

1 2 3 4

A/YL-ST/178 - applied for Temporary Container Tractor/Trailer Park for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/181 - applied for Proposed Temporary Container Vehicle Park with Ancillary Office, Staff Canteen and Vehicle Repair Workshop for a Period of 3 Years *located at SAN TIN, YUEN LONG*
A/YL-ST/182 - applied for Temporary Container Trailer/Tractor Park with Ancillary Office for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/186 - applied for Temporary Open Storage of Construction Machinery and Ancillary Workshop for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/187 - applied for Temporary Private Car, Lorry and Container Trailer/Tractor Park for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/188 - applied for Temporary Container Trailer/Tractor Park with Ancillary Workshop for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/197 - applied for Temporary Container Trailer Park and Tyre Repair Workshop for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/213 - applied for Temporary Open Storage of Construction Machinery and Ancillary Workshop for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/220 - applied for Temp container tractor/trailer park & Open Storage of building Machinery for a period of 3 years *located at San Tin, Yuen Long*
A/YL-ST/223 - applied for Temporary container trailer/tractor park for a period of 3 years *located at San Tin, Yuen Long*

1 2 3 4

Results are grouped by following categories:

Application for Planning Permission 37 records

Appendix B.1

Sort by: ◉ Case No. Tuen Mun and Yuen Long - San Tin
Application for Planning Permission search result - Page 3
1 2 3 4
A/YL-ST/227 - applied for Temporary vehicle Park (including container vehicles & lorries) for a Period od 3 Years *located at San Tin, Yuen Long*
A/YL-ST/231 - applied for Temporary Open Storage of Construction Machinery and Ancillary Workshop for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/246 - applied for Temporary Container Vehicle Park with ancillary Vehicle Repair Workshop, office & staff canteen for a Period of 1 Years *located at San Tin, Yuen Long*
A/YL-ST/250 - applied for Temporary Container Tractor/Trailer Park and Open Storage of Building Materials for a Period of One Years *located at San Tin, Yuen Long*
A/YL-ST/253 - applied for Temporary Container Trailer/Tractor Park with Ancillary Office for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/254 - applied for Proposed Temporary Public Car Park for Private Cars with Ancillary Offices for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/263 - applied for Temporary vehicle Park (including container vehicles & lorries) for a Period od 3 Years *located at San Tin, Yuen Long*
A/YL-ST/266 - applied for Temporary Open Storage of Construction Machinery and Ancillary Workshop for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/267 - applied for Temporary Tyre Repair Workshop with Ancillary Parking, Office and Storage Facilities for a Period of 3 Years *located at San Tin, Yuen Long*
A/YL-ST/273 - applied for Temporary Container Tractor/Trailer Park and Open Storage of Building Materials for a Period of 1 Year *located at San Tin, Yuen Long*
1 2 3 4

Appendix B.1

Results are grouped by following categories:

Application for Planning Permission 37 records

Sort by: ◉ Case No. Tuen Mun and Yuen Long - San Tin

Application for Planning Permission search result - Page 4

1 2 3 4

A/YL-ST/278 - applied for Temporary Sale and Display Centre for Used Light Vehicles, Tractors and Tractor Parts for a Period of 12 Months *located at San Tin, Yuen Long*

A/YL-ST/287 - applied for Comprehensive Residential Development to include Wetland Restoration Area *located at Lin Barn Tsuen, San Tin, Yuen Long*

A/YL-ST/297 - applied for Temporary Sales and Display Centre for Used Light Vehicles, Tractors and Tractor Parts for a Period of 12 Months *located at San Tin, Yuen Long*

A/YL-ST/298 - applied for Temporary Container Tractor/Trailer Park and Open Storage of Building Materials for a Period of 12 Months *located at San Tin, Yuen Long*

A/YL-ST/299 - applied for Proposed Temporary Tyre Repair Workshop for a Period of 3 Years *located at San Tin, Yuen Long*

A/YL-ST/322 - applied for Temporary Public Vehicle Park (Including Container Vehicles and Heavy Goods Vehicles) with Ancillary Site Offices for a Period of 3 Years *located at San Tin, Yuen Long*

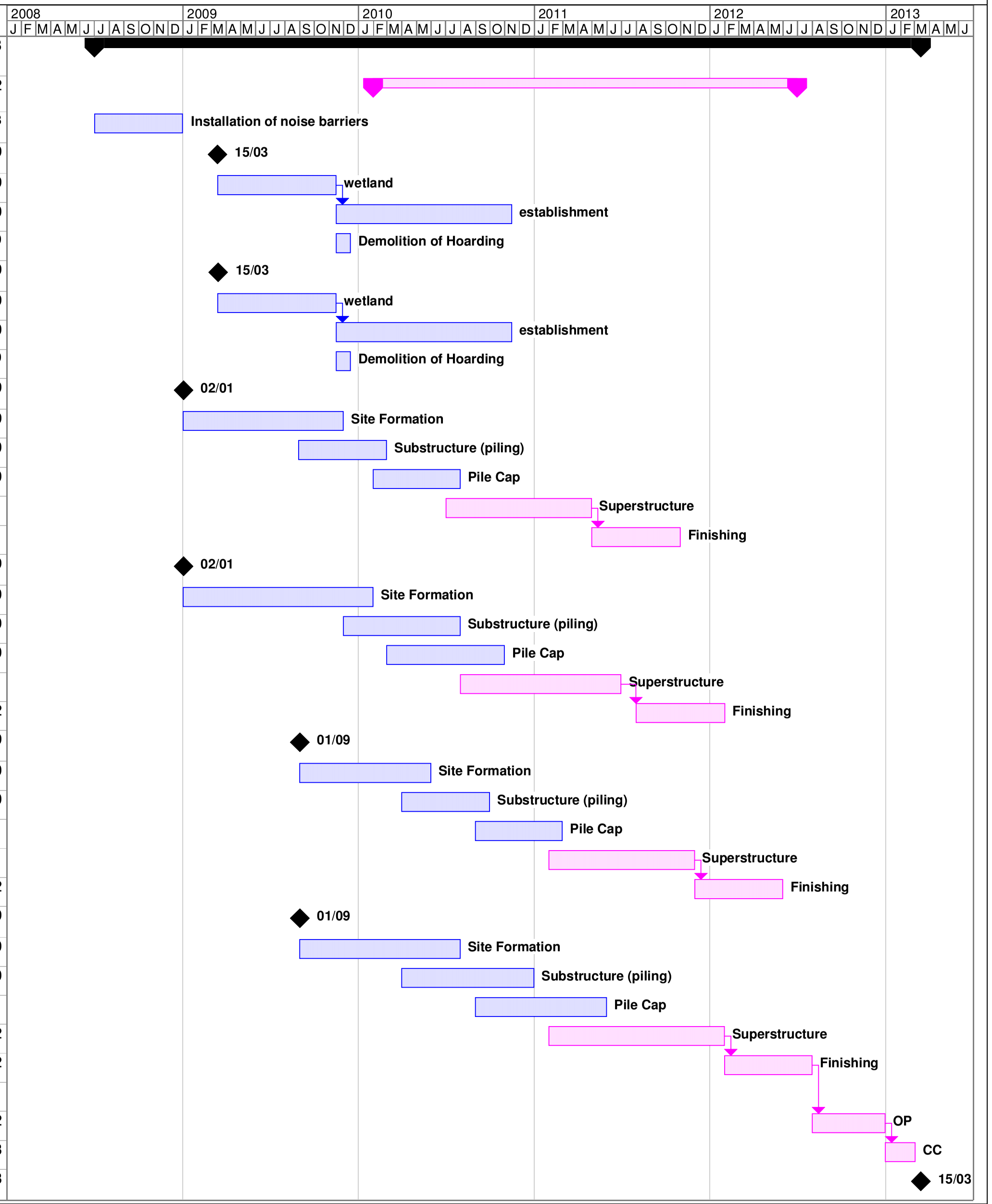
A/YL-ST/326 - applied for Temporary Open Storage of Recyclable Metal for a Period of 3 Years *located at San Tin, Yuen Long*

1 2 3 4

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long

Appendix B.2 Implementation Programme

ID	Task Name	Duration	Start	Finish
1	**CONTRACT PERIOD**	**1717 days**	**Wed 02/07/08**	**Fri 15/03/13**
2	**Superstructure & Finishing Work (Total Days)**	881 days	Mon 01/02/10	Sat 30/06/12
3	**Foundation and erection of noise barriers**	183 days	Wed 02/07/08	Wed 31/12/08
4	**Phase A - Wetland Restoration**	0 days	Sun 15/03/09	Sun 15/03/09
5	Construction of wetland	246 days	Sun 15/03/09	Sun 15/11/09
6	Establishment of wetland	365 days	Mon 16/11/09	Mon 15/11/10
7	Demolition of Hoarding	30 days	Mon 16/11/09	Tue 15/12/09
8	**Phase B - Wetland Restoration**	0 days	Sun 15/03/09	Sun 15/03/09
9	Construction of wetland	246 days	Sun 15/03/09	Sun 15/11/09
10	Establishment of wetland	365 days	Mon 16/11/09	Mon 15/11/10
11	Demolition of Hoarding	30 days	Mon 16/11/09	Tue 15/12/09
12	**Phase C - Site Formation/Preloading/Substructure/Superstructure**	0 days	Fri 02/01/09	Fri 02/01/09
13	Site Formation	333 days	Fri 02/01/09	Mon 30/11/09
14	Building Construction - Substructure work (piling + underground drainage)	183 days	Sun 30/08/09	Sun 28/02/10
15	Building Construction - Pile Cap / Footing work	181 days	Mon 01/02/10	Sat 31/07/10
16	Building Construction - Superstructure Work	303 days	Fri 02/07/10	Sat 30/04/11
17	Building Construction - Finishing Period	184 days	Sun 01/05/11	Mon 31/10/11
18	**Phase D - Site Formation/Preloading/Substructure/Superstructure**	0 days	Fri 02/01/09	Fri 02/01/09
19	Site Formation	395 days	Fri 02/01/09	Sun 31/01/10
20	Building Construction - Substructure work (piling + underground drainage)	243 days	Tue 01/12/09	Sat 31/07/10
21	Building Construction - Pile Cap / Footing work	245 days	Mon 01/03/10	Sun 31/10/10
22	Building Construction - Superstructure Work	334 days	Sun 01/08/10	Thu 30/06/11
23	Building Construction - Finishing Period	185 days	Mon 01/08/11	Wed 01/02/12
24	**Phase E - Site Formation/Preloading/Substructure/Superstructure**	0 days	Tue 01/09/09	Tue 01/09/09
25	Site Formation	273 days	Tue 01/09/09	Mon 31/05/10
26	Building Construction - Substructure work (piling + underground drainage)	183 days	Thu 01/04/10	Thu 30/09/10
27	Building Construction - Pile Cap / Footing work	181 days	Wed 01/09/10	Mon 28/02/11
28	Building Construction - Superstructure Work	303 days	Tue 01/02/11	Wed 30/11/11
29	Building Construction - Finishing Period	183 days	Thu 01/12/11	Thu 31/05/12
30	**Phase F - Site Formation/Preloading/Substructure/Superstructure**	0 days	Tue 01/09/09	Tue 01/09/09
31	Site Formation	334 days	Tue 01/09/09	Sat 31/07/10
32	Building Construction - Substructure work (piling + underground drainage)	275 days	Thu 01/04/10	Fri 31/12/10
33	Building Construction - Pile Cap / Footing work	273 days	Wed 01/09/10	Tue 31/05/11
34	Building Construction - Superstructure Work	365 days	Tue 01/02/11	Tue 31/01/12
35	Building Construction - Finishing Period	182 days	Wed 01/02/12	Tue 31/07/12
36				
37	Obtain Operation Permit (OP)	152 days	Wed 01/08/12	Sun 30/12/12
38	Obtain Certification of Completion (CC)	62 days	Mon 31/12/12	Sat 02/03/13
39	**Population Intake**	0 days	Fri 15/03/13	Fri 15/03/13



Task | Milestone | Summary | Project Summary | External Tasks | External Milestone

APPENDIX C

Air Quality

(Not Use)

APPENDIX D

Noise

APPENDIX A

EIA Study Brief No. ESB - 131/2005

APPENDIX D-1A

Letters from Planning Department and Lands Department

By Fax (2827 1823) and Post

規劃署

屯門及元朗規劃處
新界沙田上禾輋路一號
沙田政府合署 14 樓

Planning Department
Tuen Mun and Yuen Long
District Planning Office
14/F., Sha Tin Government Offices,
No. 1, Sheung Wo Che Road,
Sha Tin, N.T.

來函檔號 Your Reference:	KMY/AFK/TMC/CWK/mc/T221005/30.09/L0063	
本署檔號 Our Reference:	( ) in PDYL/1/7/25	23 May 2007
電話號碼 Tel. No.:	2158 6289	
傳真機號碼 Fax No.:	2489 9711	

Mott Connell Limited
40th Floor, Hopewell Centre,
183 Queen's Road East,
Wanchai,
Hong Kong

(Attn.: Dr Anne F Kerr)

	To	Action	Information	Copy	Sign	Date
1	AFK					
2	SMF				SW	28/5
Rec'd	25 MAY 2007					
	JC					
	CWK					28/5
No.					mm	

Dear Dr Kerr,

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Land Use for Existing Open Storage Site in "OU" Zone

Thank you for your letter dated 15 May 2007.

The subject two zones at the vicinity of Mai Po Lo Wai involve "Other Specified Uses" annotated "Comprehensive Development to include Wetland Restoration Area" ("OU(CDWRA)") and "Village Type development" ("V"). According to the Notes of the approved Mai Po and Fairview Park Outline Zoning Plan (OZP) No. S/YL-MP/6, the planning intention of the "OU(CDWRA)" zone is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds through comprehensive residential and/or recreational development to include wetland restoration area. It is also intended to phase out existing sporadic open storage and port back-up uses on degraded wetlands. Any new building should be located farthest away from Deep Bay. The eastern portion of the "OU(CDWRA)" zone is partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks. These uses existed immediately before the first publication in the Gazette of the notice of the Mai Po and Fairview Park IDPA Plan are tolerated.

The planning intention of the "V" zone is to reflect existing recognized and other villages, and to provide land considered suitable for village expansion and reprovisioning of village houses affected by Government projects. Land within this zone is primarily intended for development of Small Houses by indigenous villagers. It is also intended to concentrate village type development within this zone for a more orderly development pattern, efficient use of land and provision of infrastructures and services.

According to our office's records, no planning application or rezoning application in respect of these two zones has been received. In the circumstances, we may not be able to accord higher priority for the review of these zones at this moment.

Should you have any queries on the above, please contact the undersigned on 2158 6234.

Yours faithfully,

(Ms Vienna TONG)
for District Planning Officer/TMYL
Planning Department

c.c.
EPD (Attn.: Mr. Tom T.H. TAM)

ACYL/VT/vt

(78)

地政總署
元朗地政處
DISTRICT LANDS OFFICE, YUEN LONG
LANDS DEPARTMENT

電話 Tel: 2443 3327
圖文傳真 Fax: 2442 1070
電郵地址 Email: leylt1@landsd.gov.hk
本處檔號 Our Ref.: (28) in DLOYL 193/YLT/2005

我們矢志努力不懈，提供盡善盡美的土地行政服務。
We strive to achieve excellence in land administration.

新界元朗橋樂坊二號大橋政府合署九至十一樓
9/F.-11/F., Yuen Long Government Offices & Tai Kiu Market,
No. 2 Kiu Lok Square, Yuen Long, N.T.

來函檔號 Your Ref.: KMY/AFK/TMC/CWK/mc/T221005/30.09/L0068

By Fax and by mail

Mott Connell Limited
40/F Hopewell Centre
183 Queen's Road East
Wanchai
Hong Kong

15 JUN 2007

Dear Sirs,

Proposed Comprehensive Development at Wo Sang Wai, Yuen Long
Land use for existing open storage site in OU zone

I refer to your letter dated ~~18.5~~.2007 (21) and the telephone conversation on 14.6.2007 between your Mr. W. K. CHIU and the undersigned on the captioned.

I regret to inform you that your request cannot be acceded to as this office is not in a position to release any information relating to the land to any third party. Perhaps you may consider to approach direct to the respective landowners for the required information.

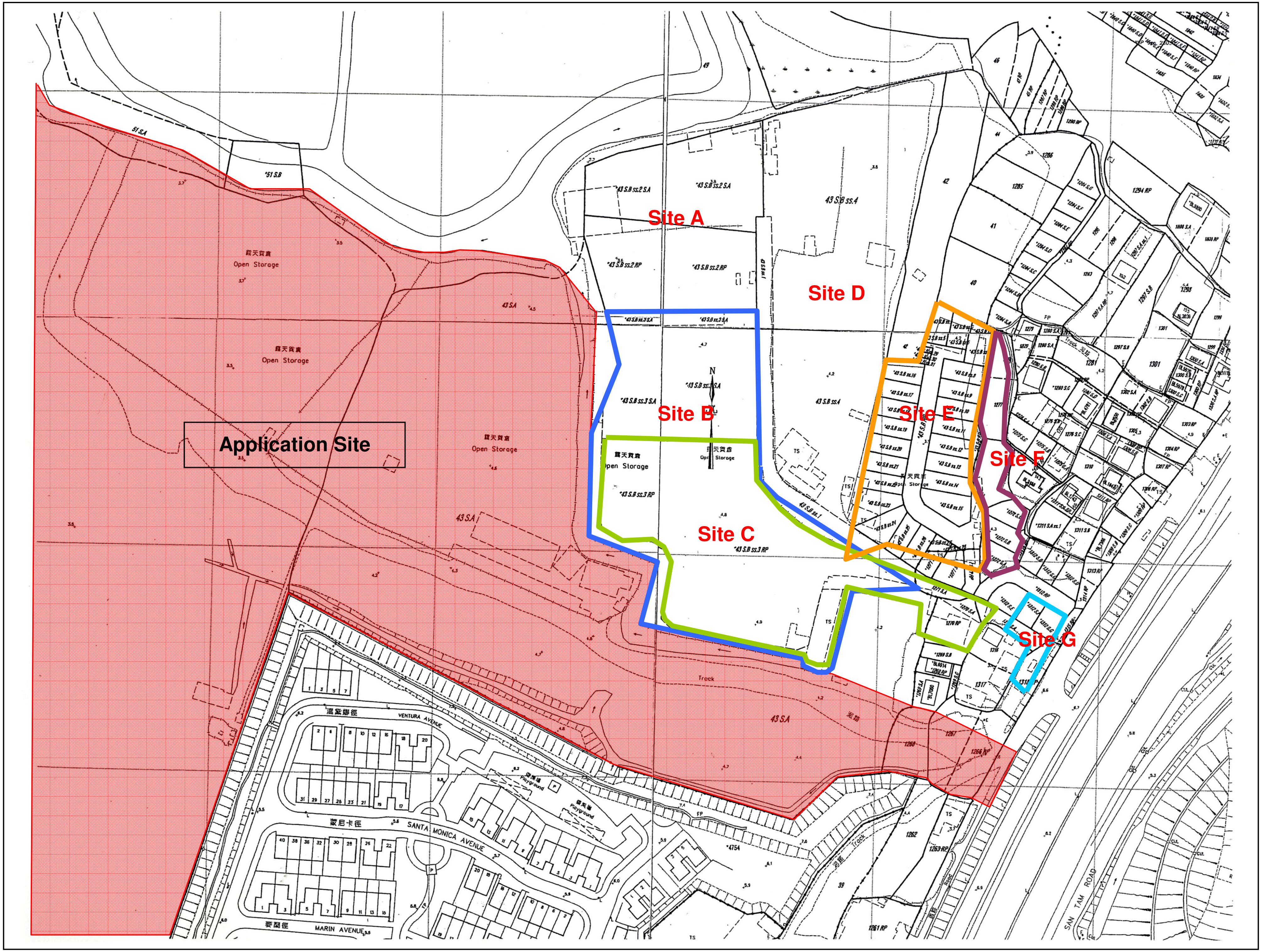
Should you have any query, please contact the undersigned on telephone number 2443 3327.

Yours faithfully,

(LEUNG Sum-ping)
for District Lands Officer, Yuen Long

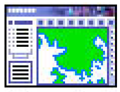
APPENDIX D-1B

Reference of Planning Application Cases


Application Site
Site A
Site B
Site C
Site D
Site E
Site F
Site G
露天貨倉
Open Storage
43 S.A
Track
SAN TAM ROAD
SANTA MONICA AVENUE
蒙尼卡徑
VENTURA AVENUE
溫富雅徑
MARIN AVENUE
麥麗徑
Playground
N

Site B

Detail information of Planning Application Case	
General Information:	
Case Number.:	**A/YL-MP/061**
Use Applied for:	Temporary Car, Lorry and Container Trailer/Tractor Park for a Period of 12 Months
Location:	
Address:	Mai Po, Yuen Long
Lot Number:	DD 101 Lots 43A(P), 43B3RP and 43B3A
Statutory Plan:	S/YL-MP/1 (Mai Po & Fairview Park OZP)
Detailed Information:	
Site Area (sq.m):	9910.00
Proposed Number of Unit:	N/A
Number of Storeys:	N/A
GFA/UFA Applied for (sq.m):	N/A
Zoning:	Conservation Area,Village Type Development



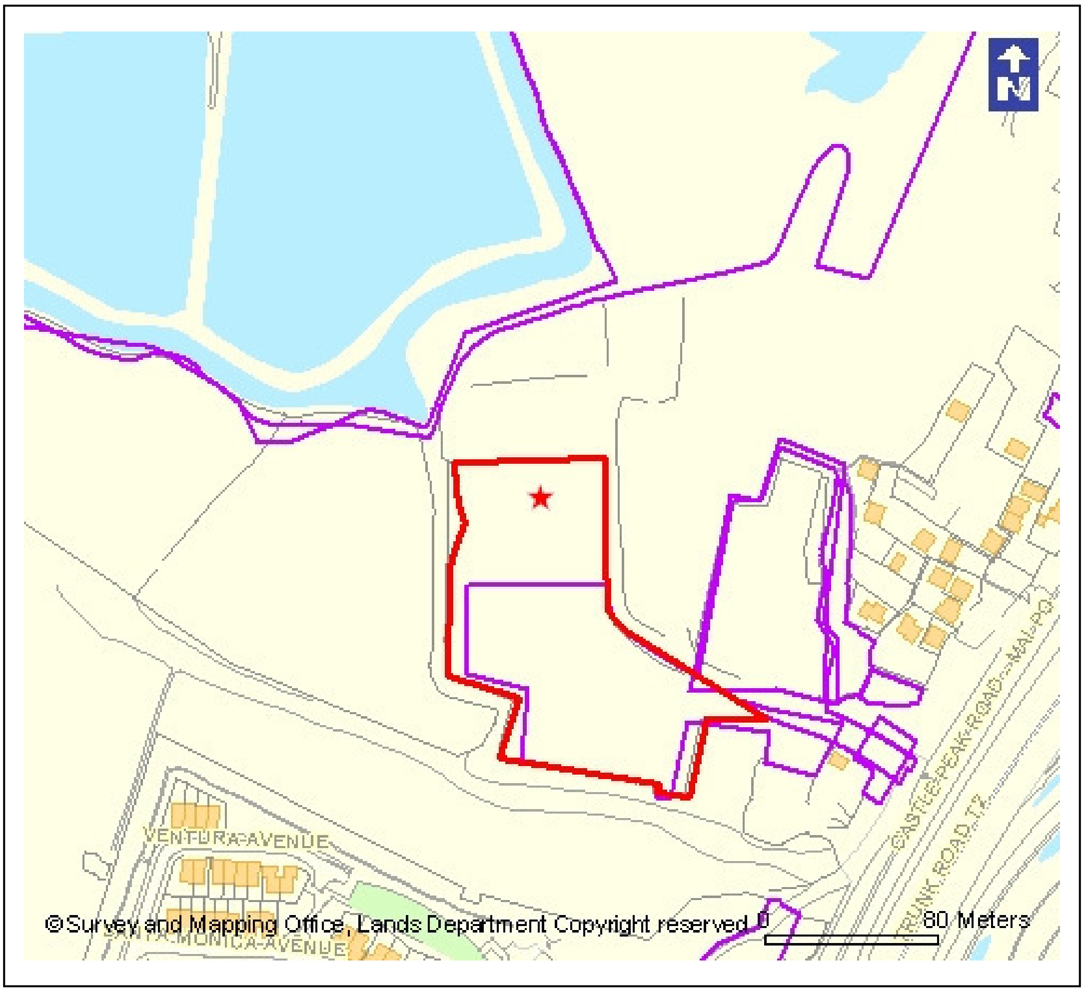
Show Map

Decision Meeting(s):

Decision Date (DD/MM/YYYY)	Type of consideration	Decision	Authority
14/01/2000	Planning application	Rejected	Rural & NT Planning Committee

Previous Case:A/YL-MP/021

Detailed Information
The Town Planning Board (the Board) decided not to approve the application and the reasons are :- (a) The development is not in line with the planning intention of the "Conservation Area" ("CA") zone to give further protection to Mai Po Nature Reserve and to separate sensitive natural systems from the adverse effects of developments and that of the "Village" ("V") zone to designate land for existing recognised villages and their future expansion. There is no strong justification in the submission for a departure from such planning intention, even on a temporary basis; (b) The development is not compatible with the land uses of the surrounding areas which include houses to its east, the villages of Mai Po San Tsuen and Mai Po Lo Wai to its north, and the residential development of Royal Palms to its south. The development is likely to have negative impacts on them; (c) The development does not comply with the revised Town Planning Board Guidelines on "Application for Developments within Deep Bay Area" in that there is no information in the submission to demonstrate that the development would not have adverse disturbance impact on the ecological integrity and ecological value of the fish ponds within the Wetland Conservation Area in the Deep Bay Area; and (d) The approval of the application would set an undesirable precedent for other similar applications. The cumulative effect of approving such similar applications would result in a general degradation of the ecology and environment of the area.



Site C

Detail information of Planning Application Case	
General Information:	
Case Number.:	A/YL-MP/021
Use Applied for:	Temporary container Storage, Container Repair Workshop with Ancillary Office And Canteen on for a Period of 12 Months.
Location:	
Address:	Mai Po, Yuen Long
Lot Number:	DD 101 LOTs 43A(P) & 43B3 and DD 105 LOTs 1270, 1271(P), 1312A(P) & 1312RP(P)
Statutory Plan:	S/YL-MP/1 (Mai Po & Fairview Park OZP)
Detailed Information:	
Site Area (sq.m):	7645.00
Proposed Number of Unit:	N/A
Number of Storeys:	1-2
GFA/UFA Applied for (sq.m):	N/A
Zoning:	Conservation Area,Village Type Development

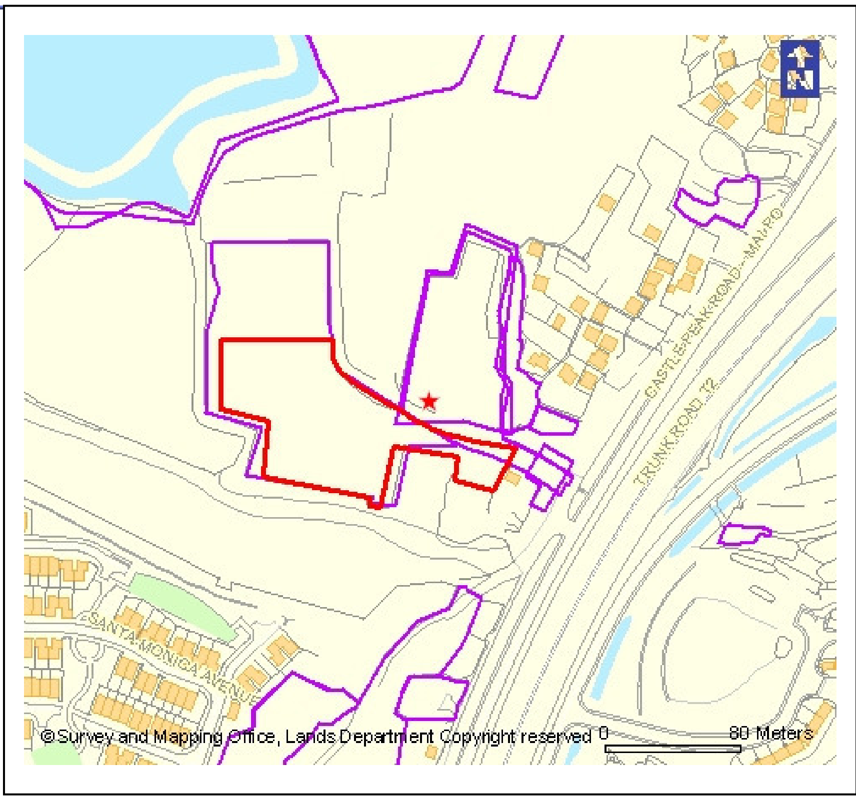
Show Map

Decision Meeting(s):

Decision Date (DD/MM/YYYY)	Type of consideration	Decision	Authority
20/06/1997	Planning application	Rejected	Rural & NT Planning Committee
29/05/1998	Review	Rejected	Town Planning Board
26/05/1999	Appeal (no. 13/1998)	Abandoned by applicant	Appeal Board

Subsequent Case:A/YL-MP/061

Detailed Information
The Town Planning Board (the Board) decided on review not to approve the application and the reasons are: (a) The development is not in line with the planning intentions for the "Conservation Area" ("CA") and "Village Type Development" ("V") zones. The planning intention of the "CA" zone is to retain the existing natural characteristics of the area and to give added protection to the Mai Po Nature Reserve (MPNR) in the area and to preserve the special landscape and ecological value of Inner Deep Bay area. The planning intention of the "V" zone is to designate both existing recognized villages and areas of land considered suitable for village expansion. There is no strong justification to merit a departure from the planning intentions, even on a temporary basis; (b) The development is not in line with the "Town Planning Board Guidelines for Application for Developments Within Deep Bay Buffer Zones" in that: (i) The development is not compatible with the conservation objective of MPNR and Inner Deep Bay. It is not appropriate to the area's rural setting and would not enhance the visual appearance and landscape character of the area; (ii) There is insufficient information in the submission to demonstrate that the development would not have adverse impacts on the environment, ecology and sewerage in the area including MPNR and Inner Deep Bay; and (iii) There is insufficient information in the submission to demonstrate that the development would not add pollution loading into the Inner Deep Bay; (c) The development is not in line with the "Town Planning Board Guidelines for Application for Open Storage and Port Back-up Uses" in that the application site is located adjacent to residential dwellings which are sensitive receivers; and (d) The approval of the application would set an undesirable precedent for similar applications, the cumulative effect of which would further degrade the environment in the area.



APPENDIX D-2A

Unmitigated Plant Inventory

Plant Inventory and Cumulative SWL for All Phases
- Unmitigated Scenario

	PME	TM Ref. / BS no.	SWL/Unit, dB(A)	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
	Wetland Restoration																																							
Wetland Restoration	Breaker, excavator mounted (pneumatic)	CNP027	122			2	2	2	2	2	2	2	2	2																										
	Excavator	CNP081	112			4	4	4	4	4	4	4	4	4																										
	Dump Truck	CNP067	117			2	2	2	2	2	2	2	2	2																										
	Roller, vibratory	CNP186	108			4	4	4	4	4	4	4	4	4																										
	Bulldozer	CNP030	115			4	4	4	4	4	4	4	4	4																										
	Generator, standard	CNP101	108			2	2	2	2	2	2	2	2	2																										
Removal of hoarding at northern boundary	Breaker, hand-held, mass > 35 kg	CNP026	114												2																									
	Lorry, with crane, gross vehicle weight > 38 ton	*	112												2																									
	Site Formation and Excavation																																							
Site Formation and Excavation	Breaker, excavator mounted (pneumatic)	CNP027	122	2	2	2	2	2	2	2	2	4	4	4	3	3	2	2	2	2	1	1																		
	Excavator	CNP081	112	4	4	4	4	4	4	4	4	8	8	8	6	6	4	4	4	4	2	2																		
	Dump Truck	CNP067	117	6	6	6	6	6	6	6	6	13	13	13	10	10	7	7	7	7	4	4																		
	Roller, vibratory	CNP186	108	6	6	6	6	6	6	6	6	12	12	12	9	9	6	6	6	6	3	3																		
	Bulldozer	CNP030	115	6	6	6	6	6	6	6	6	12	12	15	12	12	6	6	6	6	3	3																		
	Generator, standard	CNP101	108	4	4	4	4	4	4	4	4	8	8	8	6	6	4	4	4	4	2	2																		
Installation of Band Drains	Band drains installation machine (Compactor, vibratory)	CNP050	105	12	12	12	12	12	6	6	6	12	12	12	12	12	6	6																						
	Substructure																																							
Piling	Continuous flight auger (CFA) piles (Piling, earth auger)	CNP167	114									4	4	4	8	8	8	4	12	12	12	12	8	8	4	4	4													
	Generator, standard	CNP101	108									2	2	2	4	4	4	2	6	6	6	6	4	4	2	2	2													
	Bar bender and cutter (electric)	CNP021	90									2	2	2	4	4	4	2	6	6	6	6	4	4	2	2	2													
	Concrete pump	CNP047	109									2	2	2	4	4	4	2	6	6	6	6	4	4	2	2	2													
	Concrete lorry mixer	CNP044	109									3	3	3	6	6	6	3	9	9	9	9	6	6	3	3	3													
Pile Cap	Bar bender and cutter (electric)	CNP021	90														2	4	4	4	4	4	2	6	6	4	4	4	4	2	2	2								
	Generator, standard	CNP101	108														2	4	4	4	4	4	2	6	6	4	4	4	4	2	2	2								
	Lorry	CNP141	112														3	6	6	6	6	6	3	9	9	6	6	6	6	3	3	3								
Concreting	Crane, Mobile	CNP048	112														1	2	2	2	2	2	1	3	3	2	2	2	2	1	1	1								
	Concrete lorry mixer	CNP044	109														3	6	6	6	6	6	3	9	9	6	6	6	6	3	3	3								
	Compactor, vibratory	CNP050	105														3	6	6	6	6	6	3	9	9	6	6	6	6	3	3	3								
	Superstructure																																							
Superstructure	Air Compressor, air flow Air flow >10 m3/min and ≤ 30 m3/min	CNP002	102																			4	8	8	8	8	8	8	16	16	16	12	12	8	8	8	8	8	4	4
	Bar bender and cutter (electric)	CNP021	90																			3	6	6	6	6	6	6	12	12	12	9	9	6	6	6	6	6	3	3
	Concrete lorry mixer	CNP044	109																			5	10	10	10	10	10	10	20	20	20	15	15	10	10	10	10	10	5	5
	Concrete pump	CNP047	109																			5	10	10	10	10	10	10	20	20	20	15	15	10	10	10	10	10	5	5
	Crane, tower (electric)	CNP049	95																			2	4	4	4	4	4	4	8	8	8	6	6	4	4	4	4	4	2	2
	Drill/ grinder, hand-held (electric)	CNP065	98																			5	10	10	10	10	10	10	20	20	20	15	15	10	10	10	10	10	5	5
	Excavator	CNP081	112																			3	6	6	6	6	6	6	12	12	12	9	9	6	6	6	6	6	3	3
	Generator, standard	CNP101	108																			4	8	8	8	8	8	8	16	16	16	12	12	8	8	8	8	8	4	4
	Lorry	CNP141	112																			4	8	8	8	8	8	8	16	16	16	12	12	8	8	8	8	8	4	4
	Poker, vibratory, hand-held	CNP170	113																			6	12	12	12	12	12	12	24	24	24	18	18	12	12	12	12	12	6	6
	Saw, circular, wood	CNP201	108																			6	12	12	12	12	12	12	24	24	24	18	18	12	12	12	12	12	6	6
	Water pump (electric)	CNP281	88																			6	12	12	12	12	12	12	24	24	24	18	18	12	12	12	12	12	6	6
	Water pump, submersible (electric)	CNP283	85																			6	12	12	12	12	12	12	24	24	24	18	18	12	12	12	12	12	6	6
			Total SWL of each month	**129.9**	**129.9**	**132.1**	**132.1**	**132.1**	**132.0**	**132.0**	**132.0**	**134.4**	**134.4**	**134.5**	**132.9**	**132.8**	**131.5**	**131.4**	**132.2**	**132.2**	**130.8**	**132.0**	**130.7**	**131.5**	**131.0**	**130.6**	**130.6**	**129.9**	**132.4**	**132.2**	**132.2**	**131.0**	**130.6**	**128.9**	**128.9**	**128.9**	**128.9**	**128.9**	**125.8**	**125.8**

* Reference: http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf

APPENDIX D-2B

Unmitigated Construction Noise Levels

Unmitigated Noise Levels from Construction Work other than Percussive Piling (Shaded area means exceedance)

Appendix D-2B

	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09
NSR1	76	76	82	82	82	82	82	82	87	87	87	86
NSR1a	76	76	84	84	84	84	84	84	86	86	86	83
NSR2	75	75	77	77	77	77	77	77	84	84	85	84
NSR3	78	78	79	79	79	79	79	79	85	85	85	84
NSR4	78	78	79	79	79	79	79	79	88	88	88	88
NSR4a	77	77	78	78	78	78	78	78	85	85	85	85
NSR4b	80	80	81	81	81	80	80	80	87	87	87	86
NSR5	84	84	85	85	85	85	85	85	86	86	87	87
NSR6	79	79	80	80	80	80	80	80	85	85	85	85
NSR7	75	75	76	76	76	76	76	76	77	77	77	77
NSR8	72	72	73	73	73	73	73	73	75	75	75	74
NSR9	75	75	76	76	76	76	76	76	81	81	81	81
NSR10	80	80	80	80	80	80	80	80	81	81	81	81

	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10
NSR1	86	86	86	87	87	82	82	82	84	81	81	81
NSR1a	83	83	83	84	84	79	80	80	81	79	79	79
NSR2	84	84	84	85	85	80	81	80	82	79	79	79
NSR3	84	83	83	84	84	83	84	80	82	81	81	81
NSR4	88	88	87	88	88	88	88	83	85	85	85	85
NSR4a	85	84	84	85	85	85	85	80	82	82	82	82
NSR4b	86	86	86	87	87	86	87	82	84	84	84	84
NSR5	87	84	85	85	85	85	85	85	85	85	84	84
NSR6	85	84	84	85	85	85	85	81	82	82	82	82
NSR7	77	74	75	75	75	75	75	75	75	75	74	74
NSR8	74	73	73	73	73	73	74	72	72	72	71	71
NSR9	81	80	80	81	81	80	81	77	79	78	78	78
NSR10	82	80	80	81	81	81	81	78	78	78	78	78

	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
NSR1	81	86	85	85	85	85	85	85	85	85	85	70
NSR1a	79	83	82	82	82	82	82	82	82	82	82	70
NSR2	79	84	83	83	83	82	82	82	82	82	82	73
NSR3	80	84	83	83	82	81	81	81	81	81	81	79
NSR4	82	87	87	87	87	86	86	86	86	86	86	86
NSR4a	79	84	84	84	84	83	83	83	83	83	83	82
NSR4b	82	86	86	86	85	84	84	84	84	84	84	83
NSR5	84	85	85	85	81	80	80	80	80	80	80	80
NSR6	80	84	84	84	83	82	82	82	82	82	82	81
NSR7	74	75	75	75	70	69	69	69	69	69	69	68
NSR8	71	73	72	72	69	68	68	68	68	68	68	67
NSR9	76	80	80	80	79	78	78	78	78	78	78	77
NSR10	77	78	78	78	72	71	71	71	71	71	71	70

	Jan-12
NSR1	70
NSR1a	70
NSR2	73
NSR3	79
NSR4	86
NSR4a	82
NSR4b	83
NSR5	80
NSR6	81
NSR7	68
NSR8	67
NSR9	77
NSR10	70

Remarks: Noise criteria for NSR9 was 70 dB(A) during normal days and 65 dB(A) during examination

Unmitigated Construction Noise Levels, dB(A)

Calculation of SPL for each NSR from Phase A

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month						125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	114.0																									
NSR1	104	-48.3				79.7	79.7	79.7	79.7	79.7	79.7	79.7	79.7	79.7	68.7																									
NSR1a	76	-45.6				82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	71.4																									
NSR2	272	-56.7				71.4	71.4	71.4	71.4	71.4	71.4	71.4	71.4	71.4	60.3																									
NSR3	296	-57.4				70.7	70.7	70.7	70.7	70.7	70.7	70.7	70.7	70.7	59.6																									
NSR4	330	-58.4				69.7	69.7	69.7	69.7	69.7	69.7	69.7	69.7	69.7	58.6																									
NSR4a	418	-60.4				67.7	67.7	67.7	67.7	67.7	67.7	67.7	67.7	67.7	56.6																									
NSR4b	278	-56.9	3			71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	60.1																									
NSR5	370	-59.4				68.7	68.7	68.7	68.7	68.7	68.7	68.7	68.7	68.7	57.6																									
NSR6	400	-60.0				68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	57.0																									
NSR7	652	-64.3				63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	52.7																									
NSR8	800	-66.1				62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	50.9																									
NSR9	412	-60.3				67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	56.7																									
NSR10	578	-63.2				64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	53.8																									

Calculation of SPL for each NSR from Phase B

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month						125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	114.0																									
NSR1	364	-59.2				68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	57.8																									
NSR1a	338	-58.6				69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	58.4																									
NSR2	488	-61.8				66.3	66.3	66.3	66.3	66.3	66.3	66.3	66.3	66.3	55.2																									
NSR3	406	-60.2				67.9	67.9	67.9	67.9	67.9	67.9	67.9	67.9	67.9	56.8																									
NSR4	364	-59.2				68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	57.8																									
NSR4a	396	-60.0				68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	57.0																									
NSR4b	366	-59.3	3			68.8	68.8	68.8	68.8	68.8	68.8	68.8	68.8	68.8	57.7																									
NSR5	208	-54.4				73.7	73.7	73.7	73.7	73.7	73.7	73.7	73.7	73.7	62.6																									
NSR6	288	-57.2				70.9	70.9	70.9	70.9	70.9	70.9	70.9	70.9	70.9	59.8																									
NSR7	394	-59.9				68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	57.1																									
NSR8	608	-63.7				64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	53.3																									
NSR9	466	-61.4				66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	55.6																									
NSR10	360	-59.1				69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	57.9																									

Calculation of SPL for each NSR from Phase C

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month				126.9	126.9	126.9	126.9	126.9	126.7	126.7	126.7	127.9	127.9	127.9	121.8	121.8	124.2	120.4	120.4	120.4	120.4	126.9	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8									
NSR1	220	-54.8		75.0	75.0	75.0	75.0	75.0	74.8	74.8	74.8	76.1	76.1	76.1	70.0	70.0	72.3	68.5	68.5	68.5	68.5	75.1	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0									
NSR1a	214	-54.6		75.3	75.3	75.3	75.3	75.3	75.1	75.1	75.1	76.3	76.3	76.3	70.2	70.2	72.6	68.8	68.8	68.8	68.8	75.3	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2									
NSR2	254	-56.1		73.8	73.8	73.8	73.8	73.8	73.6	73.6	73.6	74.8	74.8	74.8	68.8	68.8	71.1	67.3	67.3	67.3	67.3	73.8	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7									
NSR3	176	-52.9		77.0	77.0	77.0	77.0	77.0	76.8	76.8	76.8	78.0	78.0	78.0	71.9	71.9	74.3	70.5	70.5	70.5	70.5	77.0	75.9	75.9	75.9	75.9	75.9	75.9	75.9	75.9	75.9									
NSR4	180	-53.1		76.8	76.8	76.8	76.8	76.8	76.6	76.6	76.6	77.8	77.8	77.8	71.7	71.7	74.1	70.3	70.3	70.3	70.3	76.8	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7									
NSR4a	256	-56.2		73.7	73.7	73.7	73.7	73.7	73.5	73.5	73.5	74.8	74.8	74.8	68.7	68.7	71.0	67.2	67.2	67.2	67.2	73.8	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7									
NSR4b	148	-51.4	3	78.5	78.5	78.5	78.5	78.5	78.3	78.3	78.3	79.5	79.5	79.5	73.4	73.4	75.8	72.0	72.0	72.0	72.0	78.5	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4									
NSR5	224	-55.0		74.9	74.9	74.9	74.9	74.9	74.7	74.7	74.7	75.9	75.9	75.9	69.8	69.8	72.2	68.4	68.4	68.4	68.4	74.9	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8									
NSR6	226	-55.1		74.8	74.8	74.8	74.8	74.8	74.6	74.6	74.6	75.8	75.8	75.8	69.8	69.8	72.1	68.3	68.3	68.3	68.3	74.9	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8									
NSR7	548	-62.8		67.1	67.1	67.1	67.1	67.1	66.9	66.9	66.9	68.1	68.1	68.1	62.1	62.1	64.4	60.6	60.6	60.6	60.6	67.2	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1									
NSR8	644	-64.2		65.7	65.7	65.7	65.7	65.7	65.5	65.5	65.5	66.7	66.7	66.7	60.7	60.7	63.0	59.2	59.2	59.2	59.2	65.8	64.7	64.7	64.7	64.7	64.7	64.7	64.7	64.7	64.7									
NSR9	272	-56.7		73.2	73.2	73.2	73.2	73.2	73.0	73.0	73.0	74.2	74.2	74.2	68.2	68.2	70.5	66.7	66.7	66.7	66.7	73.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2									
NSR10	448	-61.0		68.8	68.8	68.8	68.8	68.8	68.7	68.7	68.7	69.9	69.9	69.9	63.8	63.8	66.2	62.4	62.4	62.4	62.4	68.9	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8									

Calculation of SPL for each NSR from Phase D

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month				126.9	126.9	126.9	126.9	126.9	126.9	126.9	126.9	126.7	126.7	127.5	128.5	128.5	121.8	124.2	124.2	124.2	124.2	124.2	126.9	126.9	126.9	125.8	125.8	125.8	125.8	125.8	125.8									
NSR1	442	-60.9		69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	68.8	68.8	69.6	70.6	70.6	63.9	66.3	66.3	66.3	66.3	66.3	69.0	69.0	69.0	67.9	67.9	67.9	67.9	67.9	67.9									
NSR1a	424	-60.5		69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.1	69.1	69.9	71.0	71.0	64.3	66.6	66.6	66.6	66.6	66.6	69.4	69.4	69.4	68.3	68.3	68.3	68.3	68.3	68.3									
NSR2	484	-61.7		68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.0	68.0	68.8	69.8	69.8	63.2	65.5	65.5	65.5	65.5	65.5	68.2	68.2	68.2	67.1	67.1	67.1	67.1	67.1	67.1									
NSR3	336	-58.5		71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.2	71.2	72.0	73.0	73.0	66.3	68.7	68.7	68.7	68.7	68.7	71.4	71.4	71.4	70.3	70.3	70.3	70.3	70.3	70.3									
NSR4	282	-57.0		72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.7	72.7	73.5	74.5	74.5	67.8	70.2	70.2	70.2	70.2	70.2	72.9	72.9	72.9	71.8	71.8	71.8	71.8	71.8	71.8									
NSR4a	280	-56.9		72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.7	72.7	73.6	74.6	74.6	67.9	70.2	70.2	70.2	70.2	70.2	73.0	73.0	73.0	71.9	71.9	71.9	71.9	71.9	71.9									
NSR4b	294	-57.4	3	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.3	72.3	73.1	74.2	74.2	67.5	69.8	69.8	69.8	69.8	69.8	72.6	72.6	72.6	71.5	71.5	71.5	71.5	71.5	71.5									
NSR5	84	-46.5		83.4	83.4	83.4	83.4	83.4	83.4	83.4	83.4	83.2	83.2	84.0	85.1	85.1	78.4	80.7	80.7	80.7	80.7	80.7	83.4	83.4	83.4	82.4	82.4	82.4	82.4	82.4	82.4									
NSR6	180	-53.1		76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.6	76.6	77.4	78.4	78.4	71.7	74.1	74.1	74.1	74.1	74.1	76.8	76.8	76.8	75.7	75.7	75.7	75.7	75.7	75.7									
NSR7	268	-56.6		73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.1	73.1	73.9	75.0	75.0	68.3	70.6	70.6	70.6	70.6	70.6	73.4	73.4	73.4	72.3	72.3	72.3	72.3	72.3	72.3									
NSR8	414	-60.3		69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.4	69.4	70.2	71.2	71.2	64.5	66.9	66.9	66.9	66.9	66.9	69.6	69.6	69.6	68.5	68.5	68.5	68.5	68.5	68.5									
NSR9	376	-59.5		70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.2	70.2	71.0	72.0	72.0	65.3	67.7	67.7	67.7	67.7	67.7	70.4	70.4	70.4	69.3	69.3	69.3	69.3	69.3	69.3									
NSR10	168	-52.5		77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.2	77.2	78.0	79.0	79.0	72.3	74.7	74.7	74.7	74.7	74.7	77.4	77.4	77.4	76.3	76.3	76.3	76.3	76.3	76.3									

Calculation of SPL for each NSR from Phase E

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month												126.9	126.9	126.9	126.9	126.9	126.7	126.7	127.9	127.9	121.8	121.8	121.8	124.2	120.4	120.4	120.4	120.4	126.9	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8		
NSR1	66	-44.4										85.5	85.5	85.5	85.5	85.5	85.3	85.3	86.5	86.5	80.5	80.5	80.5	82.8	79.0	79.0	79.0	79.0	85.5	84.5	84.5	84.5	84.5	84.5	84.5	84.5	84.5	84.5		
NSR1a	96	-47.6										82.2	82.2	82.2	82.2	82.2	82.0	82.0	83.3	83.3	77.2	77.2	77.2	79.5	75.7	75.7	75.7	75.7	82.3	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2		
NSR2	88	-46.9										83.0	83.0	83.0	83.0	83.0	82.8	82.8	84.0	84.0	78.0	78.0	78.0	80.3	76.5	76.5	76.5	76.5	83.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0		
NSR3	150	-51.5										78.3	78.3	78.3	78.3	78.3	78.2	78.2	79.4	79.4	73.3	73.3	73.3	75.7	71.9	71.9	71.9	71.9	78.4	77.3	77.3	77.3	77.3	77.3	77.3	77.3	77.3	77.3		
NSR4	234	-55.4										74.5	74.5	74.5	74.5	74.5	74.3	74.3	75.5	75.5	69.5	69.5	69.5	71.8	68.0	68.0	68.0	68.0	74.6	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5		
NSR4a	344	-58.7										71.1	71.1	71.1	71.1	71.1	71.0	71.0	72.2	72.2	66.1	66.1	66.1	68.5	64.7	64.7	64.7	64.7	71.2	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1		
NSR4b	156	-51.9	3									78.0	78.0	78.0	78.0	78.0	77.8	77.8	79.1	79.1	73.0	73.0	73.0	75.3	71.5	71.5	71.5	71.5	78.1	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0		
NSR5	408	-60.2										69.7	69.7	69.7	69.7	69.7	69.5	69.5	70.7	70.7	64.6	64.6	64.6	67.0	63.2	63.2	63.2	63.2	69.7	68.6	68.6	68.6	68.6	68.6	68.6	68.6	68.6	68.6		
NSR6	398	-60.0										69.9	69.9	69.9	69.9	69.9	69.7	69.7	70.9	70.9	64.8	64.8	64.8	67.2	63.4	63.4	63.4	63.4	69.9	68.8	68.8	68.8	68.8	68.8	68.8	68.8	68.8	68.8		
NSR7	740	-65.4										64.5	64.5	64.5	64.5	64.5	64.3	64.3	65.5	65.5	59.5	59.5	59.5	61.8	58.0	58.0	58.0	58.0	64.6	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5		
NSR8	816	-66.2										63.6	63.6	63.6	63.6	63.6	63.5	63.5	64.7	64.7	58.6	58.6	58.6	61.0	57.2	57.2	57.2	57.2	63.7	62.6	62.6	62.6	62.6	62.6	62.6	62.6	62.6	62.6		
NSR9	280	-56.9										72.9	72.9	72.9	72.9	72.9	72.7	72.7	74.0	74.0	67.9	67.9	67.9	70.2	66.5	66.5	66.5	66.5	73.0	71.9	71.9	71.9	71.9	71.9	71.9	71.9	71.9	71.9		
NSR10	636	-64.1										65.8	65.8	65.8	65.8	65.8	65.6	65.6	66.9	66.9	60.8	60.8	60.8	63.1	59.3	59.3	59.3	59.3	65.9	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8		

Calculation of SPL for each NSR from Phase F

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month												127.3	127.3	127.3	127.3	127.3	127.3	127.3	128.3	128.3	128.3	128.3	121.8	124.2	124.2	124.2	124.2	120.4	126.9	126.9	126.9	126.9	125.8	125.8	125.8	125.8	125.8	125.8	125.8	125.8
NSR1	338	-58.6										71.7	71.7	71.7	71.7	71.7	71.7	71.7	72.7	72.7	72.7	72.7	66.3	68.6	68.6	68.6	68.6	64.8	71.4	71.4	71.4	71.4	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3
NSR1a	358	-59.1										71.2	71.2	71.2	71.2	71.2	71.2	71.2	72.2	72.2	72.2	72.2	65.8	68.1	68.1	68.1	68.1	64.3	70.9	70.9	70.9	70.9	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
NSR2	256	-56.2										74.1	74.1	74.1	74.1	74.1	74.1	74.1	75.1	75.1	75.1	75.1	68.7	71.0	71.0	71.0	71.0	67.2	73.8	73.8	73.8	73.8	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7
NSR3	120	-49.6										80.7	80.7	80.7	80.7	80.7	80.7	80.7	81.7	81.7	81.7	81.7	75.3	77.6	77.6	77.6	77.6	73.8	80.4	80.4	80.4	80.4	79.3	79.3	79.3	79.3	79.3	79.3	79.3	79.3
NSR4	58	-43.3										87.0	87.0	87.0	87.0	87.0	87.0	87.0	88.0	88.0	88.0	88.0	81.6	83.9	83.9	83.9	83.9	80.1	86.7	86.7	86.7	86.7	85.6	85.6	85.6	85.6	85.6	85.6	85.6	85.6
NSR4a	84	-46.5										83.8	83.8	83.8	83.8	83.8	83.8	83.8	84.8	84.8	84.8	84.8	78.4	80.7	80.7	80.7	80.7	76.9	83.4	83.4	83.4	83.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4
NSR4b	76	-45.6	3									84.7	84.7	84.7	84.7	84.7	84.7	84.7	85.6	85.6	85.6	85.6	79.2	81.6	81.6	81.6	81.6	77.8	84.3	84.3	84.3	84.3	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2
NSR5	110	-48.8										81.5	81.5	81.5	81.5	81.5	81.5	81.5	82.4	82.4	82.4	82.4	76.0	78.4	78.4	78.4	78.4	74.6	81.1	81.1	81.1	81.1	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
NSR6	94	-47.5										82.8	82.8	82.8	82.8	82.8	82.8	82.8	83.8	83.8	83.8	83.8	77.4	79.7	79.7	79.7	79.7	75.9	82.5	82.5	82.5	82.5	81.4	81.4	81.4	81.4	81.4	81.4	81.4	81.4
NSR7	452	-61.1										69.2	69.2	69.2	69.2	69.2	69.2	69.2	70.2	70.2	70.2	70.2	63.7	66.1	66.1	66.1	66.1	62.3	68.8	68.8	68.8	68.8	67.7	67.7	67.7	67.7	67.7	67.7	67.7	67.7
NSR8	514	-62.2										68.1	68.1	68.1	68.1	68.1	68.1	68.1	69.0	69.0	69.0	69.0	62.6	65.0	65.0	65.0	65.0	61.2	67.7	67.7	67.7	67.7	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6
NSR9	156	-51.9										78.4	78.4	78.4	78.4	78.4	78.4	78.4	79.4	79.4	79.4	79.4	73.0	75.3	75.3	75.3	75.3	71.5	78.1	78.1	78.1	78.1	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
NSR10	340	-58.6										71.7	71.7	71.7	71.7	71.7	71.7	71.7	72.6	72.6	72.6	72.6	66.2	68.6	68.6	68.6	68.6	64.8	71.3	71.3	71.3	71.3	70.2	70.2	70.2	70.2	70.2	70.2	70.2	70.2

Calculation of noise level of dump truck travelling along the haul road (during site formation stage)

SWL 117 dB(A)
No. of Dump Truck 15 per hour
Speed 10 km/hr

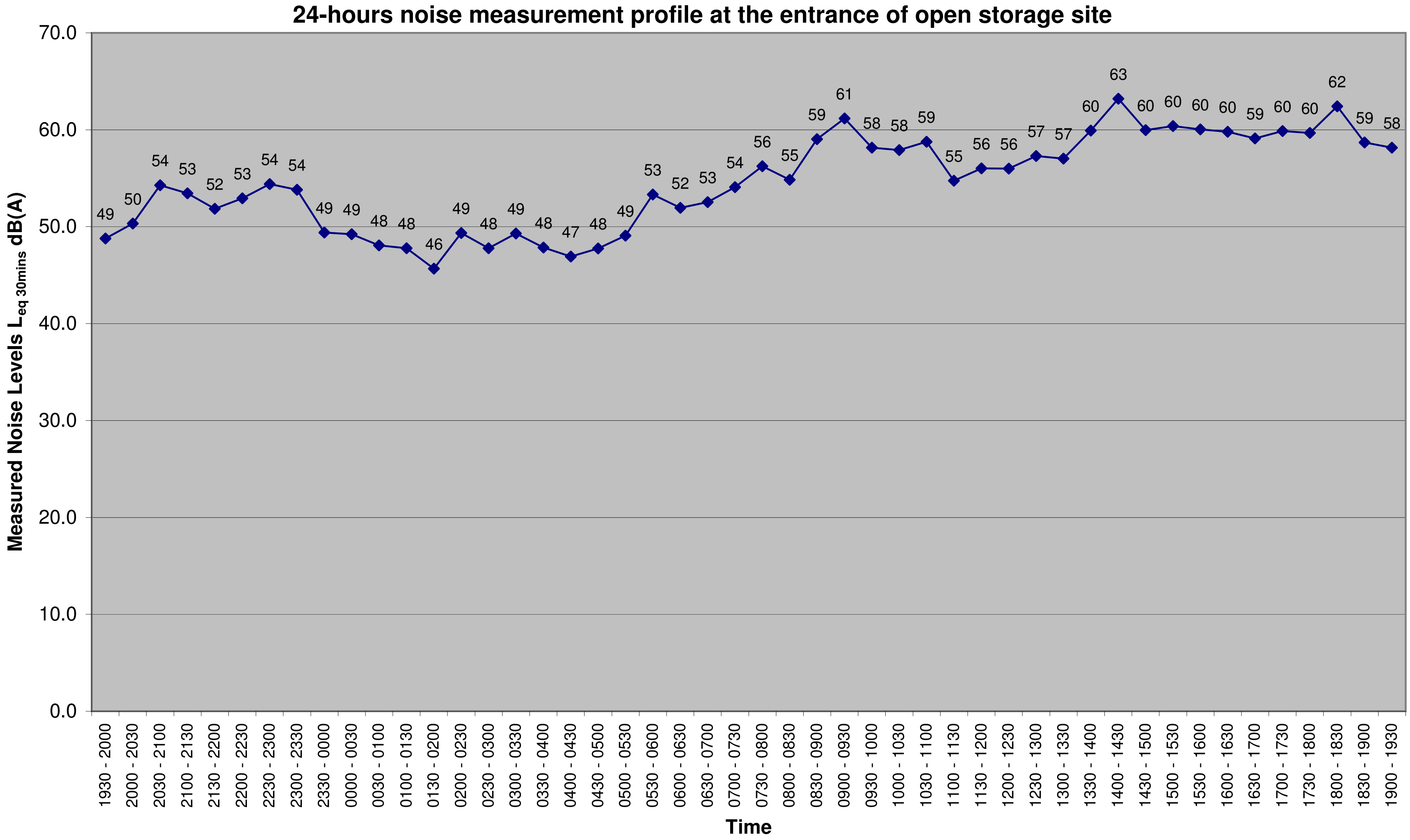
NSR	Shortest Horizontal Distance from Centre of Haul Road (m)	Façade Effect (dB(A))	SPL (dB(A)
NSR1	180	3	66.2
NSR1a	172	3	66.4
NSR2	176	3	66.3
NSR3	112	3	68.3
NSR4	140	3	67.3
NSR4a	212	3	65.5
NSR4b	96	3	68.9
NSR5	48	3	71.9
NSR6	84	3	69.5
NSR7	118	3	68.0
NSR8	148	3	67.1
NSR9	230	3	65.1
NSR10	12	3	78.0

APPENDIX D-3

24-hour Noise Measurement Profile

24-hours noise measurement result

Time Period	Number of Heavy Vehicles passed by	Measured Noise Level ($L_{eq\ 30mins}$ dB(A))	Time Period	Number of Heavy Vehicles passed by	Measured Noise Level ($L_{eq\ 30mins}$ dB(A))
1930 – 2000	2	48.8	0730 – 0800	16	56.3
2000 – 2030	3	50.3	0800 – 0830	16	54.8
2030 – 2100	12	54.3	0830 – 0900	13	59.0
2100 – 2130	12	53.4	0900 – 0930	13	61.2
2130 – 2200	6	51.9	0930 – 1000	20	58.1
2200 – 2230	7	52.9	1000 – 1030	21	57.9
2230 – 2300	8	54.4	1030 – 1100	17	58.8
2300 – 2330	9	53.8	1100 – 1130	17	54.8
2330 – 2400	4	49.4	1130 – 1200	22	56.0
0000 – 0030	4	49.2	1200 – 1230	22	56.0
0030 – 0100	2	48.1	1230 – 1300	24	57.3
0100 – 0130	3	47.8	1300 – 1330	24	57.0
0130 – 0200	2	45.7	1330 – 1400	25	59.9
0200 – 0230	2	49.4	1400 – 1430	26	63.2
0230 – 0300	3	47.8	1430 – 1500	26	60.0
0300 – 0330	3	49.3	1500 – 1530	26	60.4
0330 – 0400	2	47.9	1530 – 1600	20	60.0
0400 – 0430	3	46.9	1600 – 1630	20	59.8
0430 – 0500	1	47.8	1630 – 1700	24	59.1
0500 – 0530	1	49.1	1700 – 1730	24	59.9
0530 – 0600	7	53.3	1730 – 1800	14	59.7
0600 – 0630	7	51.9	1800 – 1830	14	62.4
0630 – 0700	7	52.5	1830 – 1900	15	58.7
0700 - 0730	8	54.1	1900 - 1930	15	58.2


24-hours noise measurement profile at the entrance of open storage site
Measured Noise Levels $L_{eq\ 30mins}$ dB(A)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
49
50
54
53
52
53
54
54
49
49
48
48
46
49
48
49
48
47
48
49
53
52
53
54
56
55
59
61
58
58
59
55
56
56
57
57
60
63
60
60
60
60
59
60
60
62
59
58
1930 - 2000
2000 - 2030
2030 - 2100
2100 - 2130
2130 - 2200
2200 - 2230
2230 - 2300
2300 - 2330
2330 - 0000
0000 - 0030
0030 - 0100
0100 - 0130
0130 - 0200
0200 - 0230
0230 - 0300
0300 - 0330
0330 - 0400
0400 - 0430
0430 - 0500
0500 - 0530
0530 - 0600
0600 - 0630
0630 - 0700
0700 - 0730
0730 - 0800
0800 - 0830
0830 - 0900
0900 - 0930
0930 - 1000
1000 - 1030
1030 - 1100
1100 - 1130
1130 - 1200
1200 - 1230
1230 - 1300
1300 - 1330
1330 - 1400
1400 - 1430
1430 - 1500
1500 - 1530
1530 - 1600
1600 - 1630
1630 - 1700
1700 - 1730
1730 - 1800
1800 - 1830
1830 - 1900
1900 - 1930
Time

APPENDIX D-4

Correspondences with Transport Department

23813799

By fax (2827 1823)

運輸署
Transport Department

Our ref.: ( ) in NR 157/161-YLDD 101
Your ref.: KMY/AFK/TMC/M&M/mc/T221005/12.01/L0062
Tel. No.: 2399 2421

16 May 2007

Wilbur Smith Associates Limited,
Room 5208, 52/F, Hopewell Centre,
183 Queen's Road East,
Wanchai,
Hong Kong.
(Attn.: Kelper Chan)

Dear Sirs,

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Traffic Flow Forecast

I refer to your above letter dated 9 May 2007. Please be advised that the traffic forecast based on the traffic count in 2005 should be more accurate than the traffic forecast based on the traffic count before 2003. The traffic data of Wo Shang Wai Development is more appropriate to be used in Wo Shang Wai EIA Study.

Yours faithfully,

(Stephen S. K. CHIU)
for Assistant Commissioner
for Transport/NT

	To	Action	Information	Copy	
1	TMC				
2	M&M				
Rec'd	16 MAY				
3					
4					
File No.					

市區(九龍)及新界分區辦事處
Urban (Kln.) & NT Regional Offices
九龍聯運街三十號旺角政府合署七樓及八樓
7th & 8th Floors, Mong Kok Government Offices, 30 Luen Wan Street, Kowloon.
圖文傳真 Fax No.: 2381 3799 (新界區) (NTRO) 2397 8046 (九龍市區) (U(K)RO)
網址 Web Site: http://www.info.gov.hk/td

TOTAL P.01

Mott Connell 萬佳

Our Ref : KMY/AFK/TMC/M&M/mc/T221005/12.01/L0062

Transport Department
NT Regional Office
Traffic Engineering (NTW) Division
Boundary Section
7/F, Mongkok Government Offices
30 Luen Wan Street
Mongkok, Kowloon.

Mott Connell Limited
40th Floor, Hopewell Centre
183 Queen's Road East
Wanchai, Hong Kong

Telephone (852) 2828 5757
Fax (852) 2827 1823

Attn: Mr. Chiu Sung Ko(Tel: 2399 2421)

9 May 2007

Dear Sirs

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Traffic Flow Forecast

The traffic flow forecast of the captioned project was submitted to your department for approval on 27 October 2006 and 'no comment' reply was received on 6 November 2006. However, the Environmental Protection Department commented that the traffic flow forecast of the captioned project was different from the traffic flow forecast of another project – Agreement No.CE38/ 2002(HY) Improvements to San Tin Interchange. We are required by EPD to seek clarification of the traffic data with your department.

The traffic flow forecast of the captioned project was carried out in 2006, and which is more updated than the traffic flow forecast of the San Tin Interchange EIA Report which was completed in 2003. An additional traffic count was carried out on 23 March 2007 at San Tin Highway and the result showed that the traffic data presented in the Wo Shang Wai Development EIA is more appropriate. The detailed comparison of the traffic flow of aforesaid EIA Reports is enclosed for your considerable. We consider that the approved traffic data of Wo Shang Wai Development is more appropriate to be used in Wo Shang Wai EIA study than the traffic data presented in the San Tin Interchange EIA Report.

We would be grateful if you could confirm your agreement to the above by 16 May 2007 such that we can carry out further discussion with EPD. Please contact our Miss Margaret Mak at 2828 5740 or the undersigned at 2828 5858 for any queries.

Yours faithfully,
For Mott Connell Limited

Terry TM Chung

cc. Henderson Land Dev. Co. Ltd. – Mr Shuki Leung/ Ms. Vicky Chung/ Mr. Eric Loke
EPD – Mr. Edmund Chu

Comparison between Traffic Data of 'EIA report for Wo Shang Wai Development' and 'EIA report for the Improvement of San Tin Interchange'

1. According to Section 2.32 of the EIA Report for the Improvement of San Tin Interchange (EIA ISTI), the traffic forecasts were derived "using MCAL's in-house transport models", where as the traffic forecasts for Wo Shang Wai development were projected based on traffic growth and trip patterns derived from the TD's endorsed CTS-3 models.

2. The 2005 traffic flow and projected traffic flow of Castle Peak Road near the Wo Shang Wai development and San Tin Interchange are showed in the table below.

Road Section	Source	2005 Traffic Flow		Projected Traffic Flow	
		AM	PM	AM	PM
Castle Peak Road – near the Wo Shang Wai development	Wo Shang Wai Development EIA	538(1)	405(1)	535(3)	499(3)
Castle Peak Road – near San Tin Interchange	Improvement of San Tin Interchange EIA	2194(2)	1613(2)	3048(4)	2382(4)

Notes:

(1). 2005 Observed Traffic Flow

(2). 2005 Projected Traffic Flow

(3). 2027 Projected Traffic Flow

(4). 2022 Projected Traffic Flow

According to the EIA ISTI, the projected traffic flow at 2005 at Castle Peak Road near San Tin Interchange is significantly higher than that the actual on site observed flow at Castle Peak Road near the Wo Shang Wai Development. Even though the traffic flows are for different sections of Castle Peak Road, it should not have such a large difference considering the proximity of the two sections of road and the road conditions.

According to the Transport Planning & Design Manual by Transport Department, Table 2.4.1.1 and 2.4.1.2 , the peak hourly flow for 7.3m single 2-lane carriageway is only 1530 veh/hr (1530= 1700 x 0.9). However, the EIA ISTI stated that the 2005 and 2022 projected AM peak hour flows along Castle Peak Road are 2194 and 3048 veh/hr respectively. These traffic figures are not sensible and unrealistic.

3. A traffic count was carried out on 23 March 2007 at San Tin Highway to verify the traffic flow projection of the EIA ISTI, which was completed in 2003. The observed and projected traffic flows of San Tin Highway near San Tin Interchange are showed in the table below.

Road Section	Year	Source	Type	AM	PM
San Tin Highway – near San Tin Interchange	2007	Traffic Count	Observed	5250	5129
	2007	Improvement of San Tin Interchange EIA	Projected	6539	6176

At the same road section of San Tin Highway near San Tin Interchange, the 2007 projected traffic flow based on the EIA ISTI is more than 20% higher than the 2007 observed traffic count. This demonstrates that the traffic flow projection of the EIA ISTI is over-estimated.

4. To conclude, the traffic data presented in the Wo Shang Wai Development EIA is the most updated projection. It is more realistic and more appropriate to be used in the Wo Shang Wai Development project.

By fax (2385 7215)

運輸署
Transport Department

FAX IN

Our ref.: ( ) in NR 157/161-YLDD 101
Your ref.: 06OL405/818220/KRC/BW/twm
Tel. No.: 2399 2421

6 November 2006

Wilbur Smith Associates Limited,
Room 5208, 52/F, Hopewell Centre,
183 Queen's Road East,
Wanchai,
Hong Kong.
(Attn.: Kelper Chan)

Dear Sirs,

Traffic Forecast for Residential Development at Wo Shang Wai, Yuen Long

I refer to your above letter dated 27 October 2006. Please be advised that I have no comment.

Yours faithfully,

(Stephen S. K. CHIU)
for Assistant Commissioner
for Transport/NT

06 IP 404.

WSA	Job No. 818220	
Reply Ref.:	By:	Date
Action Required:		
Received - 6 NOV 2006		

Inits.	Sign	Date	Inits.	Sign	Date

市區(九龍)及新界分區辦事處
Urban (Kln.) & NT Regional Offices
九龍聯運街三十號旺角政府合署七樓及八樓
7th & 8th Floors, Mong Kok Government Offices, 30 Luen Wan Street, Kowloon.
圖文傳真 Fax No.: 2381 3799 (新界區) (NTRO) 2397 8046 (九龍市區) (U(K)RO)
網址 Web Site: http://www.info.gov.hk/td

Wilbur Smith Associates Limited
施 偉 拔 有 限 公 司

香港灣仔皇后大道東183號
合和中心52樓5208室
電話: (852) 2359-5700
傳真: (852) 2385-7215
直線: (852) 2359-5731

ENGINEERS
PLANNERS
ECONOMISTS
Wilbur Smith Associates

Room 5208, 52nd Floor, Hopewell Centre
183 Queen's Road East, Wanchai
Hong Kong
Tel : (852) 2359-5700
Fax : (852) 2385-7215
Dir : (852) 2359-5731

Our Ref. : 06OL405/818220/KRC/BW/twm

BY POST and FAX (Fax: 2381- 3799)

27 October 2006

Transport Department
NT Regional Office
Traffic Engineering (NTW) Division
Boundary Section
7/F, Mongkok Government Offices
30 Luen Wan Street
Mongkok, Kowloon

Attn: Mr. CHIU Sung Ko (Engr/Yuen Long)

Dear Sir,

Traffic Forecast for Residential Development at Wo Shang Wai, Yuen Long

The Environmental Impact Assessment Report of the captioned project was submitted to Environmental Protection Department for comments by the environmental consultant, Mott Connell Limited. As Environmental Protection Department has requested to seek agreement from Transport Department on the traffic forecasts for year 2027 as shown in **Table 1**, **Table 2** and **Table 3**. We would be much grateful if you would provide your comments, if any.

Existing traffic flows on roads in the project vicinity areas were determined by manually classified traffic survey counts and the traffic data from the Annual Traffic Census 2005 published by Transport Department. And the traffic forecasts presented were projected based on traffic growth and trip patterns derived from the TD's endorsed CTS-3 models.

…2/cont.

Q CERTIFIED COMPANY HKQAA
CNAB
CNAB018-Q
ISO 9001 : 2000
Certificate No.: CC 1253

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Table 1 Peak Hour Vehicular Flows for Year 2027

Peak Hour Vehicle flows	San Tin Highway		Castle Peak Road		Project Access Road		San Tam Road	
	AM	PM	AM	PM	AM	PM	AM	PM
Motor cycles	51	82	6	8	2	3	4	6
Private Car*	2,533	2,631	226	240	88	89	162	213
Taxi	243	212	20	18	8	7	15	16
Private light buses	30	35	16	21	0	0	19	29
Public light buses	148	114	81	68	0	0	95	96
LGV@	846	984	68	46	18	20	59	38
HGV#	1,454	1,482	105	88	2	1	121	122
Non-franchised buses	203	271	11	8	3	3	9	8
Single Deck Franchised Buses	13	15	0	0	0	0	0	0
Double Deck Franchised Buses	81	105	3	2	0	0	3	3
Total	5,602	5,931	535	499	121	122	487	530

Remarks: * Private car: Private Cars & Light Goods Vehicles <=2.5 tonnes including the types of Diesel and Petrol
@ LGV: Goods Vehicles <3.5 tonne
# HGV: Goods Vehicles >= 3.5 tonne

Table 2 Percentage Split for Year 2027

Peak Hour Vehicle flows	San Tin Highway		Castle Peak Road		Project Access Road		San Tam Road	
	AM	PM	AM	PM	AM	PM	AM	PM
Motor cycles	0.9%	1.4%	1.1%	1.6%	1.9%	2.8%	0.8%	1.2%
Private Car*	45.2%	44.4%	42.2%	48.1%	72.5%	72.7%	33.3%	40.1%
Taxi	4.3%	3.6%	3.8%	3.5%	6.6%	5.4%	3.0%	3.0%
Private light buses	0.5%	0.6%	3.0%	4.2%	0.0%	0.0%	3.9%	5.5%
Public light buses	2.6%	1.9%	15.1%	13.6%	0.0%	0.0%	19.5%	18.1%
LGV@	15.1%	16.6%	12.7%	9.3%	15.0%	16.0%	12.0%	7.1%
HGV#	26.0%	25.0%	19.5%	17.6%	1.4%	0.9%	24.9%	23.0%
Non-franchised buses	3.6%	4.6%	2.0%	1.7%	2.7%	2.3%	1.8%	1.5%
Single Deck Franchised Buses	0.2%	0.2%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%
Double Deck Franchised Buses	1.4%	1.8%	0.5%	0.4%	0.0%	0.0%	0.6%	0.5%

Remarks: * Private car: Private Cars & Light Goods Vehicles <=2.5 tonnes including the types of Diesel and Petrol
@ LGV: Goods Vehicles <3.5 tonne
# HGV: Goods Vehicles >= 3.5 tonne

…3/cont.

ENGINEERS
PLANNERS
ECONOMISTS
Wilbur Smith Associates

Table 3 Speed Limit

Speed Limit	San Tin Highway	Castle Peak Road	Project Access Road	San Tam Road
Km/hr	100	50	50*	50

Remark: * WSA recommendation

Because of the tight schedule of the planning application, your prompt reply would be appreciated.

Should you have any enquires, please feel free to contact the undersigned at 2359-5731 or our Mr. Mak at 2359-5721.

Yours faithfully,
WILBUR SMITH ASSOCIATES LTD.

Kepler Chan
Associate

Encl.

cc: Mott Connell – Miss. Margaret Mak (Email: Margaret.Mak@mottconnell.com.hk)

HIGHWAYS DEPARTMENT + 852 2714 5228
NEW TERRITORIES REGION
2nd floor Ho Man Tin Government Offices,
88, Chung Hau Street, Ho Man Tin, Kowloon.
Web Site : http://www.hyd.gov.hk

Urgent by Fax
2827 1823

路政署
新界區
九龍何文田忠孝街88號
何文田政府合署二樓
網址：http://www.hyd.gov.hk

[7VZD]

本署檔號 Our Ref.: (85ZN) in HNT/YL/DD101/43
來函檔號 Your Ref.: KMY/AFK/TMC/CWK/me/T221005/30.09/L0069
電話 Tel. No.: 2762 4948
圖文傳真 Fax No.: 2714 5228

25 June 2007

Mott Connell Limited
40th Floor, Hopewell Centre
183 Queen's Road East
Wanchai, Hong Kong
(Attn: Dr. Anne F Kerr)

Dear Sir,

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Road surface type for public roads

I refer to your above letter dated 18.05.2007 regarding the captioned subject.

Please be advised of the requested information as follows:

(a) San Tin Highway: porous friction course material
(b) Castle Peak Road – Mai Po: flexible/concrete pavement, extent of which to be checked on site.
(c) San Tam Road: flexible pavement with wearing course

Yours faithfully,

(FU, Yin Yan)
for Chief Highway Engineer/NT West
Highways Department

APPENDIX D-5

roadNoise Input Files

```
TEXT
Master File

TEXT


COA=     1.0COD=  1000.0COR=     0.0

READ
WSW2027.FLO
READ
WSW2027.SEG
READ
WSW2027.PRO
READ
WSW2027.CON
READ
WSW2027.GND
READ
WSW2027.BAR
READ
WSW2027.HSE

LINK
Existing Road
1,
LINK
New Road
2,
LINK
All
1,2,

DISK
WSW2027.MAS

TEXT
RN98 RNB
TEXT
P:\HONG KONG\INF\PROJECTS2\221005\WO SHANG
WAI\EIA\OPERATION NOISE\2027PM_V3\200
TEXT
70109ALL\WSW.RNB
TEXT

TEXT


READ
WSW2027.REC

END


TEXT
Segment File

TEXT


TEXT
SAN TIN HIGHWAY (NB)
UFN=     1.0CAT=
1.0RSX=824092.6RSY=838501.5HCS=     7.2HCG=
0.0
SEG=     1.0NCY=     1.0WCY=     3.5DCY=
0.0HCY=     0.0
RST=     2.0RTD=     1.2GND=     0.0NBA=    -
1.0RCT=     0.0
REX=824102.4REY=838569.0HCE=     6.3SEND
.0
REX=824122.9REY=838646.8HCE=     6.6SEND
.0
REX=824154.2REY=838737.8HCE=     6.3SEND
.0
REX=824189.4REY=838810.5HCE=     6.2SEND
.0
REX=824244.2REY=838899.6HCE=     7.0SEND
.0
REX=824307.2REY=838977.8HCE=     7.2SEND
.0
REX=824353.4REY=839022.5HCE=     9.8SEND
.0
REX=824415.4REY=839077.6HCE=    12.2SEND
.0

TEXT
SAN TIN HIGHWAY (SB)
UFN=     5.0RSX=824422.9RSY=839053.3HCS=
12.2
REX=824314.4REY=838950.8HCE=     7.2SEND
.0
REX=824243.4REY=838859.8HCE=     6.3SEND
.0
REX=824186.4REY=838762.3HCE=     6.2SEND
.0
REX=824140.4REY=838647.8HCE=     6.2SEND
.0
REX=824115.9REY=838560.8HCE=     6.3SEND
.0
REX=824104.9REY=838484.8HCE=     6.7SEND
.0

TEXT
San Tam Road
UFN=     3.0RSX=824450.1RSY=839001.3HCS=
6.6
NCY=     0.0WCY=     4.0
RST=     0.0
REX=824433.8REY=838972.1HCE=     6.4SEND
.0
REX=824391.7REY=838936.4HCE=     6.0SEND
.0
REX=824285.5REY=838871.7HCE=     5.3SEND
.0
REX=824234.9REY=838819.7HCE=     5.3SEND
.0
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REX=824153.9REY=838647.7HCE=     5.7SEND
.0
REX=824134.4REY=838567.8HCE=     5.8SEND
.0
REX=824121.4REY=838499.8HCE=     6.1SEND
.0
REX=824118.2REY=838454.3HCE=     6.4SEND
.0

TEXT
Project Access Road
UFN=     4.0CAT=
2.0RSX=824169.4RSY=838805.8HCS=     6.8
SEG=    32.0WCY=     3.5
REX=824133.0REY=838815.1HCE=     6.6SEND
.0
REX=824078.5REY=838818.4HCE=     6.4SEND
.0
REX=824058.8REY=838817.8HCE=     6.3SEND
.0
REX=824032.0REY=838822.4HCE=     6.2SEND
.0
REX=823995.1REY=838838.0HCE=     6.2SEND
.0

TEXT
Project Access Road
RSX=823817.6RSY=838918.8HCS=     5.8
SEG=    45.0
REX=823850.8REY=838905.8HCE=     5.9SEND
.0
```

```
REX=823873.9REY=838893.1HCE=     5.9SEND
.0
REX=823897.9REY=838881.7HCE=     6.0SEND
.0
REX=823948.3REY=838867.8HCE=     6.1SEND
.0
REX=823995.3REY=838838.3HCE=     6.2SEND
.0

TEXT
San Tin Highway NB
UFN=     1.0CAT=
1.0RSX=824082.2RSY=838360.1HCS=     6.7
NCY=     1.0
RST=     2.0
REX=824092.4REY=838501.6HCE=     7.2SEND
.0

TEXT
San Tin Highway SB
UFN=     5.0RSX=824095.9RSY=838345.8HCS=
6.7
REX=824104.9REY=838484.3HCE=     6.7SEND
.0

TEXT
Castle Peak Road
UFN=     2.0RSX=824066.1RSY=838308.0HCS=
6.3
NCY=     0.0
RST=     0.0
REX=824070.8REY=838435.8HCE=     6.9SEND
.0
REX=824075.4REY=838480.9HCE=     7.5SEND
.0
REX=824086.4REY=838560.9HCE=     7.3SEND
.0
REX=824111.4REY=838655.6HCE=     6.9SEND
.0
REX=824149.8REY=838754.9HCE=     6.9SEND
.0
REX=824192.1REY=838835.8HCE=     6.7SEND
.0
REX=824247.3REY=838923.1HCE=     6.1SEND
.0
REX=824288.7REY=838982.9HCE=     6.4SEND
.0
REX=824331.9REY=839045.4HCE=     6.1SEND
.0
REX=824373.3REY=839113.5HCE=     4.5SEND
.0


RETN     0.0
```

TEXT
Building Barrier

```
TEXT


TEXT
Mai Po San Tsuen
NBA=   297.0BSX=824159.5BSY=838935.6HBS=
14.5FOA=     0.0WBA=     0.0
            BEX=824200.9BEY=838916.9HBE=
14.5
NBA=   298.0BEX=824271.0BEY=838998.9HBE=
14.5
NBA=   299.0BEX=824214.9BEY=839028.5HBE=
14.5
NBA=   300.0BEX=824159.5BEY=838934.9HBE=
14.5

TEXT
Central Divider
NBA=   304.0BSX=824430.5BSY=839073.6HBS=
13.0
            BEX=824356.9BEY=839009.9HBE=
10.6
NBA=   305.0BEX=824303.3BEY=838953.7HBE=
8.0
NBA=   306.0BEX=824253.1BEY=838889.8HBE=
7.2
NBA=   307.0BEX=824207.1BEY=838821.0HBE=
6.4
NBA=   307.0BEX=824178.4BEY=838765.8HBE=
7.0
NBA=   308.0BEX=824152.4BEY=838703.9HBE=
6.8
NBA=   309.0BEX=824129.0BEY=838637.3HBE=
7.4
NBA=   310.0BEX=824108.8BEY=838554.8HBE=
7.1
NBA=   311.0BEX=824099.1BEY=838492.9HBE=
7.3
NBA=   312.0BEX=824094.4BEY=838435.9HBE=
7.5

NBA=   312.0BSX=824094.8BSY=838435.9HBS=
7.5
            BEX=824090.7BEY=838374.1HBE=
7.4

TEXT
kerb
NBA=   417.0BSX=824236.4BSY=838917.2HBS=
6.1
            BEX=824189.3BEY=838840.8HBE=
6.7

TEXT
kerb
NBA=   418.0BSX=824159.2BSY=838785.6HBS=
6.9
            BEX=824143.1BEY=838752.6HBE=
6.9
NBA=   419.0BEX=824117.3BEY=838689.9HBE=
6.9
NBA=   420.0BEX=824105.8BEY=838656.1HBE=
6.9
NBA=   421.0BEX=824093.0BEY=838606.6HBE=
6.9
NBA=   422.0BEX=824081.8BEY=838565.1HBE=
7.3

TEXT
kerb
NBA=   424.0BSX=824065.4BSY=838426.6HBS=
6.9
            BEX=824064.4BEY=838380.1HBE=
6.3

TEXT
kerb
NBA=   423.0BSX=824081.6BSY=838564.4HBS=
7.3
            BEX=824067.4BEY=838449.8HBE=
6.9

TEXT
kerb
NBA=   425.0BSX=824367.8BSY=839115.6HBS=
4.5
            BEX=824322.9BEY=839041.9HBE=
5.1
NBA=   426.0BEX=824236.3BEY=838917.1HBE=
6.1

TEXT
kerb
```

```
NBA=   427.0BSX=824409.9BSY=839075.9HBS=
12.2
            BEX=824348.0BEY=839020.8HBE=
9.8
NBA=   428.0BEX=824301.8BEY=838975.2HBE=
7.2

NBA=   429.0BSX=824301.8BSY=838975.2HBS=
7.2
            BEX=824260.8BEY=838924.9HBE=
7.2

TEXT
House
NBA=   430.0BSX=823930.7BSY=838852.1HBS=
16.0WBA=    12.5
            BEX=823894.2BEY=838864.8HBE=
16.0
NBA=   431.0BEX=823842.9BEY=838890.9HBE=
16.0

TEXT
House
NBA=   432.0BSX=823823.6BSY=838889.4HBS=
18.9WBA=    10.0
            BEX=823745.1BEY=838645.5HBE=
19.1

TEXT
House
NBA=   433.0BSX=823718.0BSY=838648.1HBS=
16.0WBA=    12.5
            BEX=823514.3BEY=838721.3HBE=
16.0

TEXT
House
NBA=   434.0BSX=823490.1BSY=838729.0HBS=
18.9WBA=    10.0
            BEX=823438.4BEY=838747.5HBE=
19.1

TEXT
House
NBA=   435.0BSX=823433.2BSY=838751.4HBS=
19.1
            BEX=823355.7BEY=838754.9HBE=
19.1

TEXT
House
NBA=   436.0BSX=823328.9BSY=838765.9HBS=
18.3
            BEX=823334.1BEY=838862.8HBE=
18.3

TEXT
House
NBA=   437.0BSX=823335.7BSY=838871.3HBS=
16.0WBA=    12.5
            BEX=823343.1BEY=838889.0HBE=
16.0
NBA=   438.0BEX=823360.6BEY=838903.0HBE=
16.0

TEXT
House
NBA=   439.0BSX=823370.8BSY=838905.6HBS=
16.0
            BEX=823436.7BEY=838906.3HBE=
16.0

TEXT
House
NBA=   440.0BSX=823447.2BSY=838897.1HBS=
16.0
            BEX=823461.3BEY=838872.3HBE=
16.0
NBA=   441.0BEX=823450.9BEY=838823.4HBE=
16.0
NBA=   442.0BEX=823453.8BEY=838771.4HBE=
16.0

TEXT
House
NBA=   443.0BSX=823371.1BSY=838875.6HBS=
16.0
            BEX=823363.3BEY=838780.1HBE=
16.0

TEXT
House
NBA=   444.0BSX=823421.9BSY=838878.1HBS=
16.0
            BEX=823415.2BEY=838782.3HBE=
16.0

TEXT
House
NBA=   445.0BSX=823491.4BSY=838764.8HBS=
16.0
            BEX=823511.4BEY=838799.2HBE=
16.0
NBA=   446.0BEX=823523.5BEY=838809.1HBE=
16.0
NBA=   447.0BEX=823517.7BEY=838884.8HBE=
16.0
NBA=   448.0BEX=823503.6BEY=838910.4HBE=
16.0
NBA=   449.0BEX=823513.4BEY=838928.0HBE=
16.0

TEXT
House
NBA=   450.0BSX=823524.3BSY=838933.4HBS=
16.0
            BEX=823534.1BEY=838933.1HBE=
16.0

TEXT
House
NBA=   451.0BSX=823545.8BSY=838932.0HBS=
16.0
            BEX=823553.6BEY=838926.1HBE=
16.0

TEXT
House
NBA=   452.0BSX=823556.7BSY=838917.8HBS=
16.0
            BEX=823558.6BEY=838895.4HBE=
16.0

TEXT
House
NBA=   453.0BSX=823551.3BSY=838892.5HBS=
16.0
            BEX=823557.7BEY=838844.6HBE=
16.0
NBA=   454.0BEX=823557.9BEY=838831.4HBE=
16.0

TEXT
House
NBA=   455.0BSX=823602.4BSY=838816.8HBS=
16.0
            BEX=823600.0BEY=838839.8HBE=
16.0
NBA=   456.0BEX=823611.8BEY=838888.8HBE=
16.0

TEXT
```

```
House
NBA=    457.0BSX=823611.3BSY=838893.1HBS=
16.0
         BEX=823610.7BEY=838901.3HBE=
16.0

TEXT
House
NBA=    458.0BSX=823614.8BSY=838905.9HBS=
16.0
         BEX=823605.1BEY=838926.3HBE=
16.0
NBA=    459.0BEX=823596.6BEY=838936.6HBE=
16.0

TEXT
House
NBA=    460.0BSX=823588.8BSY=838939.9HBS=
16.0
         BEX=823586.9BEY=838949.6HBE=
16.0

TEXT
House
NBA=    461.0BSX=823589.1BSY=838961.8HBS=
16.0
         BEX=823594.4BEY=838968.8HBE=
16.0

TEXT
House
NBA=    462.0BSX=823604.1BSY=838977.3HBS=
16.0
         BEX=823613.4BEY=838978.3HBE=
16.0

TEXT
House
NBA=    463.0BSX=823626.9BSY=838975.8HBS=
16.0
         BEX=823634.3BEY=838970.3HBE=
16.0

TEXT
House
NBA=    464.0BSX=823639.8BSY=838962.6HBS=
16.0
         BEX=823643.3BEY=838953.1HBE=
16.0

TEXT
House
NBA=    465.0BSX=823638.9BSY=838948.4HBS=
16.0
         BEX=823648.7BEY=838898.6HBE=
16.0
NBA=    466.0BEX=823637.0BEY=838849.6HBE=
16.0
NBA=    467.0BEX=823636.6BEY=838825.4HBE=
16.0

TEXT
House
NBA=    468.0BSX=823686.9BSY=838837.5HBS=
16.0
         BEX=823686.6BEY=838861.3HBE=
16.0
NBA=    469.0BEX=823698.3BEY=838912.1HBE=
16.0
NBA=    470.0BEX=823696.7BEY=838937.4HBE=
16.0

TEXT
House
NBA=    471.0BSX=823688.5BSY=838938.5HBS=
16.0
         BEX=823684.6BEY=838961.2HBE=
16.0

TEXT
House
NBA=    472.0BSX=823684.9BSY=838971.7HBS=
16.0
         BEX=823691.4BEY=838978.8HBE=
16.0

TEXT
House
NBA=    473.0BSX=823701.8BSY=838983.8HBS=
16.0
         BEX=823711.7BEY=838984.5HBE=
16.0

TEXT
House
NBA=    474.0BSX=823721.7BSY=838982.4HBS=
16.0
         BEX=823730.7BEY=838976.9HBE=
16.0

TEXT
House
NBA=    475.0BSX=823735.8BSY=838968.9HBS=
16.0
         BEX=823737.3BEY=838959.0HBE=
16.0

TEXT
House
NBA=    476.0BSX=823735.8BSY=838952.4HBS=
16.0
         BEX=823731.4BEY=838893.4HBE=
16.0
NBA=    477.0BEX=823723.3BEY=838855.1HBE=
16.0
NBA=    478.0BEX=823726.8BEY=838841.5HBE=
16.0

TEXT
House
NBA=    479.0BSX=823769.0BSY=838843.6HBS=
16.0
         BEX=823791.3BEY=838910.1HBE=
16.0

TEXT
House
NBA=    480.0BSX=823800.3BSY=838913.8HBS=
16.0
         BEX=823794.0BEY=838937.6HBE=
16.0

TEXT
House
NBA=    481.0BSX=823788.1BSY=838940.1HBS=
16.0
         BEX=823778.8BEY=838963.6HBE=
16.0

TEXT
House
NBA=    482.0BSX=823782.3BSY=838974.1HBS=
16.0
         BEX=823803.4BEY=838988.1HBE=
16.0

TEXT
House
NBA=    483.0BSX=823814.7BSY=838985.1HBS=
16.0
         BEX=823824.1BEY=838979.6HBE=
16.0
```

```
TEXT
House
NBA=   484.0BSX=823826.4BSY=838973.4HBS=
16.0
            BEX=823834.2BEY=838949.3HBE=
16.0

TEXT
House
NBA=   485.0BSX=823829.9BSY=838944.5HBS=
16.0
            BEX=823842.4BEY=838924.8HBE=
16.0

TEXT
House
NBA=   486.0BSX=823851.4BSY=838926.6HBS=
16.0
            BEX=823903.3BEY=838900.3HBE=
16.0

TEXT
House
NBA=   487.0BSX=823747.9BSY=838797.9HBS=
18.9WBA=    10.0
            BEX=823718.4BEY=838707.4HBE=
18.9

TEXT
House
NBA=   488.0BSX=823702.4BSY=838712.3HBS=
18.9
            BEX=823732.5BEY=838802.3HBE=
18.9

TEXT
House
NBA=   489.0BSX=823642.4BSY=838722.1HBS=
18.6
            BEX=823552.2BEY=838754.3HBE=
18.6

TEXT
House
NBA=   490.0BSX=823649.0BSY=838737.8HBS=
18.6
            BEX=823558.1BEY=838769.3HBE=
18.6

TEXT
House
NBA=   491.0BSX=823608.6BSY=838789.9HBS=
15.8WBA=    12.5
            BEX=823702.2BEY=838812.4HBE=
15.8

TEXT
Club house
NBA=   494.0BSX=823895.9BSY=838938.9HBS=
17.0WBA=     0.0
            BEX=823906.0BEY=839007.0HBE=
17.0

TEXT
Club house
NBA=   495.0BSX=823886.9BSY=838960.1HBS=
17.0
            BEX=823924.4BEY=838993.8HBE=
17.0

TEXT
Royal Palms
NBA=   496.0BSX=823847.3BSY=838815.8HBS=
14.4WBA=    10.0
            BEX=823900.8BEY=838810.6HBE=
14.4

TEXT
Royal Palms
NBA=   497.0BSX=823840.8BSY=838789.7HBS=
14.4
            BEX=823890.9BEY=838789.7HBE=
14.4

TEXT
Royal Palms
NBA=   498.0BSX=823921.6BSY=838783.8HBS=
14.4
            BEX=823979.0BEY=838755.8HBE=
14.4

TEXT
Royal Palms
NBA=   499.0BSX=823992.0BSY=838740.8HBS=
14.4
            BEX=824021.4BEY=838767.5HBE=
14.4

TEXT
Royal Palms
NBA=   500.0BSX=823832.3BSY=838766.3HBS=
14.4
            BEX=823883.1BEY=838764.3HBE=
14.4

TEXT
Royal Palms
NBA=   501.0BSX=823824.4BSY=838743.4HBS=
14.4
            BEX=823883.8BEY=838739.5HBE=
14.4

TEXT
Royal Palms
NBA=   502.0BSX=823814.7BSY=838718.6HBS=
14.4
            BEX=823866.2BEY=838716.0HBE=
14.4

TEXT
Royal Palms
NBA=   503.0BSX=823811.4BSY=838697.8HBS=
14.4
            BEX=823851.8BEY=838694.5HBE=
14.4

TEXT
Royal Palms
NBA=   504.0BSX=823791.2BSY=838677.6HBS=
14.4
            BEX=823805.6BEY=838672.3HBE=
14.4
NBA=   505.0BEX=823853.8BEY=838669.1HBE=
14.4

TEXT
Royal Palms
NBA=   506.0BSX=823784.7BSY=838648.2HBS=
14.4
            BEX=823851.2BEY=838646.3HBE=
14.4

TEXT
Royal Palms
NBA=   507.0BSX=823919.0BSY=838755.1HBS=
14.4WBA=    14.0
            BEX=823964.0BEY=838733.6HBE=
14.4

TEXT
```

```
Royal Palms
NBA=   508.0BSX=823905.9BSY=838732.3HBS=
14.4WBA=    10.0
            BEX=823961.4BEY=838710.8HBE=
14.4

TEXT
Royal Palms
NBA=   509.0BSX=823912.5BSY=838701.0HBS=
14.4
            BEX=823951.6BEY=838687.3HBE=
14.4

TEXT
Royal Palms
NBA=   510.0BSX=823902.7BSY=838682.8HBS=
14.4
            BEX=823929.4BEY=838670.4HBE=
14.4
NBA=   511.0BEX=823944.4BEY=838669.8HBE=
14.4

TEXT
Royal Palms
NBA=   512.0BSX=823784.7BSY=838622.8HBS=
14.4
            BEX=823841.4BEY=838620.8HBE=
14.4

TEXT
Royal Palms
NBA=   513.0BSX=823778.8BSY=838600.6HBS=
14.4
            BEX=823842.1BEY=838599.3HBE=
14.4

TEXT
Royal Palms
NBA=   514.0BSX=823769.0BSY=838576.5HBS=
14.4
            BEX=823840.1BEY=838573.9HBE=
14.4

TEXT
Royal Palms
NBA=   515.0BSX=823769.7BSY=838551.7HBS=
14.4
            BEX=823836.8BEY=838551.1HBE=
14.4

TEXT

NBA=   516.0BSX=823555.8BSY=838828.1HBS=
16.0WBA=    12.5
            BEX=823558.9BEY=838806.1HBE=
16.0

TEXT
House
NBA=   517.0BSX=823752.8BSY=838807.3HBS=
15.8WBA=    15.0
            BEX=823756.8BEY=838820.3HBE=
15.8

TEXT
Royal Palms
NBA=   518.0BSX=823841.8BSY=838839.9HBS=
14.4WBA=    10.0
            BEX=823866.6BEY=838839.1HBE=
14.4


RETN     0.0
```

TEXT
Receivers

```
TEXT


TEXT
9    NSR B
HRA=     7.2HRG=
1.0OPX=823849.6OPY=838896.0AN1=   276.2AN2=
118.2
REF=     1.0GO        .0
HPF=     3.0RPT=     2.0

TEXT
10   NSR C
HRA=     7.2OPX=823807.4OPY=838819.1AN1=
17.2AN2=   198.1
GO        .0
RPT=     3.0

TEXT
12   NSR A(1)
HRA=     7.2OPX=823931.1OPY=838851.3AN1=
13.6AN2=   205.9
GO        .0
RPT=     2.0

TEXT
13   NSR A (2)
HRA=     7.2OPX=823929.7OPY=838859.9AN1=
287.6AN2=   120.5
GO        .0
RPT=     2.0


RETN     0.0
```

TEXT
Year 2027 traffic flow

```
TEXT
San Tin Highway

TEXT
San Tin Highway NB
FLO= -2966.0PHV=    50.7SPD=   100.0BAS=
2.0FNO=     1.0

TEXT
Castle Peak Road
FLO=  -499.0PHV=    46.7SPD=    50.0BAS=
2.0FNO=     2.0

TEXT
San Tam Road
FLO=  -530.0PHV=    55.8SPD=    50.0BAS=
2.0FNO=     3.0

TEXT
Project Access Road
FLO=  -122.0PHV=    19.7SPD=    50.0BAS=
2.0FNO=     4.0

TEXT
San Tin Highway SB
FLO= -2965.0PHV=    50.7SPD=   100.0BAS=
2.0FNO=     5.0


RETN     0.0
```

APPENDIX D-6

Calculation of Noise from Fixed Noise Sources

Measurement Point	Date	Time	Description	Noise Source	Measured SPL, dB(A)	Distance from the noise source, m	Calculated SWL, dB(A)	Remark
E	19-Mar-07	1030 - 1045	Microphone pointing toward the sewage treatment plant	Operational noise from STP	55.5	3	73.0	The operational noise from STP is constant throughout the day
F	19-Apr-07	24 hours	Microphone pointing toward the entrance of the storage site	Heavy vehicles traveling in and out of the open storage site	63.2	3	80.7	The maximum noise level was recorded during day time (1400 - 1430)
F	19-Apr-07	24 hours	Microphone pointing toward the entrance of the storage site	Heavy vehicles traveling in and out of the open storage site	53.8	3	71.3	The maximum noise level was recorded during night time (2300 - 2330)

Noise Source	SWL of Noise Source, dB(A)	Closest NSR to the noise source	Horizontal Distance, m	Distance Attenuation, dB(A)	Facade Correction, dB(A)	Predicted Noise Level, dB(A)	Noise Criteria, dB(A)	Compliance of Noise Criteria
Operational noise from STP	73.0	Row of NSR C	230	55.2	3	20.8	46	Yes
Heavy vehicles traveling in and out of the open storage site	80.7	NSR A	60	43.6	3	40.2	46	Yes
Heavy vehicles traveling in and out of the open storage site	71.3	NSR A	60	43.6	3	30.8	45	Yes

APPENDIX D-7A

Mitigated Plant Inventory (QPME)

Cumulative SWL for All Phases
- Use of Quiet PME

	PME	TM Ref. / BS no.	SWL/Unit, dB(A)	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
	Wetland Restoration																																							
Wetland Restoration	Compressor, pneumatic breaker	C3/101	113			2	2	2	2	2	2	2	2	2																										
	Excavator	Kato HD-512E	104			4	4	4	4	4	4	4	4	4																										
	Dump Truck	Gross weight 5.5-38 ton*	105			2	2	2	2	2	2	2	2	2																										
	Roller, vibratory	Komatsu SW750, 77kW	104			4	4	4	4	4	4	4	4	4																										
	Bulldozer	Komatsu D21A-8	102			8	8	8	8	8	8	8	8	8																										
	Generator, standard	Atlas Copco QAS 300	99			2	2	2	2	2	2	2	2	2																										
Removal of hoarding at northern boundary	Breaker, hand-held, mass > 35 kg	CNP026	114												2																									
	Lorry, with crane, gross vehicle weight > 38 ton	*	112												2																									
	Site Formation and Excavation																																							
Site Formation and Excavation	Compressor, pneumatic breaker	C3/101	113	2	2	2	2	2	2	2	2	4	4	4	3	3	2	2	2	2	1	1																		
	Excavator	Kato HD-512E	104	4	4	4	4	4	4	4	4	8	8	8	6	6	4	4	4	4	2	2																		
	Dump Truck	Gross weight 5.5-38 ton*	105	6	6	6	6	6	6	6	6	13	13	13	10	10	7	7	7	7	4	4																		
	Roller, vibratory	Komatsu SW750, 77kW	104	6	6	6	6	6	6	6	6	12	12	12	9	9	6	6	6	6	3	3																		
	Bulldozer	Komatsu D21A-8	102	12	12	12	12	12	12	12	12	24	24	24	18	18	12	12	12	12	6	6																		
	Generator, standard	Atlas Copco QAS 300	99	4	4	4	4	4	4	4	4	8	8	8	6	6	4	4	4	4	2	2																		
Installation of Band Drains	Band drains installation machine (Compactor, vibratory)	CNP050	105	12	12	12	12	12	6	6	6	12	12	12	12	12	6	6																						
	Substructure																																							
Piling	Continuous flight auger (CFA) piles (Piling, earth auger)	CNP167	114									4	4	4	8	8	8	4	12	12	12	12	8	8	4	4	4													
	Generator, standard	Atlas Copco QAS 300	99									2	2	2	4	4	4	2	6	6	6	6	4	4	2	2	2													
	Bar bender and cutter (electric)	CNP021	90									2	2	2	4	4	4	2	6	6	6	6	4	4	2	2	2													
	Concrete pump	C6/36	106									2	2	2	4	4	4	2	6	6	6	6	4	4	2	2	2													
	Concrete lorry mixer	C6/35	100									3	3	3	6	6	6	3	9	9	9	9	6	6	3	3	3													
Pile Cap	Bar bender and cutter (electric)	CNP021	90														2	4	4	4	4	4	2	6	6	4	4	4	4	2	2	2								
	Generator, standard	Atlas Copco QAS 300	99														2	4	4	4	4	4	2	6	6	4	4	4	4	2	2	2								
	Lorry	C3/59	105														3	6	6	6	6	6	3	9	9	6	6	6	6	3	3	3								
Concreting	Crane, Mobile	Hitachi Sumitomo SCX700, 132kW	101														1	2	2	2	2	2	1	3	3	2	2	2	2	1	1	1								
	Concrete lorry mixer	C6/35	100														3	6	6	6	6	6	3	9	9	6	6	6	6	3	3	3								
	Compactor, vibratory	CNP050	105														3	6	6	6	6	6	3	9	9	6	6	6	6	3	3	3								
	Superstructure																																							
	Air Compressor, air flow Air flow ≤ 10 m3/min	CNP001	100																			4	8	8	8	8	8	8	16	16	16	12	12	8	8	8	8	8	4	4
	Bar bender and cutter (electric)	CNP021	90																			3	6	6	6	6	6	6	12	12	12	9	9	6	6	6	6	6	3	3
	Concrete lorry mixer	C6/35	100																			5	10	10	10	10	10	10	20	20	20	15	15	10	10	10	10	10	5	5
	Concrete pump	C6/36	106																			5	10	10	10	10	10	10	20	20	20	15	15	10	10	10	10	10	5	5
	Crane, tower (electric)	CNP049	95																			2	4	4	4	4	4	4	8	8	8	6	6	4	4	4	4	4	2	2
	Drill/ grinder, hand-held (electric)	CNP065	98																			5	10	10	10	10	10	10	20	20	20	15	15	10	10	10	10	10	5	5
	Excavator	Kato HD-512E	104																			3	6	6	6	6	6	6	12	12	12	9	9	6	6	6	6	6	3	3
	Generator, standard	Atlas Copco QAS 300	99																			4	8	8	8	8	8	8	16	16	16	12	12	8	8	8	8	8	4	4
	Lorry	C3/59	105																			4	8	8	8	8	8	8	16	16	16	12	12	8	8	8	8	8	4	4
	Poker, vibratory, hand-held	C6/40	98																			6	12	12	12	12	12	12	24	24	24	18	18	12	12	12	12	12	6	6
	Saw, circular, wood	C7/78	106																			6	12	12	12	12	12	12	24	24	24	18	18	12	12	12	12	12	6	6
	Water pump (electric)	CNP281	88																			6	12	12	12	12	12	12	24	24	24	18	18	12	12	12	12	12	6	6
	Water pump, submersible (electric)	CNP283	85																			6	12	12	12	12	12	12	24	24	24	18	18	12	12	12	12	12	6	6
			Total SWL of each month	**121.6**	**121.6**	**123.5**	**123.5**	**123.5**	**123.1**	**123.1**	**123.1**	**126.5**	**126.5**	**126.5**	**127.1**	**126.3**	**125.8**	**124.6**	**127.0**	**127.0**	**126.5**	**127.2**	**126.2**	**126.7**	**125.5**	**125.2**	**125.2**	**123.4**	**125.9**	**125.6**	**125.6**	**124.5**	**124.0**	**122.3**	**122.3**	**122.3**	**122.3**	**122.3**	**119.3**	**119.3**

* Reference: http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf

APPENDIX D-7B

Mitigated Construction Noise Levels (Use of QPME)

Mitigated Noise Levels from Construction Work other than Percussive Piling (Shaded area means exceedance)
- Use of Quiet PME **Appendix D-7B**

	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09
NSR1	68	68	73	73	73	72	72	72	79	79	79	79
NSR1a	68	68	75	75	75	75	75	75	78	78	78	77
NSR2	67	67	68	68	68	68	68	68	76	76	76	76
NSR3	70	70	71	71	71	70	70	70	77	77	77	77
NSR4	70	70	71	71	71	70	70	70	80	80	80	80
NSR4a	68	68	69	69	69	69	69	69	77	77	77	77
NSR4b	71	71	72	72	72	71	71	71	79	79	79	79
NSR5	76	76	76	76	76	76	76	76	78	78	78	80
NSR6	71	71	72	72	72	71	71	71	77	77	77	77
NSR7	66	66	67	67	67	67	67	67	69	69	69	70
NSR8	63	63	64	64	64	64	64	64	66	66	66	68
NSR9	67	67	68	68	68	67	67	67	74	74	74	73
NSR10	71	71	72	72	72	72	72	72	72	72	72	74

	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10
NSR1	78	77	77	81	81	80	80	80	80	75	75	75
NSR1a	76	75	74	78	78	77	77	77	78	73	73	73
NSR2	76	75	75	79	79	78	78	78	78	74	73	73
NSR3	76	76	75	78	78	78	78	77	78	77	77	77
NSR4	80	80	79	82	82	82	83	81	82	82	82	82
NSR4a	77	77	76	79	79	79	80	78	79	79	78	78
NSR4b	79	79	78	81	81	81	81	80	80	80	80	80
NSR5	80	79	79	80	80	80	81	79	80	80	79	79
NSR6	77	77	76	79	79	79	79	78	78	78	78	78
NSR7	70	69	69	70	70	70	70	69	69	69	68	68
NSR8	67	67	66	68	68	68	68	67	67	66	66	66
NSR9	73	73	72	75	75	75	75	74	75	74	74	74
NSR10	74	73	73	74	74	74	74	72	73	72	72	72

	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
NSR1	74	80	79	79	78	78	78	78	78	78	78	64
NSR1a	72	77	76	76	75	75	75	75	75	75	75	63
NSR2	72	77	77	77	76	76	76	76	76	76	76	66
NSR3	73	77	77	77	76	75	75	75	75	75	75	73
NSR4	76	81	81	81	80	79	79	79	79	79	79	79
NSR4a	73	78	78	78	77	76	76	76	76	76	76	76
NSR4b	75	80	79	79	79	78	78	78	78	78	78	77
NSR5	77	79	79	79	75	74	74	74	74	74	74	73
NSR6	74	77	77	77	76	75	75	75	75	75	75	75
NSR7	67	68	68	68	63	63	63	63	63	63	63	61
NSR8	64	66	66	66	62	62	62	62	62	62	62	60
NSR9	70	74	74	74	72	72	72	72	72	72	72	70
NSR10	71	72	72	72	66	65	65	65	65	65	65	64

	Jan-12
NSR1	64
NSR1a	63
NSR2	66
NSR3	73
NSR4	79
NSR4a	76
NSR4b	77
NSR5	73
NSR6	75
NSR7	61
NSR8	60
NSR9	70
NSR10	64

Remarks: Noise criteria for NSR9 was 70 dB(A) during normal days and 65 dB(A) during examination

Calculation of SPL for each NSR from Phase A
- Use of Quiet PME

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month						116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	114.0																									
NSR1	104	-48.3				70.7	70.7	70.7	70.7	70.7	70.7	70.7	70.7	70.7	68.7																									
NSR1a	76	-45.6				73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	71.4																									
NSR2	272	-56.7				62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	60.3																									
NSR3	296	-57.4				61.6	61.6	61.6	61.6	61.6	61.6	61.6	61.6	61.6	59.6																									
NSR4	330	-58.4				60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	58.6																									
NSR4a	418	-60.4				58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	56.6																									
NSR4b	278	-56.9	3			62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	60.1																									
NSR5	370	-59.4				59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	57.6																									
NSR6	400	-60.0				59.0	59.0	59.0	59.0	59.0	59.0	59.0	59.0	59.0	57.0																									
NSR7	652	-64.3				54.8	54.8	54.8	54.8	54.8	54.8	54.8	54.8	54.8	52.7																									
NSR8	800	-66.1				53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	50.9																									
NSR9	412	-60.3				58.8	58.8	58.8	58.8	58.8	58.8	58.8	58.8	58.8	56.7																									
NSR10	578	-63.2				55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	53.8																									

Calculation of SPL for each NSR from Phase B
- Use of Quiet PME

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month						116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	114.0																									
NSR1	364	-59.2				59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	57.8																									
NSR1a	338	-58.6				60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5	58.4																									
NSR2	488	-61.8				57.3	57.3	57.3	57.3	57.3	57.3	57.3	57.3	57.3	55.2																									
NSR3	406	-60.2				58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	56.8																									
NSR4	364	-59.2				59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	57.8																									
NSR4a	396	-60.0				59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	57.0																									
NSR4b	366	-59.3	3			59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	57.7																									
NSR5	208	-54.4				64.7	64.7	64.7	64.7	64.7	64.7	64.7	64.7	64.7	62.6																									
NSR6	288	-57.2				61.9	61.9	61.9	61.9	61.9	61.9	61.9	61.9	61.9	59.8																									
NSR7	394	-59.9				59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	57.1																									
NSR8	608	-63.7				55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	53.3																									
NSR9	466	-61.4				57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	55.6																									
NSR10	360	-59.1				59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	57.9																									

Calculation of SPL for each NSR from Phase C
- Use of Quiet PME

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month				118.6	118.6	118.6	118.6	118.6	117.3	117.3	117.3	122.2	122.2	122.2	120.5	120.5	121.4	114.0	114.0	114.0	114.0	120.4	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3									
NSR1	220	-54.8		66.7	66.7	66.7	66.7	66.7	65.4	65.4	65.4	70.4	70.4	70.4	68.7	68.7	69.6	62.1	62.1	62.1	62.1	68.6	67.4	67.4	67.4	67.4	67.4	67.4	67.4	67.4	67.4									
NSR1a	214	-54.6		67.0	67.0	67.0	67.0	67.0	65.6	65.6	65.6	70.6	70.6	70.6	68.9	68.9	69.8	62.4	62.4	62.4	62.4	68.8	67.7	67.7	67.7	67.7	67.7	67.7	67.7	67.7	67.7									
NSR2	254	-56.1		65.5	65.5	65.5	65.5	65.5	64.2	64.2	64.2	69.1	69.1	69.1	67.4	67.4	68.3	60.9	60.9	60.9	60.9	67.3	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2									
NSR3	176	-52.9		68.7	68.7	68.7	68.7	68.7	67.3	67.3	67.3	72.3	72.3	72.3	70.6	70.6	71.5	64.1	64.1	64.1	64.1	70.5	69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4									
NSR4	180	-53.1		68.5	68.5	68.5	68.5	68.5	67.1	67.1	67.1	72.1	72.1	72.1	70.4	70.4	71.3	63.9	63.9	63.9	63.9	70.3	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2									
NSR4a	256	-56.2		65.4	65.4	65.4	65.4	65.4	64.1	64.1	64.1	69.0	69.0	69.0	67.4	67.4	68.2	60.8	60.8	60.8	60.8	67.2	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1									
NSR4b	148	-51.4	3	70.2	70.2	70.2	70.2	70.2	68.8	68.8	68.8	73.8	73.8	73.8	72.1	72.1	73.0	65.6	65.6	65.6	65.6	72.0	70.9	70.9	70.9	70.9	70.9	70.9	70.9	70.9	70.9									
NSR5	224	-55.0		66.6	66.6	66.6	66.6	66.6	65.2	65.2	65.2	70.2	70.2	70.2	68.5	68.5	69.4	62.0	62.0	62.0	62.0	68.4	67.3	67.3	67.3	67.3	67.3	67.3	67.3	67.3	67.3									
NSR6	226	-55.1		66.5	66.5	66.5	66.5	66.5	65.2	65.2	65.2	70.1	70.1	70.1	68.5	68.5	69.3	61.9	61.9	61.9	61.9	68.3	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2									
NSR7	548	-62.8		58.8	58.8	58.8	58.8	58.8	57.5	57.5	57.5	62.4	62.4	62.4	60.8	60.8	61.6	54.2	54.2	54.2	54.2	60.6	59.5	59.5	59.5	59.5	59.5	59.5	59.5	59.5	59.5									
NSR8	644	-64.2		57.4	57.4	57.4	57.4	57.4	56.1	56.1	56.1	61.0	61.0	61.0	59.4	59.4	60.2	52.8	52.8	52.8	52.8	59.2	58.1	58.1	58.1	58.1	58.1	58.1	58.1	58.1	58.1									
NSR9	272	-56.7		64.9	64.9	64.9	64.9	64.9	63.6	63.6	63.6	68.5	68.5	68.5	66.8	66.8	67.7	60.3	60.3	60.3	60.3	66.7	65.6	65.6	65.6	65.6	65.6	65.6	65.6	65.6	65.6									
NSR10	448	-61.0		60.6	60.6	60.6	60.6	60.6	59.2	59.2	59.2	64.2	64.2	64.2	62.5	62.5	63.4	56.0	56.0	56.0	56.0	62.4	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2									

Calculation of SPL for each NSR from Phase D
- Use of Quiet PME

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month				118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	117.3	117.3	117.3	122.2	122.2	120.5	121.4	121.4	121.4	121.4	121.4	120.4	120.4	120.4	119.3	119.3	119.3	119.3	119.3	119.3									
NSR1	442	-60.9		60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	59.3	59.3	59.3	64.3	64.3	62.6	63.5	63.5	63.5	63.5	63.5	62.5	62.5	62.5	61.4	61.4	61.4	61.4	61.4	61.4									
NSR1a	424	-60.5		61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	59.7	59.7	59.7	64.7	64.7	63.0	63.9	63.9	63.9	63.9	63.9	62.9	62.9	62.9	61.7	61.7	61.7	61.7	61.7	61.7									
NSR2	484	-61.7		59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	58.6	58.6	58.6	63.5	63.5	61.8	62.7	62.7	62.7	62.7	62.7	61.7	61.7	61.7	60.6	60.6	60.6	60.6	60.6	60.6									
NSR3	336	-58.5		63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1	61.7	61.7	61.7	66.7	66.7	65.0	65.9	65.9	65.9	65.9	65.9	64.9	64.9	64.9	63.7	63.7	63.7	63.7	63.7	63.7									
NSR4	282	-57.0		64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	63.2	63.2	63.2	68.2	68.2	66.5	67.4	67.4	67.4	67.4	67.4	66.4	66.4	66.4	65.3	65.3	65.3	65.3	65.3	65.3									
NSR4a	280	-56.9		64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	63.3	63.3	63.3	68.3	68.3	66.6	67.5	67.5	67.5	67.5	67.5	66.5	66.5	66.5	65.3	65.3	65.3	65.3	65.3	65.3									
NSR4b	294	-57.4	3	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	62.9	62.9	62.9	67.8	67.8	66.2	67.0	67.0	67.0	67.0	67.0	66.0	66.0	66.0	64.9	64.9	64.9	64.9	64.9	64.9									
NSR5	84	-46.5		75.1	75.1	75.1	75.1	75.1	75.1	75.1	75.1	73.8	73.8	73.8	78.7	78.7	77.1	77.9	77.9	77.9	77.9	77.9	76.9	76.9	76.9	75.8	75.8	75.8	75.8	75.8	75.8									
NSR6	180	-53.1		68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	67.1	67.1	67.1	72.1	72.1	70.4	71.3	71.3	71.3	71.3	71.3	70.3	70.3	70.3	69.2	69.2	69.2	69.2	69.2	69.2									
NSR7	268	-56.6		65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	63.7	63.7	63.7	68.6	68.6	67.0	67.8	67.8	67.8	67.8	67.8	66.8	66.8	66.8	65.7	65.7	65.7	65.7	65.7	65.7									
NSR8	414	-60.3		61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2	59.9	59.9	59.9	64.9	64.9	63.2	64.1	64.1	64.1	64.1	64.1	63.1	63.1	63.1	61.9	61.9	61.9	61.9	61.9	61.9									
NSR9	376	-59.5		62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	60.7	60.7	60.7	65.7	65.7	64.0	64.9	64.9	64.9	64.9	64.9	63.9	63.9	63.9	62.8	62.8	62.8	62.8	62.8	62.8									
NSR10	168	-52.5		69.1	69.1	69.1	69.1	69.1	69.1	69.1	69.1	67.7	67.7	67.7	72.7	72.7	71.0	71.9	71.9	71.9	71.9	71.9	70.9	70.9	70.9	69.8	69.8	69.8	69.8	69.8	69.8									

Calculation of SPL for each NSR from Phase E
- Use of Quiet PME

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month												118.6	118.6	118.6	118.6	118.6	117.3	117.3	122.2	122.2	120.5	120.5	120.5	121.4	114.0	114.0	114.0	114.0	120.4	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3		
NSR1	66	-44.4										77.2	77.2	77.2	77.2	77.2	75.9	75.9	80.8	80.8	79.1	79.1	79.1	80.0	72.6	72.6	72.6	72.6	79.0	77.9	77.9	77.9	77.9	77.9	77.9	77.9	77.9	77.9		
NSR1a	96	-47.6										73.9	73.9	73.9	73.9	73.9	72.6	72.6	77.6	77.6	75.9	75.9	75.9	76.8	69.3	69.3	69.3	69.3	75.8	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6		
NSR2	88	-46.9										74.7	74.7	74.7	74.7	74.7	73.4	73.4	78.3	78.3	76.6	76.6	76.6	77.5	70.1	70.1	70.1	70.1	76.5	75.4	75.4	75.4	75.4	75.4	75.4	75.4	75.4	75.4		
NSR3	150	-51.5										70.1	70.1	70.1	70.1	70.1	68.7	68.7	73.7	73.7	72.0	72.0	72.0	72.9	65.5	65.5	65.5	65.5	71.9	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8		
NSR4	234	-55.4										66.2	66.2	66.2	66.2	66.2	64.9	64.9	69.8	69.8	68.2	68.2	68.2	69.0	61.6	61.6	61.6	61.6	68.0	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9		
NSR4a	344	-58.7										62.8	62.8	62.8	62.8	62.8	61.5	61.5	66.5	66.5	64.8	64.8	64.8	65.7	58.3	58.3	58.3	58.3	64.7	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5		
NSR4b	156	-51.9	3									69.7	69.7	69.7	69.7	69.7	68.4	68.4	73.3	73.3	71.7	71.7	71.7	72.5	65.1	65.1	65.1	65.1	71.5	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4		
NSR5	408	-60.2										61.4	61.4	61.4	61.4	61.4	60.0	60.0	65.0	65.0	63.3	63.3	63.3	64.2	56.8	56.8	56.8	56.8	63.2	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1		
NSR6	398	-60.0										61.6	61.6	61.6	61.6	61.6	60.3	60.3	65.2	65.2	63.5	63.5	63.5	64.4	57.0	57.0	57.0	57.0	63.4	62.3	62.3	62.3	62.3	62.3	62.3	62.3	62.3	62.3		
NSR7	740	-65.4										56.2	56.2	56.2	56.2	56.2	54.9	54.9	59.8	59.8	58.2	58.2	58.2	59.0	51.6	51.6	51.6	51.6	58.0	56.9	56.9	56.9	56.9	56.9	56.9	56.9	56.9	56.9		
NSR8	816	-66.2										55.3	55.3	55.3	55.3	55.3	54.0	54.0	59.0	59.0	57.3	57.3	57.3	58.2	50.7	50.7	50.7	50.7	57.2	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0		
NSR9	280	-56.9										64.6	64.6	64.6	64.6	64.6	63.3	63.3	68.3	68.3	66.6	66.6	66.6	67.5	60.0	60.0	60.0	60.0	66.5	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3		
NSR10	636	-64.1										57.5	57.5	57.5	57.5	57.5	56.2	56.2	61.1	61.1	59.5	59.5	59.5	60.3	52.9	52.9	52.9	52.9	59.3	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2		

Calculation of SPL for each NSR from Phase F
- Use of Quiet PME

NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month												118.8	118.8	118.8	118.8	118.8	118.8	118.8	122.3	122.3	122.3	122.3	120.5	121.4	121.4	121.4	121.4	114.0	120.4	120.4	120.4	120.4	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3
NSR1	338	-58.6										63.2	63.2	63.2	63.2	63.2	63.2	63.2	66.7	66.7	66.7	66.7	65.0	65.8	65.8	65.8	65.8	58.4	64.8	64.8	64.8	64.8	63.7	63.7	63.7	63.7	63.7	63.7	63.7	63.7
NSR1a	358	-59.1										62.7	62.7	62.7	62.7	62.7	62.7	62.7	66.2	66.2	66.2	66.2	64.5	65.3	65.3	65.3	65.3	57.9	64.3	64.3	64.3	64.3	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2
NSR2	256	-56.2										65.6	65.6	65.6	65.6	65.6	65.6	65.6	69.1	69.1	69.1	69.1	67.4	68.2	68.2	68.2	68.2	60.8	67.2	67.2	67.2	67.2	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1
NSR3	120	-49.6										72.2	72.2	72.2	72.2	72.2	72.2	72.2	75.7	75.7	75.7	75.7	74.0	74.8	74.8	74.8	74.8	67.4	73.8	73.8	73.8	73.8	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7
NSR4	58	-43.3										78.5	78.5	78.5	78.5	78.5	78.5	78.5	82.0	82.0	82.0	82.0	80.3	81.1	81.1	81.1	81.1	73.7	80.1	80.1	80.1	80.1	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0
NSR4a	84	-46.5										75.3	75.3	75.3	75.3	75.3	75.3	75.3	78.8	78.8	78.8	78.8	77.1	77.9	77.9	77.9	77.9	70.5	76.9	76.9	76.9	76.9	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8
NSR4b	76	-45.6	3									76.1	76.1	76.1	76.1	76.1	76.1	76.1	79.7	79.7	79.7	79.7	77.9	78.8	78.8	78.8	78.8	71.4	77.8	77.8	77.8	77.8	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7
NSR5	110	-48.8										72.9	72.9	72.9	72.9	72.9	72.9	72.9	76.5	76.5	76.5	76.5	74.7	75.6	75.6	75.6	75.6	68.2	74.6	74.6	74.6	74.6	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4
NSR6	94	-47.5										74.3	74.3	74.3	74.3	74.3	74.3	74.3	77.8	77.8	77.8	77.8	76.1	76.9	76.9	76.9	76.9	69.5	75.9	75.9	75.9	75.9	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8
NSR7	452	-61.1										60.7	60.7	60.7	60.7	60.7	60.7	60.7	64.2	64.2	64.2	64.2	62.4	63.3	63.3	63.3	63.3	55.9	62.3	62.3	62.3	62.3	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2
NSR8	514	-62.2										59.5	59.5	59.5	59.5	59.5	59.5	59.5	63.1	63.1	63.1	63.1	61.3	62.2	62.2	62.2	62.2	54.8	61.2	61.2	61.2	61.2	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1
NSR9	156	-51.9										69.9	69.9	69.9	69.9	69.9	69.9	69.9	73.4	73.4	73.4	73.4	71.7	72.5	72.5	72.5	72.5	65.1	71.5	71.5	71.5	71.5	70.4	70.4	70.4	70.4	70.4	70.4	70.4	70.4
NSR10	340	-58.6										63.1	63.1	63.1	63.1	63.1	63.1	63.1	66.7	66.7	66.7	66.7	64.9	65.8	65.8	65.8	65.8	58.4	64.8	64.8	64.8	64.8	63.6	63.6	63.6	63.6	63.6	63.6	63.6	63.6

Calculation of noise level of dump truck travelling along the haul road (during site formation stage)
- Use of Quiet PME

SWL 105 dB(A)*
No. of Dump Truck 15 per hour
Speed 10 km/hr

NSR	Shortest Horizontal Distance from Haul Road (m)	Façade Effect (dB(A))	SPL (dB(A)
NSR1	180	3	54.2
NSR1a	172	3	54.4
NSR2	176	3	54.3
NSR3	112	3	56.3
NSR4	140	3	55.3
NSR4a	212	3	53.5
NSR4b	96	3	56.9
NSR5	48	3	59.9
NSR6	84	3	57.5
NSR7	118	3	56.0
NSR8	148	3	55.1
NSR9	230	3	53.1
NSR10	12	3	66.0

* Reference: http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf

APPENDIX D-7C

Mitigated Construction Noise Levels (Use of QPME, Noise Barriers and Site Hoardings)

Mitigated Noise Levels from Construction Work other than Percussive Piling **Appendix D-7C**
- Use of Quiet PME + Noise Barriers and Site Hoardings

	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09
NSR1	68	68	69	69	69	68	68	68	73	73	73	73
NSR1a	68	68	70	70	70	69	69	69	73	73	73	72
NSR2	67	67	68	68	68	68	68	68	73	73	73	72
NSR3	70	70	71	71	71	70	70	70	74	74	74	73
NSR4	70	70	71	71	71	70	70	70	75	75	75	74
NSR4a	68	68	69	69	69	69	69	69	72	72	72	72
NSR4b	71	71	72	72	72	71	71	71	75	75	75	75
NSR5	69	69	71	71	71	71	71	71	73	73	73	73
NSR6	68	68	69	69	69	68	68	68	73	73	73	72
NSR7	66	66	67	67	67	67	67	67	69	69	69	70
NSR8	63	63	64	64	64	64	64	64	66	66	66	68
NSR9	67	67	68	68	68	67	67	67	70	70	70	70
NSR10	71	71	72	72	72	72	72	72	72	72	72	74

	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10
NSR1	72	72	70	73	73	72	74	73	73	71	71	71
NSR1a	72	72	69	72	72	71	73	72	72	71	71	71
NSR2	72	72	70	73	73	72	73	72	73	71	71	71
NSR3	73	73	70	71	71	71	73	72	72	72	72	72
NSR4	74	74	72	74	74	74	75	74	74	74	74	74
NSR4a	72	72	70	72	72	72	73	71	72	72	71	71
NSR4b	74	75	71	73	73	73	75	74	74	74	74	74
NSR5	73	72	71	72	72	72	73	72	72	72	71	71
NSR6	71	71	69	71	71	71	72	71	71	71	71	71
NSR7	70	69	69	70	70	70	70	69	69	69	68	68
NSR8	67	67	66	68	68	68	68	67	67	66	66	66
NSR9	70	70	67	69	69	68	70	69	69	69	69	69
NSR10	74	73	73	74	74	74	74	72	73	72	72	72

	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
NSR1	70	73	72	72	70	69	69	69	69	69	69	64
NSR1a	69	71	71	71	67	67	67	67	67	67	67	63
NSR2	69	72	71	71	69	69	69	69	69	69	69	66
NSR3	71	72	72	72	66	65	65	65	65	65	65	63
NSR4	71	74	74	74	70	69	69	69	69	69	69	69
NSR4a	69	71	71	71	67	66	66	66	66	66	66	66
NSR4b	72	74	74	74	69	68	68	68	68	68	68	67
NSR5	70	71	71	71	67	66	66	66	66	66	66	63
NSR6	69	71	71	71	67	67	67	67	67	67	67	65
NSR7	67	68	68	68	63	63	63	63	63	63	63	61
NSR8	64	66	66	66	62	62	62	62	62	62	62	60
NSR9	68	69	69	69	62	62	62	62	62	62	62	60
NSR10	71	72	72	72	66	65	65	65	65	65	65	64

	Jan-12
NSR1	64
NSR1a	63
NSR2	66
NSR3	63
NSR4	69
NSR4a	66
NSR4b	67
NSR5	63
NSR6	65
NSR7	61
NSR8	60
NSR9	60
NSR10	64

Remarks: Noise criteria for NSR9 was 70 dB(A) during normal days and 65 dB(A) during examination, however, a further -10 dB(A) was provided as the direct line of sight to subject site is obstructed, full compliance of noise criteria was achieved

Mitigated Construction Noise Levels, dB(A) (Use of QPME + Noise Barriers and Site Hoardings)

Calculation of SPL for each NSR from Phase A
- Use of Quiet PME + Noise Barriers and Site Hoardings

Month					Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month							116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	114.0																									
NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Barrier Effect (dB(A))																																					
NSR1	104	-48.3		-10			60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	58.7																									
NSR1a	76	-45.6		-10			63.4	63.4	63.4	63.4	63.4	63.4	63.4	63.4	63.4	61.4																									
NSR2	272	-56.7		0			62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	60.3																									
NSR3	296	-57.4		0			61.6	61.6	61.6	61.6	61.6	61.6	61.6	61.6	61.6	59.6																									
NSR4	330	-58.4		0			60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	58.6																									
NSR4a	418	-60.4		0			58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	56.6																									
NSR4b	278	-56.9	3	0			62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	60.1																									
NSR5	370	-59.4		0			59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	57.6																									
NSR6	400	-60.0		0			59.0	59.0	59.0	59.0	59.0	59.0	59.0	59.0	59.0	57.0																									
NSR7	652	-64.3		0			54.8	54.8	54.8	54.8	54.8	54.8	54.8	54.8	54.8	52.7																									
NSR8	800	-66.1		0			53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	50.9																									
NSR9	412	-60.3		0			58.8	58.8	58.8	58.8	58.8	58.8	58.8	58.8	58.8	56.7																									
NSR10	578	-63.2		0			55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	53.8																									

Calculation of SPL for each NSR from Phase B
- Use of Quiet PME + Noise Barriers and Site Hoardings

Month					Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month							116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	114.0																									
NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Barrier Effect (dB(A))																																					
NSR1	364	-59.2		0			59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	57.8																									
NSR1a	338	-58.6		0			60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5	58.4																									
NSR2	488	-61.8		0			57.3	57.3	57.3	57.3	57.3	57.3	57.3	57.3	57.3	55.2																									
NSR3	406	-60.2		0			58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	56.8																									
NSR4	364	-59.2		0			59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	57.8																									
NSR4a	396	-60.0		0			59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	57.0																									
NSR4b	366	-59.3	3	0			59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	57.7																									
NSR5	208	-54.4		0			64.7	64.7	64.7	64.7	64.7	64.7	64.7	64.7	64.7	62.6																									
NSR6	288	-57.2		0			61.9	61.9	61.9	61.9	61.9	61.9	61.9	61.9	61.9	59.8																									
NSR7	394	-59.9		0			59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	57.1																									
NSR8	608	-63.7		0			55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	53.3																									
NSR9	466	-61.4		0			57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	55.6																									
NSR10	360	-59.1		0			59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	57.9																									

Calculation of SPL for each NSR from Phase C
- Use of Quiet PME + Noise Barriers and Site Hoardings

Month					Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month					118.6	118.6	118.6	118.6	118.6	117.3	117.3	117.3	122.2	122.2	122.2	120.5	120.5	121.4	114.0	114.0	114.0	114.0	120.4	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3									
NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Barrier Effect (dB(A))																																					
NSR1	220	-54.8		0	66.7	66.7	66.7	66.7	66.7	65.4	65.4	65.4	70.4	70.4	70.4	68.7	68.7	69.6	62.1	62.1	62.1	62.1	68.6	67.4	67.4	67.4	67.4	67.4	67.4	67.4	67.4	67.4									
NSR1a	214	-54.6		0	67.0	67.0	67.0	67.0	67.0	65.6	65.6	65.6	70.6	70.6	70.6	68.9	68.9	69.8	62.4	62.4	62.4	62.4	68.8	67.7	67.7	67.7	67.7	67.7	67.7	67.7	67.7	67.7									
NSR2	254	-56.1		0	65.5	65.5	65.5	65.5	65.5	64.2	64.2	64.2	69.1	69.1	69.1	67.4	67.4	68.3	60.9	60.9	60.9	60.9	67.3	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2									
NSR3	176	-52.9		0	68.7	68.7	68.7	68.7	68.7	67.3	67.3	67.3	72.3	72.3	72.3	70.6	70.6	71.5	64.1	64.1	64.1	64.1	70.5	69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4									
NSR4	180	-53.1		0	68.5	68.5	68.5	68.5	68.5	67.1	67.1	67.1	72.1	72.1	72.1	70.4	70.4	71.3	63.9	63.9	63.9	63.9	70.3	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2									
NSR4a	256	-56.2		0	65.4	65.4	65.4	65.4	65.4	64.1	64.1	64.1	69.0	69.0	69.0	67.4	67.4	68.2	60.8	60.8	60.8	60.8	67.2	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1									
NSR4b	148	-51.4	3	0	70.2	70.2	70.2	70.2	70.2	68.8	68.8	68.8	73.8	73.8	73.8	72.1	72.1	73.0	65.6	65.6	65.6	65.6	72.0	70.9	70.9	70.9	70.9	70.9	70.9	70.9	70.9	70.9									
NSR5	224	-55.0		0	66.6	66.6	66.6	66.6	66.6	65.2	65.2	65.2	70.2	70.2	70.2	68.5	68.5	69.4	62.0	62.0	62.0	62.0	68.4	67.3	67.3	67.3	67.3	67.3	67.3	67.3	67.3	67.3									
NSR6	226	-55.1		0	66.5	66.5	66.5	66.5	66.5	65.2	65.2	65.2	70.1	70.1	70.1	68.5	68.5	69.3	61.9	61.9	61.9	61.9	68.3	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2									
NSR7	548	-62.8		0	58.8	58.8	58.8	58.8	58.8	57.5	57.5	57.5	62.4	62.4	62.4	60.8	60.8	61.6	54.2	54.2	54.2	54.2	60.6	59.5	59.5	59.5	59.5	59.5	59.5	59.5	59.5	59.5									
NSR8	644	-64.2		0	57.4	57.4	57.4	57.4	57.4	56.1	56.1	56.1	61.0	61.0	61.0	59.4	59.4	60.2	52.8	52.8	52.8	52.8	59.2	58.1	58.1	58.1	58.1	58.1	58.1	58.1	58.1	58.1									
NSR9	272	-56.7		0	64.9	64.9	64.9	64.9	64.9	63.6	63.6	63.6	68.5	68.5	68.5	66.8	66.8	67.7	60.3	60.3	60.3	60.3	66.7	65.6	65.6	65.6	65.6	65.6	65.6	65.6	65.6	65.6									
NSR10	448	-61.0		0	60.6	60.6	60.6	60.6	60.6	59.2	59.2	59.2	64.2	64.2	64.2	62.5	62.5	63.4	56.0	56.0	56.0	56.0	62.4	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2									

Calculation of SPL for each NSR from Phase D
- Use of Quiet PME + Noise Barriers and Site Hoardings

Month					Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month					118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	117.3	117.3	117.3	122.2	122.2	120.5	121.4	121.4	121.4	121.4	121.4	120.4	120.4	120.4	119.3	119.3	119.3	119.3	119.3	119.3									
NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Barrier Effect (dB(A))																																					
NSR1	442	-60.9		0	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	59.3	59.3	59.3	64.3	64.3	62.6	63.5	63.5	63.5	63.5	63.5	62.5	62.5	62.5	61.4	61.4	61.4	61.4	61.4	61.4									
NSR1a	424	-60.5		0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	61.0	59.7	59.7	59.7	64.7	64.7	63.0	63.9	63.9	63.9	63.9	63.9	62.9	62.9	62.9	61.7	61.7	61.7	61.7	61.7	61.7									
NSR2	484	-61.7		0	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	58.6	58.6	58.6	63.5	63.5	61.8	62.7	62.7	62.7	62.7	62.7	61.7	61.7	61.7	60.6	60.6	60.6	60.6	60.6	60.6									
NSR3	336	-58.5		0	63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1	61.7	61.7	61.7	66.7	66.7	65.0	65.9	65.9	65.9	65.9	65.9	64.9	64.9	64.9	63.7	63.7	63.7	63.7	63.7	63.7									
NSR4	282	-57.0		0	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	63.2	63.2	63.2	68.2	68.2	66.5	67.4	67.4	67.4	67.4	67.4	66.4	66.4	66.4	65.3	65.3	65.3	65.3	65.3	65.3									
NSR4a	280	-56.9		0	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	63.3	63.3	63.3	68.3	68.3	66.6	67.5	67.5	67.5	67.5	67.5	66.5	66.5	66.5	65.3	65.3	65.3	65.3	65.3	65.3									
NSR4b	294	-57.4	3	0	64.2	64.2	64.2	64.2	64.2	64.2	64.2	64.2	62.9	62.9	62.9	67.8	67.8	66.2	67.0	67.0	67.0	67.0	67.0	66.0	66.0	66.0	64.9	64.9	64.9	64.9	64.9	64.9									
NSR5	84	-46.5		-10	65.1	65.1	65.1	65.1	65.1	65.1	65.1	65.1	63.8	63.8	63.8	68.7	68.7	67.1	67.9	67.9	67.9	67.9	67.9	66.9	66.9	66.9	65.8	65.8	65.8	65.8	65.8	65.8									
NSR6	180	-53.1		-10	58.5	58.5	58.5	58.5	58.5	58.5	58.5	58.5	57.1	57.1	57.1	62.1	62.1	60.4	61.3	61.3	61.3	61.3	61.3	60.3	60.3	60.3	59.2	59.2	59.2	59.2	59.2	59.2									
NSR7	268	-56.6		0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	63.7	63.7	63.7	68.6	68.6	67.0	67.8	67.8	67.8	67.8	67.8	66.8	66.8	66.8	65.7	65.7	65.7	65.7	65.7	65.7									
NSR8	414	-60.3		0	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2	59.9	59.9	59.9	64.9	64.9	63.2	64.1	64.1	64.1	64.1	64.1	63.1	63.1	63.1	61.9	61.9	61.9	61.9	61.9	61.9									
NSR9	376	-59.5		0	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	60.7	60.7	60.7	65.7	65.7	64.0	64.9	64.9	64.9	64.9	64.9	63.9	63.9	63.9	62.8	62.8	62.8	62.8	62.8	62.8									
NSR10	168	-52.5		0	69.1	69.1	69.1	69.1	69.1	69.1	69.1	69.1	67.7	67.7	67.7	72.7	72.7	71.0	71.9	71.9	71.9	71.9	71.9	70.9	70.9	70.9	69.8	69.8	69.8	69.8	69.8	69.8									

Calculation of SPL for each NSR from Phase E
- Use of Quiet PME + Noise Barriers and Site Hoardings

Month					Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month													118.6	118.6	118.6	118.6	118.6	117.3	117.3	122.2	122.2	120.5	120.5	120.5	121.4	114.0	114.0	114.0	114.0	120.4	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3		
NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Barrier Effect (dB(A))																																					
NSR1	66	-44.4		-10									67.2	67.2	67.2	67.2	67.2	65.9	65.9	70.8	70.8	69.1	69.1	69.1	70.0	62.6	62.6	62.6	62.6	69.0	67.9	67.9	67.9	67.9	67.9	67.9	67.9	67.9	67.9		
NSR1a	96	-47.6		-10									63.9	63.9	63.9	63.9	63.9	62.6	62.6	67.6	67.6	65.9	65.9	65.9	66.8	59.3	59.3	59.3	59.3	65.8	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6		
NSR2	88	-46.9		-10									64.7	64.7	64.7	64.7	64.7	63.4	63.4	68.3	68.3	66.6	66.6	66.6	67.5	60.1	60.1	60.1	60.1	66.5	65.4	65.4	65.4	65.4	65.4	65.4	65.4	65.4	65.4		
NSR3	150	-51.5		-10									60.1	60.1	60.1	60.1	60.1	58.7	58.7	63.7	63.7	62.0	62.0	62.0	62.9	55.5	55.5	55.5	55.5	61.9	60.8	60.8	60.8	60.8	60.8	60.8	60.8	60.8	60.8		
NSR4	234	-55.4		-10									56.2	56.2	56.2	56.2	56.2	54.9	54.9	59.8	59.8	58.2	58.2	58.2	59.0	51.6	51.6	51.6	51.6	58.0	56.9	56.9	56.9	56.9	56.9	56.9	56.9	56.9	56.9		
NSR4a	344	-58.7		-10									52.8	52.8	52.8	52.8	52.8	51.5	51.5	56.5	56.5	54.8	54.8	54.8	55.7	48.3	48.3	48.3	48.3	54.7	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5		
NSR4b	156	-51.9	3	-10									59.7	59.7	59.7	59.7	59.7	58.4	58.4	63.3	63.3	61.7	61.7	61.7	62.5	55.1	55.1	55.1	55.1	61.5	60.4	60.4	60.4	60.4	60.4	60.4	60.4	60.4	60.4		
NSR5	408	-60.2		0									61.4	61.4	61.4	61.4	61.4	60.0	60.0	65.0	65.0	63.3	63.3	63.3	64.2	56.8	56.8	56.8	56.8	63.2	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1		
NSR6	398	-60.0		0									61.6	61.6	61.6	61.6	61.6	60.3	60.3	65.2	65.2	63.5	63.5	63.5	64.4	57.0	57.0	57.0	57.0	63.4	62.3	62.3	62.3	62.3	62.3	62.3	62.3	62.3	62.3		
NSR7	740	-65.4		0									56.2	56.2	56.2	56.2	56.2	54.9	54.9	59.8	59.8	58.2	58.2	58.2	59.0	51.6	51.6	51.6	51.6	58.0	56.9	56.9	56.9	56.9	56.9	56.9	56.9	56.9	56.9		
NSR8	816	-66.2		0									55.3	55.3	55.3	55.3	55.3	54.0	54.0	59.0	59.0	57.3	57.3	57.3	58.2	50.7	50.7	50.7	50.7	57.2	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0		
NSR9	280	-56.9		-10									54.6	54.6	54.6	54.6	54.6	53.3	53.3	58.3	58.3	56.6	56.6	56.6	57.5	50.0	50.0	50.0	50.0	56.5	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3		
NSR10	636	-64.1		0									57.5	57.5	57.5	57.5	57.5	56.2	56.2	61.1	61.1	59.5	59.5	59.5	60.3	52.9	52.9	52.9	52.9	59.3	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2		

Calculation of SPL for each NSR from Phase F
- Use of Quiet PME + Noise Barriers and Site Hoardings

Month					Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
Total SWL of each month													118.8	118.8	118.8	118.8	118.8	118.8	118.8	122.3	122.3	122.3	122.3	120.5	121.4	121.4	121.4	121.4	114.0	120.4	120.4	120.4	120.4	119.3	119.3	119.3	119.3	119.3	119.3	119.3	119.3
NSR	Horizontal Distance from Source to Receiver (m)	Distance Attenuation (dB(A))	Façade Effect (dB(A))	Barrier Effect (dB(A))																																					
NSR1	338	-58.6		0									63.2	63.2	63.2	63.2	63.2	63.2	63.2	66.7	66.7	66.7	66.7	65.0	65.8	65.8	65.8	65.8	58.4	64.8	64.8	64.8	64.8	63.7	63.7	63.7	63.7	63.7	63.7	63.7	63.7
NSR1a	358	-59.1		0									62.7	62.7	62.7	62.7	62.7	62.7	62.7	66.2	66.2	66.2	66.2	64.5	65.3	65.3	65.3	65.3	57.9	64.3	64.3	64.3	64.3	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2
NSR2	256	-56.2		0									65.6	65.6	65.6	65.6	65.6	65.6	65.6	69.1	69.1	69.1	69.1	67.4	68.2	68.2	68.2	68.2	60.8	67.2	67.2	67.2	67.2	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1
NSR3	120	-49.6		-10									62.2	62.2	62.2	62.2	62.2	62.2	62.2	65.7	65.7	65.7	65.7	64.0	64.8	64.8	64.8	64.8	57.4	63.8	63.8	63.8	63.8	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7
NSR4	58	-43.3		-10									68.5	68.5	68.5	68.5	68.5	68.5	68.5	72.0	72.0	72.0	72.0	70.3	71.1	71.1	71.1	71.1	63.7	70.1	70.1	70.1	70.1	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0
NSR4a	84	-46.5		-10									65.3	65.3	65.3	65.3	65.3	65.3	65.3	68.8	68.8	68.8	68.8	67.1	67.9	67.9	67.9	67.9	60.5	66.9	66.9	66.9	66.9	65.8	65.8	65.8	65.8	65.8	65.8	65.8	65.8
NSR4b	76	-45.6	3	-10									66.1	66.1	66.1	66.1	66.1	66.1	66.1	69.7	69.7	69.7	69.7	67.9	68.8	68.8	68.8	68.8	61.4	67.8	67.8	67.8	67.8	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7
NSR5	110	-48.8		-10									62.9	62.9	62.9	62.9	62.9	62.9	62.9	66.5	66.5	66.5	66.5	64.7	65.6	65.6	65.6	65.6	58.2	64.6	64.6	64.6	64.6	63.4	63.4	63.4	63.4	63.4	63.4	63.4	63.4
NSR6	94	-47.5		-10									64.3	64.3	64.3	64.3	64.3	64.3	64.3	67.8	67.8	67.8	67.8	66.1	66.9	66.9	66.9	66.9	59.5	65.9	65.9	65.9	65.9	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8
NSR7	452	-61.1		0									60.7	60.7	60.7	60.7	60.7	60.7	60.7	64.2	64.2	64.2	64.2	62.4	63.3	63.3	63.3	63.3	55.9	62.3	62.3	62.3	62.3	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2
NSR8	514	-62.2		0									59.5	59.5	59.5	59.5	59.5	59.5	59.5	63.1	63.1	63.1	63.1	61.3	62.2	62.2	62.2	62.2	54.8	61.2	61.2	61.2	61.2	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1
NSR9	156	-51.9		-10									59.9	59.9	59.9	59.9	59.9	59.9	59.9	63.4	63.4	63.4	63.4	61.7	62.5	62.5	62.5	62.5	55.1	61.5	61.5	61.5	61.5	60.4	60.4	60.4	60.4	60.4	60.4	60.4	60.4
NSR10	340	-58.6		0									63.1	63.1	63.1	63.1	63.1	63.1	63.1	66.7	66.7	66.7	66.7	64.9	65.8	65.8	65.8	65.8	58.4	64.8	64.8	64.8	64.8	63.6	63.6	63.6	63.6	63.6	63.6	63.6	63.6

Calculation of noise level of dump truck travelling along the haul road (during site formation stage)
- Use of Quiet PME

SWL 105 dB(A)*
No. of Dump Truck 15 per hour
Speed 10 km/hr

NSR	Shortest Horizontal Distance from Haul Road (m)	Façade Effect (dB(A))	SPL (dB(A)
NSR1	180	3	54.2
NSR1a	172	3	54.4
NSR2	176	3	54.3
NSR3	112	3	56.3
NSR4	140	3	55.3
NSR4a	212	3	53.5
NSR4b	96	3	56.9
NSR5	48	3	59.9
NSR6	84	3	57.5
NSR7	118	3	56.0
NSR8	148	3	55.1
NSR9	230	3	53.1
NSR10	12	3	66.0

* Reference: http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf

APPENDIX E

Water Quality

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Appendix E Summary of Water Quality Sampling Results

ALS Lab ID	Sample ID	Date sampled	pH	Conductivity	Temp	Salinity	Suspended solids	Turbidity	Water depth	Aluminium	Cadmium	Chromium	Copper	Lead	Zinc	Ammonia as N	Nitrate as N	Total Kjeldhal N	Total Phosphorus	Reactive Phosphorus	Sulphide	Oil & grease	DOS	COD	BOD	DO (on-site)	*E. coli*	Faecal Coliform
		Unit		ug/cm	C	g/L	mg/L	NTU	m	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%	mg/L	mg/L	mg/L	cfu/100mL	cfu/100mL
		Reporting Limits	0.1	1	0.1	0.1	2	1	0.5	10	0.2	1	1	1	10	0.01	0.01	0.1	0.1	0.01	0.1	5	0.1	2	2	0.1	1	1
	Sample Description																											
HK50697	WM1	Wednesday, 29 March, 2006	6.9	525	22.6	0.4	11	7	<0.5	<10	<0.2	<1	3	<1	32	1.03	0.08	2.0	<0.1	0.01	<0.1	<5	97.4	31	<2	8.4	70	80
HK50697	WM2	Wednesday, 29 March, 2006	4.3	869	23.4	0.4	16	4	<0.5	369	0.4	<1	1	<1	239	3.91	0.67	5.2	<0.1	<0.01	<0.1	<5	34.9	19	<2	3	21	22
HK50697	WM3	Wednesday, 29 March, 2006	6.8	1090	23.0	0.5	24	33	<0.5	<10	<0.2	<1	2	<1	<10	5.74	0.02	7.6	1.2	0.46	<0.1	<5	69.7	40	<2	6	88	88
HK50697	WM4	Wednesday, 29 March, 2006	6.7	962	21.4	0.5	22	9	<0.5	<10	<0.2	<1	2	<1	10	4.74	0.05	6.3	1.1	0.50	<0.1	<5	54.0	28	<2	4.6	160	180
HK50697	WM5	Wednesday, 29 March, 2006	6.6	1030	26.6	0.5	34	15	<0.5	<10	<0.2	<1	1	<1	<10	5.96	0.02	6.9	1.8	1.20	<0.1	<5	54.4	35	<2	4.8	3,200	3,900
HK50697	WM6	Wednesday, 29 March, 2006	6.2	2320	22.5	1.2	28	10	<0.5	25	<0.2	<1	5	3	29	0.15	0.01	3.1	0.2	0.02	<0.1	<5	107.0	108	4	8.5	100	100
HK50697	WM7	Wednesday, 29 March, 2006	6.1	3610	26.9	1.9	75	31	<0.5	12	<0.2	2	<1	<1	16	1.81	2.35	4.1	1.1	0.50	<0.1	<5	60.9	35	<2	5.2	3,700	4,400
HK50697	WM8	Wednesday, 29 March, 2006	5.2	-	27.0	1.7	-	37	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	11.7	-	-	<0.01	-	-
HK50697	WM9	Wednesday, 29 March, 2006	3.3	-	28.7	1.7	-	37	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	20.0	-	-	1.6	-	-
HK50697	WM10	Wednesday, 29 March, 2006	2.9	-	-	1.5	-	6	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	132.0	-	-	10.1	-	-
HK51004	WM1	Monday, 10 April, 2006	6.2	290	30.1	0.2	37	51	<0.5	37	<0.2	<1	1	<1	141	0.26	0.08	0.9	0.2	<0.01	<0.1	<5	93.8	18	2	7.1	160	170
HK51004	WM2	Monday, 10 April, 2006	6.2	592	30.3	0.4	126	101	<0.5	18	<0.2	<1	<1	<1	<10	5.30	0.14	8.6	0.4	0.02	<0.1	<5	117.0	56	17	8.8	1,600	2,200
HK51004	WM3	Monday, 10 April, 2006	6.4	994	28.7	0.5	65	36	<0.5	46	<0.2	<1	<1	<1	<10	3.17	0.22	4.9	1.0	0.43	<0.1	<5	753.0	48	16	5.9	110	120
HK51004	WM4	Monday, 10 April, 2006	6.1	1060	29.4	0.6	35	19	<0.5	<10	<0.2	<1	<1	<1	<10	5.51	0.08	7.2	4.5	1.61	<0.1	<5	76.1	40	14	5.8	32	35
HK51004	WM5	Monday, 10 April, 2006	5.9	1280	28.3	0.7	10	33	<0.5	13	<0.2	<1	<1	<1	<10	8.52	0.01	9.0	2.6	2.40	<0.1	<5	23.1	51	8	1.8	12,000	10,000
HK51004	WM7	Monday, 10 April, 2006	6.3	1330	29.6	0.7	356	140	<0.5	<10	<0.2	<1	<1	<1	<10	1.83	3.01	4.2	1.4	0.38	1	<5	82.5	14	10	6.3	8,000	8,800
HK51004	WM10	Monday, 10 April, 2006	2.5	-	32.2	2.3	-	5	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	110.0	-	-	7.9	-	-
HK51430	WM1	Wednesday, 26 April, 2006	6.9	780	24.3	0.3	20	18	<0.5	<10	<0.2	<1	2	<1	<10	0.16	0.16	0.9	<0.1	0.01	<0.1	<5	58.0	27	<2	4.8	46	49
HK51430	WM2	Wednesday, 26 April, 2006	7.2	628	24.9	0.3	45	72	<0.5	<10	<0.2	<1	<1	<1	13	2.20	0.07	4.0	<0.1	0.03	<0.1	<5	108.0	38	7	8.9	39	47
HK51430	WM3	Wednesday, 26 April, 2006	7.3	991	23.1	0.4	104	85	<0.5	<10	<0.2	<1	2	<1	<10	8.94	0.04	10.3	2.1	1.94	0.1	<5	45.2	63	6	3.9	240	460
HK51430	WM4	Wednesday, 26 April, 2006	7.1	899	23.0	0.4	40	26	<0.5	<10	<0.2	<1	<1	<1	<10	8.67	0.04	13.1	2.2	1.68	1.1	<5	25.2	84	18	2.2	320	550
HK51430	WM5	Wednesday, 26 April, 2006	7.5	719	22.7	0.2	32	22	<0.5	<10	<0.2	<1	2	<1	<10	10.90	0.01	16.6	2.8	2.70	0.1	<5	24.9	38	6	2.1	2,100	2,700
HK51430	WM7	Wednesday, 26 April, 2006	7.4	4600	25.2	2.5	253	200	<0.5	<10	<0.2	<1	3	<1	<10	4.95	1.64	7.8	1.3	1.23	0.1	<5	56.8	66	9	4.6	4,500	5,000
HK51430	WM10	Wednesday, 26 April, 2006	2.4	-	26.3	1.3	-	7	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	101.0	-	-	8.2	-	-
HK52633	WM1	Monday, 5 June, 2006	6.5	599	28.4	0.4	7	17	<0.5	16	<0.2	<1	<1	<1	<10	1.10	<0.01	2.4	0.1	0.01	<0.1	<5	67.9	48	<2	5.1	180	280
HK52633	WM2	Monday, 5 June, 2006	6.3	717	27.6	0.4	26	83	<0.5	24	<0.2	<1	<1	<1	<10	0.92	<0.01	2.9	0.5	0.05	<0.1	<5	43.6	64	<2	3.3	230	340
HK52633	WM3	Monday, 5 June, 2006	6.7	700	27.0	0.4	31	18	<0.5	<10	<0.2	<1	<1	<1	<10	3.80	<0.01	4.4	1.8	0.81	<0.1	<5	65.1	27	<2	5	2,400	3,100
HK52633	WM4	Monday, 5 June, 2006	6.7	690	26.8	0.4	21	15	<0.5	<10	<0.2	<1	<1	<1	<10	3.65	<0.01	4.4	1.8	0.76	<0.1	<5	62.5	38	<2	4.8	1,200	1,900
HK52633	WM5	Monday, 5 June, 2006	6.6	715	26.8	0.4	28	22	<0.5	<10	<0.2	<1	<1	<1	<10	3.21	<0.01	4.5	1.8	0.87	<0.1	<5	54.6	28	<2	4.2	3,500	4,600
HK52633	WM6	Monday, 5 June, 2006	6.5	1180	27.3	0.6	42	4	<0.5	62	<0.2	<1	<1	1	<10	0.09	<0.01	3.3	1	0.36	<0.1	<5	58.4	112	<2	4.5	120	130
HK52633	WM7	Monday, 5 June, 2006	7.1	952	27.7	0.5	45	33	<0.5	17	<0.2	<1	<1	<1	<10	0.60	3.13	2.2	0.7	0.51	<0.1	<5	84.1	19	<2	6.4	3,200	4,300
HK52633	WM8	Monday, 5 June, 2006	6.4	-	27.9	0.2	-	26	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	79.0	-	<2	6	-	-
HK52633	WM9	Monday, 5 June, 2006	6.5	-	28.3	0.2	-	71	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	68.7	-	<2	5.2	-	-
HK52633	WM10	Monday, 5 June, 2006	6.2	-	28.4	0.3	-	150	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	49.8	-	<2	3.7	-	-

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
Appendix E Summary of Water Quality Sampling Results

		Analyte Description	pH	Conductivity	Temp	Salinity	Suspended solids	Turbidity	Water depth	Aluminium	Cadmium	Chromium	Copper	Lead	Zinc	Ammonia as N	Nitrate as N	Total Kjeldhal N	Total Phosphorus	Reactive Phosphorus	Sulphide	Oil & grease	DOS	COD	BOD	DO (on-site)	*E. coli*	Faecal Coliform
		Unit		ug/cm	C	g/L	mg/L	NTU	m	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%	mg/L	mg/L	mg/L	cfu/100mL	cfu/100mL
		Reporting Limits	0.1	1	0.1	0.1	2	1	0.5	10	0.2	1	1	1	10	0.01	0.01	0.1	0.1	0.01	0.1	5	0.1	2	2	0.1	1	1
Sample Description																												
ALS Lab ID	Sample ID	Date sampled																										
HK52897	WM1	Thursday, 15 June, 2006	6.7	390	28.9	0.2	23	80	<0.5	19	<0.2	<1	2	<1	<10	0.73	0.01	2.2	0.2	<0.01	<0.1	<5	47.0	67	5	3.6	510	560
HK52897	WM2	Thursday, 15 June, 2006	7.1	610	28.2	0.4	4	9	<0.5	49	<0.2	<1	1	<1	<10	0.04	<0.01	1.9	1.1	0.55	<0.1	<5	48.3	80	2	3.8	150	180
HK52897	WM3	Thursday, 15 June, 2006	7.0	519	26.7	0.2	56	84	<0.5	79	<0.2	<1	1	<1	<10	1.28	<0.01	2.6	1	0.51	0.8	<5	67.3	76	10	5.4	1,600	2,000
HK52897	WM4	Thursday, 15 June, 2006	6.9	575	26.8	0.4	44	52	<0.5	40	<0.2	<1	1	<1	<10	1.92	0.01	5.1	0.8	0.10	<0.1	<5	68.2	62	3	5.4	240	270
HK52897	WM5	Thursday, 15 June, 2006	7.0	546	26.8	0.3	13	14	<0.5	<10	<0.2	<1	1	<1	<10	2.98	0.01	3.8	1	0.20	<0.1	<5	50.2	26	3	4	9,800	10,000
HK52897	WM6	Thursday, 15 June, 2006	6.8	302	28.1	0.2	5	7	<0.5	81	<0.2	<1	1	1	<10	0.10	<0.01	2.5	0.8	0.37	<0.1	<5	58.4	96	5	4.6	29	34
HK52897	WM7	Thursday, 15 June, 2006	7.4	1730	27.3	1	14	27	<0.5	13	<0.2	<1	1	<1	15	2.94	0.78	4.6	0.8	0.53	<0.1	<5	84.1	25	5	6.6	7,400	8,000
HK52897	WM11	Thursday, 15 June, 2006	6.9	691	26.7	0.3	126	140	<0.5	38	<0.2	<1	2	1	<10	1.85	0.01	3.9	1.1	0.09	<0.1	8	64.7	46	6	5.2	3,600	4,000
HK52897	WM12	Thursday, 15 June, 2006	6.8	679	26.6	0.3	71	152	<0.5	51	<0.2	<1	2	2	<10	1.78	0.01	3.5	1	0.09	<0.1	<5	67.2	55	4	5.4	2,700	3,000
HK52897	WM13s	Thursday, 15 June, 2006	7.2	1020	27.0	0.5	67	80	1.0	14	<0.2	<1	<1	<1	<10	2.91	0.55	0.4	6.6	<0.01	<0.1	<5	157.0	63	7	12.5	29	32
HK52897	WM13b	Thursday, 15 June, 2006	7.1	1030	27.2	0.5	113	128	1.5	14	<0.2	<1	<1	<1	<10	2.90	0.54	0.5	7.3	<0.01	<0.1	<5	138.0	73	12	10.9	19	27
HK53004	WM1	Tuesday, 20 June, 2006	6.2	352	28.2	0.2	87	92	<0.5	79	<0.2	2	2	1	12	0.78	0.13	2.4	0.2	<0.01	<0.1	<5	72.0	50	12	5.4	420	480
HK53004	WM2	Tuesday, 20 June, 2006	6.1	288	29.6	0.2	21	24	<0.5	84	<0.2	3	1	<1	<10	0.14	<0.01	2.1	1	0.29	<0.1	<5	49.8	105	40	3.8	530	570
HK53004	WM3	Tuesday, 20 June, 2006	6.2	515	28.5	0.4	20	31	<0.5	30	<0.2	2	1	<1	<10	2.40	0.19	3.5	0.5	0.12	<0.1	<5	58.5	36	9	4.5	210	240
HK53004	WM4	Tuesday, 20 June, 2006	6.2	533	28.4	0.4	108	70	<0.5	36	<0.2	4	2	<1	<10	2.60	0.01	5.0	0.7	0.09	0.5	<5	35.3	70	26	2.7	1,100	1,500
HK53004	WM5	Tuesday, 20 June, 2006	6.3	440	28.6	0.2	12	11	<0.5	41	<0.2	3	1	<1	<10	3.60	0.03	4.0	0.6	0.42	<0.1	<5	53.9	24	15	4.2	1,100	1,900
HK53004	WM6	Tuesday, 20 June, 2006	6.5	210	28.9	0.2	5	8	<0.5	55	<0.2	1	1	<1	<10	0.10	0.01	1.4	0.4	0.21	<0.1	<5	55.3	76	16	4.3	2	2
HK53004	WM7	Tuesday, 20 June, 2006	7.2	1950	27.9	1.1	58	30	<0.5	21	<0.2	3	1	<1	<10	0.90	1.15	2.9	0.7	0.50	<0.1	<5	77.1	38	17	6.0	14,000	17,000
HK53004	WM11	Tuesday, 20 June, 2006	6.3	561	28.5	0.4	19	24	<0.5	19	<0.2	3	1	<1	<10	3.20	0.04	4.3	0.8	0.40	<0.1	<5	54.4	34	18	4.2	220	400
HK53004	WM12	Tuesday, 20 June, 2006	6.3	483	28.6	0.3	17	29	<0.5	26	<0.2	1	1	<1	<10	2.80	0.04	4.0	0.6	0.21	<0.1	<5	60.8	34	16	4.7	1,400	1,900
HK53004	WM13s	Tuesday, 20 June, 2006	7.2	716	28.9	0.5	60	77	1.0	17	<0.2	<1	<1	<1	<10	2.60	0.23	5.7	0.2	<0.01	<0.1	<5	143.0	72	25	11.8	26	29
HK53004	WM13b	Tuesday, 20 June, 2006	7.2	731	28.8	0.5	68	116	1.5	16	<0.2	2	1	<1	<10	2.60	0.23	6.0	0.3	<0.01	<0.1	<5	112.0	90	23	9.2	61	70

APPENDIX F

Sewage

Mott Connell Limited	Contract: Proposed Residential Development at Wo Shang Wai, Yuen Long			Job Ref: 221005
Consulting Engineers 7th Floor West Wing Office Building New World Centre, 20 Salisbury Road Tsim Sha Tsui, Kowloon, Hong Kong	Subject: Appendix F - Sewage Flow and Loading from the Proposed Redevelopment			Calc.Sheet No. Page 1
	Drawing Ref.	Calculations by RLI	Checked by MT	Date: 10-Jan-07

Ref.

Annex F.1

1. **Proposed Redevelopment**
The proposed redevelopment will replace the existing degraded wetland with residential buildings, landscaping area and restored wetland.

2. **Design Parameters**

- Design Population

Type	Population
Domestic Residents	1053

3. **Calculation of design sewage flow**

References:
- Sewerage Manual
- Guidelines for the Design of Small Sewage Treatment Plants

Assumptions:
- Residential area for the development belongs to R4 type of development due to its proposed plot ratio < 0.4
- For all employed staff and visitors, the design flow rate is taken as Services in Appendix 3 of the Design of Small Sewage Treatment Plants

Appendix 3 Small Sewage Treatment Plant

Daily Unit Sewage Flow

Type	Design Flow Rate (L/head/day)
Domestic Residents	460

Calculation

Average Dry Weather Sewage Flow, ADF (m^3/d) = Design Flow Rate (L/person/d) x Population / 1000

Average Dry Weather Sewage Flow (ADF) for existing uses

Type	Population	Unit Flow (L/d/head)	ADF (m3/d)
Domestic Residents	1053	460	484.4
		sum =	**484.4**

Ref.

4. Calculation of sewage load

Assumptions:

- Global unit load factors are taken from Table 4 of the Sewerage Manual
- Unit load factors for staff and visitors are assumed to employed population for commerical.

Sewerage Manual Table 4

Global Unit Load factors

Load Type	Unit Load Factor
	Residents
SS (kg/d/person)	0.055
BOD (kg/d/person)	0.055
TN (kg/d/person)*	0.0135
TKN (kg/d/person)	0.0085
NH3N (kg/d/person)	0.005
E. Coli. (no./d/person)	4.30E+10

Note:-
*The Total Nitrogen (TN) is equal to the sum fo inorganic nitrogen (NH3N) and the organic nitrogen (TKN)

Calculation

Total pollution loading = Unit Load Factor x Population

$$\text{Pollution Load Concentration} = \frac{\text{Total Load}}{\text{Total Flow (484380 L/d)}}$$

Total Pollution Load from Exisiting Uses

Load Type	Sewage Loading from effluent of Proposed Development		Load conc.	
SS	57.92	kg/d	119.57	mg/L
BOD	57.92	kg/d	119.57	mg/L
TN	14.22	kg/d	29.35	mg/L
TKN	8.95	kg/d	18.48	mg/L
NH3N	5.27	kg/d	10.87	mg/L
E. Coli.	4.53E+13	no./d	4.53E+13	no./d

APPENDIX G

Ecology

Appendix G1. *Plant species recorded in the Project Area (PA) and Assessment Area (AA).*

			Project Area			Assessment Area								
Species	**Native/ Exotic**	**Status**	**Grassland**	**Seasonal / Freshwater Marsh**	**Drainage Channels/ Ditches**	**Grassland**	**Seasonal Marsh**	**Freshwater Marsh/ Reedbed**	**Active/ Abandoned Fishponds**	**Drainage Channels/ Ditches**	**Woodland**	**Plantation**	**Active Dry Agriculture**	**Inactive Dry Agriculture**
Acacia auriculiformis	E	C	+						✓			✓		
Acacia confusa	E	C										✓		
Acacia mangium	E	C									✓			
Acanthus ilicifolius	N	C								✓				
Ageratum conyzoides	E	C	+			✓								✓
Albizia lebbeck	E	C										✓	✓	
Allium tuberosum	E	C											✓	
Alocasia odora	N	C									✓			
Alternanthera paronychioides	E	C						✓						
Alternanthera philoxeroides	N	C	+++	++	+		✓	✓						
Alyxia sinensis	N	C									✓			
Amaranthus spinosus	E	C											✓	✓
Amaranthus viridis	N	Vc	+		+								✓	✓
Annona squamosa	E	Cultivated	+						✓					
Apluda mutica	N	Vc	+						✓					
Aporusa dioica	N	Vc									✓			
Artocarpus macrocarpus	E	C									✓			
Avicennia marina	N	C								✓				
Bambusa textilis	E	Cultivated										✓		
Bauhinia variegata	E	C										✓		
Bidens alba	E	Vc	++		++	✓		✓	✓	✓				✓
Blechnum orientale	N	C									✓			
Bombax ceiba	E	Vc										✓		
Bothriochloa bladhii	N	Vc	+											
Brachiaria mutica	E	C	+++	+	+++	✓	✓	✓	✓	✓			✓	✓
Brassica parachinensis	E	Cultivated											✓	
Bridelia tomentosa	N	Vc									✓			
Carica papaya	E	Wc	+						✓				✓	
Cassia mimosoides	N	C	+											✓
Casuarina equisetifolia	E	Vc										✓		
Celtis sinensis	N	C	+						✓		✓	✓		
Chenopodium album	N	C											✓	✓
Chloris barbata	N	Vc							✓					
Cinnamomum camphora	N	C									✓	✓		
Clausena lansium	E	Wc									✓			
Clerodendrum chinense	N	C	+											✓
Clerodendrum cyrtophyllum	N	C							✓		✓			
Cocculus orbiculatus	N	C									✓			
Colocasia esculenta	N	Vc						✓						
Conyza bonariensis	E	Vc	++			✓			✓					✓
Cuscuta australis	N	n/a				✓			✓		✓	✓		
Cuscuta chinensis	N	C	+											
Cyclosorus interruptus	N	C		++				✓						
Cynodon dactylon	N	Vc	++			✓	✓		✓	✓				✓
Cyperus imbricatus	N	C	+	+	++				✓	✓				
Dalbergia hancei	N	C									✓			
Desmos chinensis	N	C									✓			
Dicranopteris pedata	N	Vc				✓								
Digitaria sanguinalis	N	Vc	+		+				✓					
Dimocarpus longan	E	Wc	+						✓		✓		✓	✓
Drymaria diandra	N	C											✓	
Echinochloa crusgalli	N	C	++		++		✓	✓	✓				✓	
Eclipta prostrata	N	C	+		+									
Eichhornia crassipes	E	C			++			✓	✓	✓			✓	
Elephantopus scaber	N	C									✓			

Species	Native/ Exotic	Status	Project Area			Assessment Area								
			Grassland	Seasonal / Freshwater Marsh	Drainage Channels/ Ditches	Grassland	Seasonal Marsh	Freshwater Marsh/ Reedbed	Active/ Abandoned Fishponds	Drainage Channels/ Ditches	Woodland	Plantation	Active Dry Agriculture	Inactive Dry Agriculture
Eleusine indica	N	Vc	++		++		✓		✓		✓			
Embelia laeta	N	Vc									✓			
Emilia sonchifolia	N	Vc											✓	
Eucalyptus citriodora	E	C									✓	✓		
Euphorbia hirta	E	Vc	+		+				✓					✓
Euphorbia thymifolia	N	Vc												✓
Ficus carica	E	Vc											✓	
Ficus hirta	N	C									✓			
Ficus hispida	N	Vc									✓			
Ficus microcarpa	N	C									✓	✓		
Ficus virens	N	C										✓		
Gnaphalium penslyvanicum	E	C							✓					
Gnetum luofuense	N	Vc									✓			
Hedyotis corymbosa	N	Vc											✓	
Hibiscus tiliaceus	N	Vc										✓		
Hydrocotyle sibthorpioides	N	C											✓	
Imperata koenigii	N	Vc	++		+	✓								
Ipomoea aquatica	E	Vc	++	++	++		✓	✓	✓					
Ipomoea batatas	E	n/a											✓	
Ipomoea cairica	E	Vc	++		++				✓	✓	✓		✓	✓
Ipomoea triloba	N	C	+						✓					
Kandelia obovata	N	Vc								✓				
Kyllinga monocephala	N	C								✓				
Lantana camara	E	Vc							✓					
Leucaena leucocephala	E	C	+			✓				✓		✓		✓
Ligustrum sinense	N	C									✓			
Litchi chinensis	E	Wc	+						✓		✓			✓
Litsea rotundifolia	E	Vc									✓			
Lophatherum gracile	N	Vc									✓			
Lophostemon confertus	E	C									✓	✓		
Ludwigia octovalvis	N	C	++	+				✓		✓				
Lygodium scandens	N	C			+						✓			
Macaranga tanarius	N	C			+	✓			✓	✓	✓	✓		
Maesa perlarius	N	C									✓			
Mangifera indica	E	Wc							✓		✓	✓		
Melaleuca quinquenervia	E	Vc									✓			
Melastoma candidum	N	C									✓			
Melastoma dodecandrum	N	C				✓								
Melia azedarach	E	C			+				✓	✓	✓	✓		
Merremia hederacea	N	C					✓		✓				✓	✓
Microcos paniculata	N	C									✓	✓		
Microstegium ciliatum	N	Vc				✓					✓			
Mikania micrantha	E	Vc	+	+	+	✓		✓	✓	✓	✓	✓		✓
Mimosa pudica	E	Vc	+		+	✓			✓	✓	✓	✓		✓
Miscanthus floridulus	N	C	+			✓			✓					
Miscanthus sinensis	N	Vc				✓								✓
Morus alba	EN	C	+						✓					
Murdannia nudiflora	N	C	++	+				✓						
Musa x paradisiaca	E	n/a, Wc			+				✓				✓	
Mussaenda pubescens	N	Vc									✓			
Myosoton aquaticum	N	C											✓	
Neyraudia reynaudiana	N	Vc				✓			✓					
Ottochloa malabarica	N	Vc									✓			
Paederia scandens	N	Vc	++							✓	✓			
Panicum maximum	E	Vc	++		+++	✓		✓	✓	✓		✓		✓
Panicum repens	N	Vc	++	++	+		✓	✓	✓					✓
Paspalum conjugatum	E	C	++		+	✓	✓	✓	✓	✓			✓	✓

Species	Native/ Exotic	Status	Project Area: Grassland	Project Area: Seasonal / Freshwater Marsh	Project Area: Drainage Channels/ Ditches	Assessment Area: Grassland	Assessment Area: Seasonal Marsh	Assessment Area: Freshwater Marsh/ Reedbed	Assessment Area: Active/ Abandoned Fishponds	Assessment Area: Drainage Channels/ Ditches	Assessment Area: Woodland	Assessment Area: Plantation	Assessment Area: Active Dry Agriculture	Assessment Area: Inactive Dry Agriculture
Paspalum orbiculare	N	Vc							✓					
Paspalum paspaloides	N	C	++		+				✓	✓				
Passiflora foetida	E	Vc	+		+					✓				
Pennisetum polystachyon	E	Vc	+											
Pennisetum purpureum	E	Vc	+		++				✓	✓				✓
Phragmites australis	N	Vc	+	+++			✓	✓	✓	✓				
Phyllanthus emblica	N	Vc										✓		
Phyllanthus reticulatus	N	C	+								✓			
Phytolacca americana	E	n/a	+							✓				
Pilea microphylla	E	Vc											✓	
Pinus elliottii	E	C				✓						✓		
Pinus massoniana	N	C									✓			
Polygonum barbatum	N	C	+							✓				
Polygonum chinense	N	Vc												✓
Polygonum hydropiper	N	C			++		✓		✓	✓	✓			
Polygonum perfoliatum	N	CVc	++	+										✓
Portulaca oleracea	N	Vc											✓	
Psidium guajava	E	C							✓				✓	
Psychotria asiatica	N	Vc									✓			
Psychotria serpens	N	Vc									✓			
Pteris ensiformis	N	C									✓			
Pteris semipinnata	N	Vc									✓			
Pueraria lobata	N	C						✓						
Pycreus polystachyus	N	Vc	+							✓				
Rhaphiolepis indica	N	Vc									✓			
Rhus succedanea	N	C									✓			
Rhynchelytrum repens	E	Vc	++			✓								
Ricinus communis	E	C							✓					
Rumex trisetifer	N	C	+	+			✓	✓	✓	✓			✓	
Saccharum officinarum	E	C				✓			✓				✓	
Sapium sebiferum	N	C			+				✓	✓	✓			
Schefflera heptaphylla	N	Vc									✓	✓		
Schima superba	E	C									✓			
Sesbania cannabina	E	C	++		+									
Sesbania javanica	N	C					✓	✓	✓				✓	
Sida acuta	N	C	+											
Sida rhombifolia	N	C												✓
Smilax china	N	Vc									✓			
Solanum melongena	E	C											✓	
Solanum nigrum	N	Vc	+		+						✓		✓	✓
Solanum torvum	E	C			+					✓				
Soliva anthemifolia	E	C											✓	
Sonneratia caseolaris	E	n/a								✓				
Sporobolus fertilis	N	Vc	++			✓			✓					
Sterculia lanceolata	N	Vc									✓			
Strophanthus divaricatus	N	C									✓			
Syzygium jambos	E	C									✓	✓		
Tetracera asiatica	N	Vc									✓			
Typha angustifolia	E	R						✓						
Urena lobata	N	C	+			✓								
Wedelia trilobata	E	C	++		++	✓		✓	✓					✓
Zea mays	E	C											✓	
Zingiber officinale	E	C											✓	
Total No. of Species	165	165	57	12	32	25	13	21	50	31	62	27	33	29

+ - uncommon, ++ - fairly common, +++ - very common

Appendix G2. *Bird species recorded in the Project Area (PA) and Assessment Area (AA), April 2005-June 2006. (Level of Concern based on Fellowes et al. 2002).*

					Project Area					Assessment Area					
Species	**Wetland-dependent**	**Level of Concern**	**Project Area**	**Assessment Area**	**Grassland**	**Seasonal Marsh**	**Freshwater Marsh/ Reedbed**	**Drainage Channels/ Ditches**	**Developed Area/Bare Ground**	**Freshwater Marsh/ Reedbed**	**Active/ Abandoned Fishponds**	**Drainage Channels/ Ditches**	**Active Dry Agriculture**	**Inactive Dry Agriculture**	**Developed Area/Bare Ground**
Little Grebe *Tachybaptus ruficollis*	Y	LC	-	Y							Y				
Great Cormorant *Phalacrocorax carbo*	Y	PRC	Y	Y				Y			Y	Y			
Grey Heron *Ardea cinerea*	Y	PRC	Y	Y				Y			Y	Y			
Great Egret *Egretta alba*	Y	PRC (RC)	(Y)	Y				(Y)			Y	Y			
Intermediate Egret *Egretta intermedia*	Y	RC	-	Y							Y				
Little Egret *Egretta garzetta*	Y	PRC (RC)	Y	Y		Y	Y	Y			Y	Y	Y	Y	
Cattle Egret *Bubulcus ibis*	Y	(LC)	Y	Y		Y	Y				Y	Y		Y	
Chinese Pond Heron *Ardeola bacchus*	Y	PRC (RC)	Y	Y		Y	Y	Y			Y	Y	Y	Y	
Striated Heron *Butorides striatus*	Y	(LC)	-	(Y)							(Y)				
Black-crowned Night Heron *Nycticorax nycticorax*	Y	(LC)	Y	Y			Y				Y	Y			
Black-faced Spoonbill *Platalea minor*	Y	PGC	-	Y							Y	Y			
Northern Pintail *Anas acuta*	Y	RC	-	Y							Y†				
Common Teal *Anas crecca*	Y	RC	-	Y							Y	Y			
Eurasian Wigeon *Anas penelope*	Y	RC	-	Y							Y†				
Osprey *Pandion haliaetus*	Y	RC	-	Y							Y				
Black Kite *Milvus migrans*	N	(RC)	Y	Y	Y	Y	Y		Y		Y				Y
White-bellied Sea Eagle *Haliaeetus leucogaster*	Y	(RC)	-	(Y)							(Y)†				
Common Buzzard *Buteo buteo*	N	-	Y	Y	Y		Y		Y		Y				Y
Common Kestrel *Falco tinnunculus*	N	-	Y	(Y)	Y		Y				(Y)				(Y)
Common Moorhen *Gallinula chloropus*	Y	-	-	Y							Y	Y			
White-breasted Waterhen *Amaurornis phoenicurus*	Y	-	Y	Y		Y	Y	Y	Y		Y	Y			Y
Oriental Pratincole *Glareola maldivarum*	Y	LC	(Y)	(Y)	(Y)		(Y)				(Y)				
Little Ringed Plover *Charadrius dubius*	Y	(LC)	Y	Y		Y	Y				Y				
Green Sandpiper *Tringa ochropus*	Y	-	-	(Y)							(Y)				
Common Sandpiper *Actitis hypoleucos*	Y	-	Y	Y		Y	Y				Y				
Common Snipe *Gallinago gallinago*	Y	-	Y	Y			Y					Y			
Black-headed Gull *Larus ridibundus*	Y	PRC	-	Y							Y†				
Rock Dove *Columba livia*	N	-	Y	Y	Y						Y		Y		

Species	Wetland-dependent	Level of Concern	Project Area	Assessment Area	Project Area					Assessment Area					
					Grassland	Seasonal Marsh	Freshwater Marsh/ Reedbed	Drainage Channels/ Ditches	Developed Area/Bare Ground	Freshwater Marsh/ Reedbed	Active/ Abandoned Fishponds	Drainage Channels/ Ditches	Active Dry Agriculture	Inactive Dry Agriculture	Developed Area/Bare Ground
Oriental Turtle Dove *Streptopelia orientalis*	N	-	Y	(Y)	Y†						(Y)†				
Spotted Dove *Streptopelia chinensis*	N	-	Y	Y						Y	Y	Y		Y	Y
Common Koel *Eudynamis scolopaceus*	N	-	Y	Y					Y		Y		Y	Y	Y
Greater Coucal *Centropus sinensis*	N	-	Y	(Y)			Y							(Y)	
Savanna Nightjar *Caprimulgus affinis*	N	-	Y	-	Y										
Pacific Swift *Apus pacificus*	N	(LC)	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)			(Y)				(Y)
Little Swift *Apus affinis*	N	-	Y	Y	Y	Y	Y	Y	Y		Y	Y			Y
Pied Kingfisher *Ceryle rudis*	Y	(LC)	-	Y							Y				
Common Kingfisher *Alcedo atthis*	Y	-	-	Y							Y				
White-throated Kingfisher *Halcyon smyrnensis*	Y	(LC)	-	Y							Y	Y			
Barn Swallow *Hirundo rustica*	N	-	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y
Red-rumped Swallow *Hirundo dauurica*	N	-	(Y)	(Y)	(Y)		(Y)		(Y)		(Y)				(Y)
White Wagtail *Motacilla alba*	Y#	-	Y	Y	Y	Y	Y	Y		Y	Y	Y		Y	Y
Grey Wagtail *Motacilla cinerea*	Y	-	Y	Y	Y	Y	Y	Y			Y				Y
Yellow Wagtail *Motacilla flava*	Y	-	Y	Y		Y	Y	Y			Y	Y		Y	
Richard's Pipit *Anthus richardi*	N	-	Y	-		Y	Y								
Olive-backed Pipit *Anthus hodgsoni*	N	-	Y	Y	Y		Y		Y						Y
Red-whiskered Bulbul *Pycnonotus jocosus*	N	-	Y	Y	Y		Y	Y	Y	Y	Y			Y	Y
Chinese Bulbul *Pycnonotus sinensis*	N	-	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
Long-tailed Shrike *Lanius schach*	N	-	Y	Y	Y		Y		Y		Y			Y	Y
Oriental Magpie Robin *Copsychus saularis*	N	-	Y	Y				Y			Y	Y			Y
Common Stonechat *Saxicola torquata*	N	-	Y	Y	Y		Y	Y			Y	Y			
Masked Laughingthrush *Garrulax perspicillatus*	N	-	Y	Y	Y			Y							Y
Oriental Reed Warbler *Acrocephalus orientalis*	Y	-	Y	-	Y										
Zitting Cisticola *Cisticola juncidis*	Y#	LC	Y	Y	Y							Y			
Yellow-bellied Prinia *Prinia flaviventris*	N	-	Y	Y	Y	Y	Y	Y		Y	Y	Y		Y	Y
Plain Prinia *Prinia inornata*	N	-	Y	Y	Y	Y	Y	Y			Y				Y
Common Tailorbird *Orthotomus sutorius*	N	-	(Y)	-	(Y)										
Dusky Warbler *Phylloscopus fuscatus*	N	-	Y	Y	Y	Y	Y				Y				Y

					Project Area					Assessment Area					
Species	**Wetland-dependent**	**Level of Concern**	**Project Area**	**Assessment Area**	**Grassland**	**Seasonal Marsh**	**Freshwater Marsh/ Reedbed**	**Drainage Channels/ Ditches**	**Developed Area/Bare Ground**	**Freshwater Marsh/ Reedbed**	**Active/ Abandoned Fishponds**	**Drainage Channels/ Ditches**	**Active Dry Agriculture**	**Inactive Dry Agriculture**	**Developed Area/Bare Ground**
Japanese White-eye *Zosterops japonicus*	N	-	Y	Y					Y						
Little Bunting *Emberiza pusilla*	N	-	-	Y							Y				
Black-faced Bunting *Emberiza spodocephala*	N	-	Y	-	Y										
White-rumped Munia *Lonchura striata*	N	-	Y	Y			Y				Y				Y
Scaly-breasted Munia *Lonchura punctulata*	N	-	Y	Y		Y	Y	Y			Y				Y
Eurasian Tree Sparrow *Passer montanus*	N	-	Y	Y	Y				Y		Y		Y	Y	Y
Red-billed Starling *Sturnus sericeus*	Y#	(RC)*	Y	Y		Y	Y			Y	Y	Y			Y
Black-collared Starling *Sturnus nigircollis*	N	-	Y	Y	Y		Y				Y	Y		Y	Y
White-shouldered Starling *Sturnus sinensis*	Y#	(LC)	Y	(Y)	Y						(Y)				
Common Myna *Acridotheres tristis*	N	-	-	(Y)											(Y)
Crested Myna *Acridotheres cristatellus*	N	-	Y	Y	Y	Y	Y		Y	Y	Y	Y			Y
Black Drongo *Dicrurus macrocercus*	N	-	Y	Y	Y						Y				
Azure-winged Magpie *Cyanopica cyanus*	N	-	-	Y							Y				
Common Magpie *Pica pica*	N	-	Y	Y	Y		Y	Y			Y	Y		Y	Y
Large-billed Crow *Corvus macrorhynchus*	N	-	Y	-	Y						Y				Y
Collared Crow *Corvus torquatus*	Y#	LC	-	Y							Y				Y
Total Species Recorded					33	20	35	21	13	8	61	27	7	16	37
Species of Conservation Concern					5	7	9	6	1	1	26	12	2	3	4

Y – Species recorded during transect surveys, (Y) – Species recorded outside transect surveys (point count/flight line surveys or site visits)

Y# - Species is not exclusively dependent on wetland habitats but is usually found around wetlands in Hong Kong

† - These species were recorded flying overhead but not recorded utilising the habitats

* 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 threatened. A listing of Regional Concern (RC), based on the importance of the large roosts present near Deep Bay, is considered to be more appropriate.

Appendix G3. *Summary of birds using Flight path 1, November 2005-April 2006.*

Species	**5-10m**	**11-15m**	**16-20m**	**21-50m**	**51-100m**	**Total**
Great Cormorant *Phalacrocorax carbo*	24	19	17	7		67
Grey Heron *Ardea cinerea*	1		4			5
Little Egret *Egretta garzetta*	4		4			8
Cattle Egret *Bubulcus ibis*	2					2
Chinese Pond Heron *Ardeola bacchus*	2					2
Common Teal *Anas crecca*			3			3
Black Kite *Milvus migrans*	1			2		3
Oriental Pratincole *Glareola maldivarum*	4					4
Green Sandpiper *Tringa ochruros*	1					1
Common Sandpiper *Actitis hypoleucos*	1					1
Total	40	19	28	9	0	96

Appendix G4. *Summary of birds using Flight path 2, November 2005-April 2006.*

Species	**5-10m**	**11-15m**	**16-20m**	**21-50m**	**51-100m**	**Total**
Great Cormorant *Phalacrocorax carbo*				1		1
Grey Heron *Ardea cinerea*				1	2	3
Great Egret *Egretta alba*		1				1
Little Egret *Egretta garzetta*		4		27		31
Chinese Pond Heron *Ardeola bacchus*				1		1
Black Kite *Milvus migrans*				4		4
Total	0	5	0	34	2	41

Appendix G5. *Summary of birds using Flight path 3, November 2005-April 2006.*

Species	**5-10m**	**11-15m**	**16-20m**	**21-50m**	**51-100m**	**Total**
Great Egret *Egretta alba*				1		1
Little Egret *Egretta garzetta*				10		10
Chinese Pond Heron *Ardeola bacchus*				1		1
Black Kite *Milvus migrans*				5		5
Total	0	0	0	17	0	17

Appendix G6. *Summary of birds using Flight path 4, November 2005-April 2006.*

Species	5-10m	11-15m	16-20m	21-50m	51-100m	Total
Great Cormorant *Phalacrocorax carbo*		31	14	24		69
Grey Heron *Ardea cinerea*				1		1
Great Egret *Egretta alba*		1				1
Little Egret *Egretta garzetta*			5	6		11
Total	0	32	19	31	0	82

Appendix G7. *Summary of birds using Flight path 5, November 2005-April 2006.*

Species	5-10m	11-15m	16-20m	21-50m	51-100m	Total
Great Cormorant *Phalacrocorax carbo*		5	9	17		31
Great Egret *Egretta alba*				1		1
Little Egret *Egretta garzetta*				18		18
Eurasian Wigeon *Anas penelope*				2		2
Total	0	5	9	38	0	52

Appendix G8. *Summary of birds using Flight path 6, November 2005-April 2006.*

Species	5-10m	11-15m	16-20m	21-50m	51-100m	Total
Black Kite *Milvus migrans*				1		1
Common Buzzard *Buteo buteo*				1		1
Total	0	0	0	2	0	2

Appendix G9. *Summary of birds using Flight path 7, November 2005-April 2006.*

Species	5-10m	11-15m	16-20m	21-50m	51-100m	Total
Black-headed Gull *Larus ridibundus*					70	70
Total	0	0	0	0	70	70*

* The high count on this flight path resulted from a flock recorded on a single date.

Appendix G10. *Summary of birds using Flight path 8, November 2005-April 2006.*

Species	5-10m	11-15m	16-20m	21-50m	51-100m	Total
Red-billed Starling *Sturnus sericeus*				50		50
Total	0	0	0	50	0	50*

* The high count on this flight path resulted from a flock recorded on a single date.

Appendix G11. *Herpetofauna species recorded in the Project Area (PA) and Assessment Area (AA), April 2005-June 2006. (Level of Concern based on Fellowes et al. 2002).*

					Project Area					Assessment Area					
Species	**Wetland-dependent**	**Level of Concern**	**Project Area**	**Assessment Area**	**Grassland**	**Seasonal Marsh**	**Freshwater Marsh/ Reedbed**	**Drainage Channels/ Ditches**	**Developed Area/Bare Ground**	**Freshwater Marsh/ Reedbed**	**Active/ Abandoned Fishponds**	**Drainage Channels/ Ditches**	**Active Dry Agriculture**	**Inactive Dry Agriculture**	**Developed Area/Bare Ground**
Asian Common Toad *Bufo melanostictus*	Y	-	Y	Y				Y			Y	Y			
Brown Tree Frog *Polypedates megacephalus*	Y	-	Y	-			Y								
Günther's Frog *Rana guentheri*	Y	-	Y	Y				Y			Y				
Paddy Frog *Fejervarya limnocharis*	Y	-	Y	-			Y	Y							
Ornate Pigmy Frog *Microhyla ornata*	Y	-	Y	-			Y								
Chinese Striped Terrapin *Ocadia sinensis*	Y	-	Y	-				Y							
Checkered Keelback *Xenochrophis piscator*	Y	-	-	Y							Y				
Long-tailed Skink *Mabuya longicaudata*	Y	-	-	Y								Y			
Total Species Recorded					0	0	3	4	0	0	3	2	0	0	0
Species of Conservation Concern					0	0	0	0	0	0	0	0	0	0	0

Appendix G12. *Dragonfly species recorded in the Project Area (PA) and Assessment Area (AA), April 2005-June 2006. (Level of Concern based on Fellowes et al. 2002).*

					Project Area					Assessment Area					
Species	**Wetland-dependent**	**Level of Concern**	**Project Area**	**Assessment Area**	**Grassland**	**Seasonal Marsh**	**Freshwater Marsh/ Reedbed**	**Drainage Channels/ Ditches**	**Developed Area/Bare Ground**	**Freshwater Marsh/ Reedbed**	**Active/ Abandoned Fishponds**	**Drainage Channels/ Ditches**	**Active Dry Agriculture**	**Inactive Dry Agriculture**	**Developed Area/Bare Ground**
Asian Amberwing *Brachythemis contaminata*	Y	-	Y	Y	Y	Y	Y	Y			Y				
Asian Widow *Palpopleura sexmaculata*	Y	-	Y	-			Y	Y							
Black Threadtail *Prodasineura autumnalis*	Y	-	Y	-			Y								
Blue Percher *Diplacodes trivialis*	Y	-	Y	Y	Y	Y					Y				
Blue Skimmer sp. *Orthetrum glaucum/ triangulare/luzonicum*	Y	-	Y	Y	Y	Y		Y		Y	Y	Y		Y	
Common Bluetail *Ischnura senegalensis*	Y	-	Y	Y	Y	Y	Y	Y	Y		Y	Y			Y
Common Red Skimmer *Orthetrum pruinosum*	Y	-	Y	Y		Y		Y				Y			
Crimson Darter *Crocothemis servilia*	Y	-	Y	Y		Y	Y	Y	Y		Y	Y			
Crimson Dropwing *Trithemis aurora*	Y	-	Y	Y	Y	Y	Y	Y			Y	Y			
Evening Skimmer *Tholymis tillarga*	Y	-	Y	Y				Y			Y				
Green Skimmer *Orthetrum sabina*	Y	-	Y	Y	Y	Y	Y	Y	Y		Y		Y		
Lesser Emperor *Anax parthenope*	Y	-	Y	-				Y							
Orange-tailed Midget *Agriocnemis femina*	Y	-	Y	Y			Y	Y			Y				
Orange-tailed Sprite *Ceriagrion auranticum*	Y	-	Y	Y			Y	Y		Y	Y				
Pied Percher *Neurothemis tullia*	Y	-	Y	Y	Y	Y	Y	Y			Y				
Saddlebag Glider *Tramea virginea*	Y	-	-	Y							Y				
Scarlet Basker *Urothemis signata*	Y	LC	Y	Y				Y				Y			
Variegated Flutterer *Rhyothemis variegata*	Y	-	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	
Wandering Glider *Pantala flavescens*	Y	-	Y	Y	Y	Y	Y	Y	Y		Y			Y	
Total Species Recorded					9	11	12	16	4	2	14	7	2	3	1
Species of Conservation Concern					0	0	0	1	0	0	0	1	0	0	0

Appendix G13. *Butterfly species recorded in the Project Area (PA) and Assessment Area (AA), April 2005-June 2006. (Level of Concern based on Fellowes et al. 2002).*

					Project Area					Assessment Area					
Species	**Wetland-dependent**	**Level of Concern**	**Project Area**	**Assessment Area**	**Grassland**	**Seasonal Marsh**	**Freshwater Marsh/ Reedbed**	**Drainage Channels/ Ditches**	**Developed Area/Bare Ground**	**Freshwater Marsh/ Reedbed**	**Active/ Abandoned Fishponds**	**Drainage Channels/ Ditches**	**Active Dry Agriculture**	**Inactive Dry Agriculture**	**Developed Area/Bare Ground**
Angled Castor *Ariadne ariadne*	N	-	Y	-	Y										
Blue-spotted Crow *Euploea midamus*	N	-	Y	-	Y										
Common Black Jezebel *Delias pasithoe*	N	-	Y	-	Y										
Common Grass Yellow *Eurema hecabe*	N	-	Y	Y	Y	Y	Y	Y			Y			Y	
Common Jay *Graphium doson*	N	-	Y	-				Y							
Common Mime *Chilasa clytia*	N	-	Y	-	Y										
Common Mormon *Papilio polytes*	N	-	-	Y							Y	Y			Y
Danaid Egg-fly *Hypolimnas misippus*	N	LC	Y	Y			Y							Y	
Dark-branded Bush Brown *Mycalesis mineus*	N	-	Y	-			Y	Y							
Formosan Swift *Borbo cinnara*	N	-	Y	-				Y							
Great Egg-fly *Hypolimnas bolina*	N	-	Y	Y				Y				Y			
Great Mormon *Papilio mormon*	N	-	Y	-				Y							
Indian Cabbage White *Pieris canidia*	N	-	Y	Y	Y		Y	Y			Y	Y		Y	
Large Faun *Faunis eumeus*	N	-	Y	-	Y										
Lemon Emigrant *Catopsilia pomona*	N	-	Y	Y				Y			Y				
Lime Blue *Chilades lajus*	N	-	Y	-	Y			Y							
Mottled Emigrant *Catopsilia pyranthe*	N	-	Y	Y	Y									Y	
Pale Grass Blue *Zizeeria maha*	N	-	Y	-			Y	Y							
Paris Peacock *Papilio paris*	N	-	Y	-				Y	Y						
Rustic *Cupha erymanthis*	N	-	-	Y										Y	
Skipper spp. Hesperiidae	N	-	-	Y										Y	
Southern Sullied Sailer *Neptis clinia*	N	-	-	-											
Straight Five-ring *Ypthima lisandra*	N	-	Y	-	Y										
White-edged Blue Baron *Euthalia phemius*	N	-	Y	-			Y	Y	Y						
Yellow Orange-tip *Ixias pyrene*	N	-	Y	Y				Y						Y	
Total Species Recorded					10	1	6	13	2	0	4	3	0	7	1
Species of Conservation Concern					0	0	1	0	0	0	0	0	0	1	0

APPENDIX H

Wetland Restoration Plan

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PREFACE

Wo Shang Wai to the north of Royal Palms and Palm Springs is zoned "OU(CDWRA)". This area comprises formed land, fish ponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan, and fragmented and partially filled marshland. The western portion is currently mostly vacant while the eastern portion is currently partly vacant and partly occupied by a mix of uses including open storage uses, container yards and container vehicle parks.

The planning intention of this location is to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved through comprehensive residential and/or recreational development to include wetland restoration area. Development or redevelopment schemes on the degraded wetlands directly adjoining the existing continuous and contiguous fish ponds should include wetland restoration and buffer proposals to separate the development from and minimize its impact on the fish pond areas. Any new building should be located farthest away from Deep Bay. (Approved Mai Po and Fairview Park OZP No. S/YL - MP/6). This Wetland Restoration Plan provides details required for the construction and long-term management as part of a development proposal which will meet the planning intention for the site.

1 INTRODUCTION

1.1 Background

1.1.1 The Project Area referred to in this report comprises an area of land at Wo Shang Wai, to the north of the residential developments at Palm Springs and Royal Palms. Land here comprises formed land, fishponds filled prior to the publication of the Mai Po and Fairview Park Interim Development Permission Area (IDPA) Plan and partially-filled marshland. The western portion of the Project Area is currently vacant, while the eastern area is largely occupied by a mix of uses including open storage area, container yards and container vehicle parks.

1.1.2 The Project Area lies within the Deep Bay wetland ecosystem. This is an ecologically sensitive area of international importance. The core of the wetlands is contained within the Mai Po Inner Deep Bay Ramsar Site, listed under the Ramsar Convention. According to the Ramsar Convention, any negative impacts to the ecological value of a listed site require compensation or provision of additional nature reserves. In order to further protect the ecological integrity of the Deep Bay wetlands, the Town Planning Board of the Hong Kong SAR Government has designated areas surrounding the Ramsar Site as Wetland Conservation Area (WCA) and Wetland Buffer Area (WBA). The planning intention of these areas is, respectively, 'to conserve the ecological value of the fish ponds which form an integral part of the wetland ecosystem in the Deep Bay Area' and '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' (TPB PG-No. 12B).

1.1.3 The northern boundary of the Project Area is contiguous with the boundary of the WCA, while the entire site lies within the WBA. The Project Area itself is zoned as OU(CDWRA), for which the planning intention is to provide incentive for the restoration of degraded wetlands adjoining existing fishponds (within the WCA) and to encourage the phasing out of sporadic open storage and port back-up uses on degraded wetland. This can be achieved by comprehensive residential or recreational developments on the degraded wetlands. Such development schemes should include proposals for the creation of a wetland restoration area to separate the development from adjoining wetland habitats, in order to minimise the impacts of the development on the existing wetlands and thus conserve the ecological integrity of the Deep Bay ecosystem. New buildings should be located farthest away from existing wetlands (Approved Mai Po and Fairview Park OZP No. S/YL – MP/6).

1.1.4 No sites of recognised conservation importance lie within the Project Area; however, several sites are nearby, including the Mai Po Nature Reserve, Mai Po Inner Deep Bay Ramsar Site, Mai Po Marshes SSSI, Mai Po Village SSSI and Inner Deep Bay SSSI. Adverse impacts to these ecologically-sensitive areas should be avoided during planning and construction of the project.

2 DESCRIPTION OF THE PROJECT AREA

2.1 Location

2.1.1 The Project Area and the proposed Wetland Restoration Area (WRA) is located on the southern fringe of the Deep Bay wetland, west of Mai Po San Tsuen and northwest of Castle Peak Road (refer to **Figure 8.1** of the EIA report). It is bordered to the east, south and west by low-rise residential development at Royal Palms and Palm Springs. The northern boundary of the Project Area is contiguous with the boundary of the WCA, while the entire site lies within the WBA.

2.2 Baseline Ecological Condition of the Project Area and Environs

2.2.1 A baseline assessment of the ecological value of the Project Area (including both the area proposed to be developed for housing and the proposed WRA) as well as the area within 500m of the Project Area has been undertaken and also accompanies the planning application. This assessment, together with previous literature, has been reviewed in the preparation of the WRP with the following objectives:

- to identify any habitats and species within the Project Area and the surrounding area which are of ecological significance and which require to be taken into account in the development of the housing and restored wetland areas either by avoidance of, minimisation of, or compensation for any adverse ecological impacts; and

- to inform decisions as to the appropriate design, habitats and target species for the WRP.

2.3 Geology and Soils

2.3.1 The underlying solid geology of the area consists of decomposed and metamorphosed volcanic tuffs. These are overlain by a considerable depth of estuarine deposits of marine and fluvial origin, including alluvium and marine clays. Prior to recent filling using imported material, the surface layer would have comprised a mixture of these clays and silts with recent organic deposits deriving from fish farming. Some hydric soils exist on site and although their exact extent and depth is presently unknown, initial site investigations have confirmed that pond mud deposits still exist below the filled areas and indicate that these vary in depth from 0.5 to 2.0 m. The surface layer of mixed imported materials is thought to be comprised largely of mineral soils and inert builders' rubble. Some contaminated soils were also identified during initial site investigations.

2.3.2 The original fishpond soils are derived from mangrove soils and ultimately from marine sediments and riverine alluvium and consist of silts and clays. These are generally acidic (pH 4.5 – 6.0), with moderate to high organic matter content. Soils in the filled area are likely to be more variable, depending on the source of fill.

2.4 Topography and Hydrology

2.4.1 The Project Area is relatively flat with areas varying between +2.5 and +4.2 m PD, although most of the Project Area is between +2.8 and +3.2. Ponds form in the lower parts of the site during the wet season.

2.4.2 The Project Area is located within the San Tin catchment of the Shenzhen (south) river basin. This catchment includes a series of low hills to the south of Castle Peak Road, rising to 66 m PD. To the north of Castle Peak Road there is a flat floodplain which remains largely covered by fishponds despite some reduction due to filling in recent years. This area was formerly highly susceptible to flooding, however recent flood control works, most notably in the Shenzhen River and the San Tin Eastern Drainage Channel, have considerably reduced flood risk in recent years.

2.4.3 The Project Area itself is drained by a ditch which originates to the south of Castle Peak Road. Having passed under Castle Peak Road it enters the eastern boundary of the Project Area and flows in a steep-sided channel along the southern, westerly and then northerly perimeters of the Project Area before discharging into Mai Po River, a partly tidal watercourse, which flows north into the Shenzhen River. Flow in the ditch is variable and flow may be low in the absence of recent rainfall. Water in the ditch is often highly polluted with organic material.

2.4.4 Except for the ditch there are no extant hydrological linkages between the Project Area and nearby fish ponds.

2.5 Habitats

2.5.1 Most of the Project Area is on land derived from the filling of fishponds in the early 1990s, which has since undergone vegetative succession, although this succession has been largely arrested in a relatively early stage due to regular maintenance work on site (especially cutting of vegetation). This has allowed the habitat to become dominated by a relatively low diversity of invasive plant species tolerant of this regular cutting. In lower-lying areas which hold water for some or all of the year, wetland vegetation has become established, creating seasonal and permanent marsh habitats. Six habitats were identified on site: grassland, seasonal marsh, freshwater marsh/reedbed, drainage channels/ ditches, bare ground and developed areas (**Figure 8.3** of the EIA report).

2.5.2 A total of 66 species of plants were recorded in the Project Area during the vegetation surveys, all of which are common or very common species in Hong Kong, including a number of non-native species. No protected plant species or plant species of conservation importance were recorded within the Project Area.

Grassland

2.5.3 Grassland habitats cover approximately 11.05ha in the Project Area, this being just over half of the land area of the Project Area. The distribution of plants exhibits a degree of variability, probably resulting from differences in fill material or underlying differences in soil quality and topography across the Project Area.

2.5.4 Within the Project Area, the dominant plant species within the grassland habitats is *Brachiaria mutica*, which accounts for over 60% of the plant coverage within this habitat. This is an invasive alien species, which tends to become dominant in habitats where it is able to establish. It is common on fishpond bunds in the Deep Bay area. Other common plant species in this habitat include the herbs *Bidens alba*, *Conyza bonariensis* and *Sesbania cannabina*, the climber *Ipomoea cairica*, and the grasses *Cynodon dactylon* and *Eleusine indica*. All are very common in early-successional habitats throughout Hong Kong, and most are considered to be invasive weed species.

Seasonal marsh

2.5.5 Within the grassland mosaic, some areas (totally 0.69ha in five separate locations) are lower-lying and retain water during the wet season, permitting the establishment of a seasonal wetland habitat. The extent of these habitat patches varies between years, according to rainfall levels. Within these patches a number of wetland plant species tolerant of periodic dry conditions have become established, including *Phragmites australis*, *Paspalum paspaloides*, *Cyperus imbricatus*, *Ludwigia octovalvis*, *Rumex trisetifer* and *Alternanthera philoxeroides*. All are common, widespread species found in wetland habitats throughout Hong Kong and are of no particular conservation importance.

Freshwater marsh/reedbed

2.5.6 Towards the west of the Project Area, an area of approximately 4ha is lower and retains rainwater for most of the year, allowing the establishment of a freshwater marsh. There appears to be some pollution of water in this freshwater marsh, due to domestic waste from nearby village areas.

2.5.7 dominant plant species in this part of the Project Area is *Phragmites australis*, which covers approximately 70% of the habitat. Other wetland plant species present include *Ipomoea aquatica* and *Panicum repens*, as well as smaller areas of *Alternanthera philoxeroides*, *Cyclosorus interruptus*, *Ludwigia octovalvis* and *Murdannia nudiflora*. Some shallow open water is also present.

2.5.8 As with other parts of the Project Area, the freshwater marsh has been subject to routine maintenance, including vegetation cutting and spraying with mosquito insecticide, in response to concern from adjacent residential areas. These activities have limited the development of vegetation in the area (especially *Phragmites*, which typically grows taller and denser than is the case on this Project Area), as well as limiting the potential for use by wetland fauna. In the absence of regular cutting, it is anticipated that the *Phragmites* would become more dominant, causing the freshwater marsh on site to develop into reedbed. This would increase the ecological value of the Project Area, especially for birds, including several reedbed-dependent species of conservation importance.

Drainage channels and ditches

2.5.9 Drainage channels are located around the perimeter of the Project Area. These are narrow, and the water within is shallow and relatively polluted by domestic discharge and surface run-off. Smaller drainage ditches within the Project Area dry out for a period of several weeks during the dry season. Riparian vegetation along the channels was structurally simple and dominated by species typical of disturbed habitats around Deep Bay, including *Brachiaria mutica*, *Panicum* spp., *Paspalum* spp., *Eleusine indica* and *Bidens alba*.

Developed area and Bare ground

2.5.10 The north-eastern corner of the Project Area is currently developed land used for open storage and is therefore subject to regular human disturbance. The access track into the Project Area and land surrounding the open storage has been cleared of vegetation and regularly disturbance limits the regrowth of vegetation into this habitat, creating an area of bare soil. No significant vegetative community is established, the only plants present being common roadside weeds such as *Rhynchelytrum repens*, *Panicum maximum* and *Brachiaria mutica*.

Table H2-1 Habitats present in the Wo Shang Wai Project Area.

Habitat type	Project Area	
	Area (ha)	%
Grassland	11.05	51.73
Seasonal Marsh	0.69	3.23
Freshwater Marsh/Reedbed	4.00	18.73
Drainage Ditches/Channels	0.81	3.79
Developed Land & Bare Ground	4.81	22.52
Total	**21.36**	**100**

3 OBJECTIVES AND GUIDING CONCEPTS

3.1 Plan Objectives

3.1.1 The primary objective of this WRP is to detail the specifications for the habitats and ecological functions to be provided by the wetland habitats that are to be created within the WRA. The wetland areas will comprise a mixture of micro-habitats designed to provide the habitat requirements for a number of wetland-dependent or associated birds, herpetofauna and dragonflies which are of conservation concern; these target species have been selected after a review of the existing ecological interest of the Project Area and its environs, the potential adverse impacts of the residential development on habitats and species of conservation importance, and the opportunities and constraints on the Project Area.

3.1.2 It should be noted that the detailed design of the wetland is still required and that this will be undertaken upon approval of a Section 16 Application for the proposed development.

3.2 Guiding Concepts

3.2.1 The guiding concepts upon which this WRP has been drafted are described below:

(a) Recognition of the value of the Deep Bay Wetlands especially the nearby WCA and Mai Po Inner Deep Bay Ramsar Site.

(b) Recognition of the potential of the WRA to contribute to the maintenance and enhancement of the wildlife value and microhabitat diversity of the Deep Bay Wetland system.

(c) Recognition that fauna targets for the WRA should be based upon clear conservation objectives arising from the constraints of the Project Area (including its size and proximity to established developments), opportunities presented on site (especially its location on the southern fringe of the Deep Bay Wetland system) and the need to mitigate for any potential adverse impacts of the residential development on habitats, flora or fauna of conservation importance.

(d) Recognition that wetland enhancement or rehabilitation has a proven track record in Hong Kong, including at locations that were once wetland but which were drained or filled for periods of time (relevant examples here include wetland rehabilitation or enhancement for the Lok Ma Chau Spur Line, West Rail, The Hong Kong Wetland Park, and the Yuen Long Bypass Floodway).

(e) Requirement that hydrological changes as part of the wetland rehabilitation must not increase the flood risk to other basin users.

(f) Requirement that the wetland habitats should be largely self-sustaining: once the recreated wetlands are established, management should largely be limited to maintenance works. This should still allow for adaptive management, whereby management practices change in response to on-site conditions (especially in response to any failures to attract target species, or to the use of the Project Area by species of conservation importance that are not target species).

(g) Understanding of the habitat requirements of target species, the feasibility of the provision of the required habitats and a realistic assessment of the likelihood that the habitats will be utilized once they are created.

(h) Recognition of the ecological value of any existing habitats on site, whilst acknowledging that wetland restoration may require significant alterations to other habitats which are of little or no ecological value at present.

(i) Recognition that monitoring is essential to assess the success or otherwise of the rehabilitated wetlands and to inform management decisions.

4 TARGET SPECIES FOR THE REHABILITATED WETLANDS

4.1 Overview

4.1.1 Following a review of the baseline data, target species for the rehabilitated wetlands have been identified as those species of conservation importance (as defined in Section 4.2.1) which were recorded in significant numbers during the baseline ecological surveys and will therefore be impacted by the proposed development.

4.2 Target Species

4.2.1 To qualify as a Target Species a species must fulfill 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) and Fellowes *et al.* (2002), which was recorded in numbers considered to be of significance during the baseline ecological surveys.

4.2.2 In addition to this, all data from the baseline ecological surveys were reviewed to determine whether or not there were species (especially wetland-dependent species) which, although not of conservation concern, were recorded in particularly high numbers in a Hong Kong context. The aim of this review was to determine whether or not the Project Area was of importance to species which, although not of conservation importance, 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. Based upon this review it was concluded that no species fell into this category. A summary of this data is provided in Annex 2 and the rationale behind the inclusion of species and the exclusion of other potential targets is given below.

Birds

4.2.3 Of the species listed in Annex 2.1 of Annex 2, Little Egret, Cattle Egret and Chinese Pond Heron were regularly recorded and in numbers deemed to be of significance. Most of the other species were recorded infrequently and/or in very low numbers with a mean of less than one individual per visit and were treated as not occurring in significant numbers.

4.2.4 Five other species (three of conservation importance, two which are wetland-dependent) that had a mean of more than one individual per visit were either recorded sporadically or in low numbers in the context of the size and distribution of their relevant populations in the Deep Bay area and therefore impacts were not deemed to be of significance during the review process. These five species were Black-crowned Night Heron *Nycticorax nycticorax*, Black Kite *Milvus migrans*, Grey Wagtail *Motacilla cinerea*, Yellow Wagtail *Motacilla flava* and Red-billed Starling *Sturnus sericeus*.

Butterflies

4.2.5 Only one individual of a species of butterfly of conservation importance, a Danaid Egg-fly *Hypolimnas misippus,* was recorded during the baseline ecological surveys. On this basis no butterflies were considered to qualify as targets during the review process.

Dragonflies

4.2.6 Only one species of dragonfly of conservation importance, Scarlet Basker *Urothemis signata,* was recorded during the baseline ecological surveys, with a total of three individuals noted on two dates. On this basis no dragonflies were considered to qualify as targets during the review process

Other fauna

4.2.7 Following a review of all other fauna recorded during the baseline ecological surveys it was concluded than none qualified as target species.

4.2.8 Based upon this assessment, three species were identified as Target Species. These are shown in **Table H4–1**

Table H4-1 Target Species for the Wo Shang Wai Rehabilitated Wetlands.

Species	Status	Reference
Little Egret *Egretta garzetta*	Potential Regional Concern (Regional Concern)	Fellowes *et al.* (2002).
Cattle Egret *Bubulcus ibis*	Local Concern	Fellowes *et al.* (2002).
Chinese Pond Heron *Ardeola bacchus*	Potential Regional Concern (Regional Concern)	Fellowes *et al.* (2002).

4.3 Habitat Requirements for the Target Species

4.3.1 Habitat requirements for each of the three Target Species are given below and summarised in **Table H4–2**.

Little Egret

4.3.2 Little Egrets are found in Hong Kong throughout the year, primarily in the northeast and northwest New Territories. Habitat utilization has been studied by Young (1994), Young and Chan (1997) and Cornish (1996). These studies showed that Little Egrets in Hong Kong feed primarily in fishpond and intertidal areas. Little Egrets also feed opportunistically on stranded fish in ponds which are being drained, and are often the most abundant bird species in such circumstances. Breeding birds typically forage within 3 km of egretries (Young 1994).

4.3.3 Whilst this species is reasonably widespread across wetland habitats in Hong Kong, it is highly localised as a breeding species. It breeds close to the Project Area in the Mai Po Village egretry, and is therefore considered a highly suitable target species for the restored wetlands.

4.3.4 Little Egret was recorded in the Project Area on nine out of 17 surveys. Numbers in the Project Area in most months were comparatively small (up to six), although flocks of 48 in November 2005 and 20 in May 2006 were recorded. Habitats used in the Project Area were freshwater marsh/reedbed, seasonal marsh and drainage ditches. Up to 123 were recorded on a single count around fishponds in the Assessment Area.

Cattle Egret

4.3.5 Cattle Egret is a scarce in Hong Kong with migrants occurring in spring and autumn. It is a widespread species, although records are mainly from the northwest and northeast New Territories, especially during the breeding season. In Hong Kong, Cattle Egrets tend to forage in areas of short vegetation often around cattle and water buffalo, on the bunds of fish ponds, on landfills and on golf courses and football pitches (Carey *et al.* 2001). They feed largely on insects and amphibians (Voisin 1991) and, unlike other ardeids, rarely eat fish, feeding more often on insects disturbed by grazing animals, maggots and flies around dead fish, and earthworms (Carey *et al.* 2001).

4.3.6 This is a localised species and there is strong evidence to suggest that it has declined significantly in recent years in the Deep Bay area due to land use changes.

4.3.7 Cattle Egret was recorded in the Project Area on four spring/summer counts, the maximum count in the Project Area being of 14 birds during June 2006. Up to 60 birds were recorded in the Assessment Area, mostly during spring/summer. Birds were recorded foraging in the Project Area in the freshwater marsh and seasonal marsh.

Chinese Pond Heron

4.3.8 Chinese Pond Herons are found throughout the year in Hong Kong, and although widespread, most records are from the New Territories. Habitat utilization has been studied in Hong Kong by Young (1994) who showed that birds breeding at the Mai Po Village egretry fed mainly around fishponds. Individuals typically forage solitarily along the edges of open water areas or in areas with sparse or short vegetation. Chinese Pond Herons utilize communal day or night roosting sites in areas with medium-sized trees or tall bamboo, either immediately adjacent to, or overhanging, ponds or creeks. They eat small fish, but also invertebrates and amphibians (Carey *et al.* 2001).

4.3.9 Chinese Pond Heron breeds close to the Project Area in the Mai Po Village and Tam Kon Chau egretries, but appears to be declining in the Deep Bay area, which has been attributed to wetland loss in the Deep Bay area.

4.3.10 Small numbers of Chinese Pond Herons were recorded in the Project Area on nine surveys, mostly during spring/summer, and birds in the Project Area were found foraging in the freshwater marsh/reedbed, seasonal marsh, and drainage ditches. The highest count in the Project Area was seven during June 2006, although greater numbers were recorded in the Assessment Area, especially during the evening, with up to 27 individuals observed heading towards roost sites.

Table H4-2 Summary of the Habitat to be provided for the Target Species at Wo Shang Wai.

Species	Short grass	Tall trees and shrubs	Open water	Reedbed	Non-vegetated islands
Targets					
Little Egret		R	F	F	F, R
Cattle Egret	F, R	R			
Chinese Pond Heron		R		F	

Key: habitat important for F = Foraging; R = Roosting.

Target levels

4.3.11 The target level for each of the Target Species will be an exceedance of the density across the Project Area as a whole recorded during the baseline ecological data collection period. The baseline will be based upon data collected during Baseline Ecological Monitoring and will be discussed and agreed with EPD and AFCD prior to operation of the WRA, as detailed in section 7.1. The list of target species will be expanded as required during the Operational Phase Monitoring to accommodate species of conservation importance which may colonise the recreated wetlands. The management of the wetland will be revised on an annual basis to reflect any such changes. It should be noted, however, that the design of the restored wetland has taken into account the habitat requirements of other species of conservation importance that are considered likely to utilise the area, based on experience of creating similar habitats elsewhere (AEC 2007). Details of these species are included in Annex 3.

4.4 Proposed design for the Restored Wetland

4.4.1 The size of the recreated wetland will be 4.74 ha. This is based on the area of wetland currently on site (4.69 ha) and the need for the development to avoid a net loss of wetland habitat. The wetland area is consolidated into a single unit to reduce fragmentation, lessen the effects of disturbance and maximise connectivity with existing wetland habitats. The layout of the recreated wetland is designed to maximise the extent to which it is directly adjacent to existing wetlands, at the same time preventing a direct interface between residential development and existing wetland habitats outside the Project Area. The wetland area will thus also serve to buffer the existing wetlands from potential impacts created by the residential component of the proposed scheme. Within the recreated wetland there will be a gradation in vegetation height, with the tallest vegetation at the interface between the residential and wetland components of the proposed scheme (to soften the interface between these components) grading into very short vegetation at the interface between the existing and recreated wetland area (to increase connectivity and maintain an open aspect between these wetlands).

4.4.2 The proposed habitat conditions that will provide all the requirements for the species listed in **Table H4–2** and Annex 3 are as follows:

- Open water up to 2.5 m in depth with shallow water margins (0-20 cm depth);
- reedbed with shallow water margins (0-20 cm depth) and deeper water areas up (to 1 m depth);
- vegetated and non-vegetated islands and shallow water margins (0-20 cm depth);
- trees/tall shrubs overhanging parts of the main water body;
- short grass; and
- a mixture of tall grass and shrubs.

Open water

4.4.3 The site will be formed to create a freshwater wetland comprising of four cells in order to facilitate water management, increase shallow water margins and allow access for management and monitoring. Maximum operational water depths will be approximately 2.5

m, and about 75% of the open water areas will be less than 1.5 m.

Reedbed

4.4.4 Reedbed on the site will form the majority of the vegetated area and will comprise areas with a maximum water depth of 1 m and extensive areas where water depths are less than 20 cm; these areas will be adjacent to, and continuous with, areas of open water which will have a maximum water depth on 2.5 m. The distribution of reeds on site will be controlled to prevent the entire wetland body becoming a single reedbed. This will be achieved by a rapid increase in water depth at the margins of the reeds to achieve a water depth of approximately 1.5 m – the depth at which reeds fail to grow. Without such deeper areas reeds would rapidly colonise the entire wetland at the expense of area open water, which would reduce habitat diversity.

Vegetated and non-vegetated islands

4.4.5 Four islands will be constructed, one in each of the cells; two of these will be planted with tall trees and shrubs and two will be lined and covered with gravel to create non-vegetated islands (and to reduce colonisation by terrestrial vegetation). These will be gently sloping and surrounded by shallow water less than 20 cm deep.

Trees/tall shrubs

4.4.6 Woodland areas will largely be located along the southern boundary of the wetland to form a buffer along the edge of the development area; these areas will be planted with tree and shrub species which are adapted to flooded conditions and waterlogged soils.

Tall grass/shrubs

4.4.7 Such areas will be hydro-seeded and planted with low shrubs. The grasses will be cut on a regular basis to maintain vegetation height at a suitably low level (< 0.5 m) and to prevent the colonisation of unwanted exotics.

Short grass

4.4.8 Such areas will be hydro-seeded and planted with low shrubs. The grasses will be cut on a regular basis to maintain vegetation height at a suitably low level (< 0.2 m) and to prevent the colonisation of unwanted exotics.

Planting Lists

4.4.9 Proposed planting lists for the different habitat types are provided in Annex 1 of this document.

4.5 Habitat Utilisation by the target species

Little Egret

4.5.1 The design of the restored wetlands will provide roosting opportunities for Little Egrets in the form of non-vegetated bunds and tall trees adjacent to water which are typical roost sites for this species.

4.5.2 Shallow water is important to this species when foraging and this will be provided at the margins of the open water sections of the site and also within the reedbed areas. The wetlands will be stocked with small fish and shrimp which are preferred prey of Little Egrets.

4.5.3 At times when water levels drop on site (especially during the dry season) additional shallows with stranded shrimp and small fish will create opportunistic foraging opportunities for this species.

Cattle Egret

4.5.4 This species shows a strong preference for areas of short grass and the provision of this on the bund areas within the restored wetlands will be a key aspect of the management of the wetlands. In addition, roosting habitat will be provided in the form of tall trees.

Chinese Pond Heron

4.5.5 Chinese Pond Herons tends to forage in areas of shallow water with aquatic vegetation which will be provided within the fringes of the reedbed areas. This species feeds primarily upon shrimps and small fish and these will be stocked in the restored wetlands to ensure that suitable food items are available for this species. Suitable roosting habitat will also be provided in the form of tall trees.

4.6 Habitat Change under the Current Master Layout Plan

Table H4-3 Comparison of Habitats lost and created due to the Proposed Development.

Habitat	Existing (ha)	Created (ha)
Grassland	11.05	0.33
Seasonal Marsh	0.69	-
Freshwater Marsh/Reedbed	4.00	-
Drainage Ditches/Channels	0.81	-
Developed Land/ Bare Ground	4.81	16.62
Reedbed	-	1.12
Open water	-	2.37
Tall grass/shrubs	-	0.12
Tall trees/shrubs	-	0.66
Non-vegetated islands		0.14
Total	**21.36**	**21.36**

5 MANAGEMENT STRATEGY

5.1 Responsibility for Habitat Creation, Management and Enhancement

5.1.1 The Project Proponent will be responsible for the creation, enhancement and management of the rehabilitated wetland area during the construction phase and shall provide an undertaking to take sole responsibility for management until a successor can be found to the satisfaction of EPD or its agents. An appropriately qualified ecologist with wetland design and management experience will be responsible for supervising implementation of the WRP and for long term monitoring; in addition a specialist contractor with experience in wetland construction and planting will be appointed to carry out the works for the construction and establishment of the wetland and subsequent management.

5.1.2 The wetland will be maintained and managed as a separate unit from the residential estate.

5.2 Management of Habitat Characteristics

5.2.1 Habitat characteristics within the wetland habitats are planned to be broadly as follows (to be refined at detailed design stage). These prescriptions for habitat characteristics are based on criteria and habitat condition targets which have been successfully followed in a managed wetland elsewhere in the Deep Bay area (AEC 2005, 2007) and are intended to provide clear directions to inform the practical adaptive management process. Thus, the values proposed do not represent exact targets which must be reached in order to achieve a specific threshold; rather they are indicative of workable objectives which it is known can be achieved on a regular and replicable basis by the management agency. There are, however, carefully selected in order to determine the proportion of each habitat on site so that the required balance of habitats (for example between reedbed and open water) can be monitored and maintained though management.

Open water

- >70% covered with water by the start of the dry season and >40% at any other time;
- emergent or floating vegetation < 10 % cover;
- undesirable flora species < 10% of vegetation cover;

Reedbed

- at least 80% with reed cover;
- undesirable flora species < 10 % of vegetation cover;
- standing water in range 25 – 80%.

Vegetated islands

- >70% tree canopy cover, with at least 20% overhanging water;
- undesirable flora species < 10 % of vegetation cover;

Non-vegetated islands

- > 80% bare gravel;
- < 20% herbaceous cover of which < 10% undesirable flora species.

Tall trees/shrubs

- planted area > 80%;
- undesirable flora species < 10 % cover.

Tall grass/shrubs

- 80% of grass < 0.5 m high;
- planted area > 80% cover;
- undesirable flora species < 10 % vegetation cover.

Short grass

- 80% of grass < 0.3 m high
- planted area > 80% cover;
- undesirable flora species < 10 % vegetation cover.

In addition to this habitat the needs of dragonflies and amphibians will be met by providing ponds which will not be linked to the main water bodies and will be rain-fed and maintained fish free (these are shown in **Figure H1**). This will mitigate for impacts to these communities arising from habitat loss, although no individual species qualified as targets. These ponds will be 1.5-2m deep in the middle. At the edge, a 1m wide shelf should be created at a depth of 0.3-0.5m. Dense submerged and emergent aquatic macrophytes will be planted along this shelf. Beyond this shelf, the pond profile will slope fairly steeply down to the recommended depth of 1.5-2m. In the deeper water, floating macrophytes such as lotus / lilies will be planted. The ponds will be kept free of fish, with a recommended pH range of 4.5-7.5. The ponds will be close to shrubby and/or woody vegetation which will provide roosting / refugia areas for adult dragonflies. If these conditions are maintained, the ponds will provide suitable habitat for a broad range of dragonfly species (25+), including some which are uncommon in Hong Kong and 5-10 species of amphibian.

5.3 Hydrological Management

5.3.1 Rainfall during the wet season will be the only regular source of water for the WRP. However, as shown in **Table H5–1**, there is likely to be a deficit during the months of November to March. Since the annual rainfall is significantly higher than annual evaporation, seasonal reductions in water levels could be tolerated as the wetland would be replenished during each wet season.

Table H5-1 Water Budget for the Wo Shang Wai recreated wetland (Source: Hong Kong Observatory data climatological means 1971 – 2000).*

Month	Rainfall (mm)	Evaporation (mm)	Surplus/deficit(mm)
January	24.9	80.7	- 55.8
February	52.3	67.6	-15.3
March	71.4	78.1	-6.7
April	188.5	93.2	+95.3
May	329.5	118.4	+211.1
June	388.1	129.0	+259.1
July	374.4	155.5	+218.9
August	444.6	143.2	+301.4
September	287.5	134.2	+153.3
October	151.9	136.4	+15.5
November	35.1	112.5	-77.4
December	34.5	94.5	-60.0
Year	**2382.7**	**1343.4**	**+1039.3**

* Note that rainfall at Wo Sang Wai is lower (by c. 25%) and evaporation higher than the HKO data. This is balanced to some extent by evapotranspiration from a vegetated area being lower (by c. 20%) than evaporation from an open water body.

5.3.2 As there will be areas 2.5 m deep within each cell, these will remain wet throughout the dry season. This will be important in maintaining fish stocks and a healthy reedbed. In addition, as water levels drop during the dry season areas of shallow water with stranded fish and shrimp will provide additional foraging opportunities for Little Egret and Chinese Pond Heron. Such an approach to water management requires that all rainfall is stored on site and that water levels are permitted to reach the maximum operational level before water is discharged from the wetland. In order to achieve this, a system of pipes and sluices will be installed, with uPVC pipes located within each internal bund to permit rapid distribution of water between the cells and larger sluice(s) at the discharge point to permit the rapid discharge of water when the cells are full or following heavy rainfall events. Indicative locations of water control structures are shown in **Figure H2**.

5.3.3 Water depth markers will be placed in the deepest part of each of the sections of open water (deeper than 1.5 m, as shown in **Figure H1**). As such there will be six water depth markers, allowing water depths to be accurately measured throughout the restored wetland and especially in the deep water areas, which will function as refugia for fish and shrimps during period of low water levels.

5.3.4 There may be occasions when additional water is required, either due to low water levels as a consequence of prolonged drought or when poor water quality requires the replacement or dilution of the water within the wetland. At times of drought water will either be imported, or the cells will be hydrologically isolated from each other using the uPVC pipe and sluice system and water pumped between cells to ensure the entire wetland does not dry out. One or more of the cells could be permitted to dry out, provided that sufficient water remains within at least one of the cells to facilitate recolonisation of the other cell(s) by fish, shrimp and other wetland fauna once water levels rise across the wetland. Imported water could be pumped in from nearby fishponds, pumped from mains water supply or imported via a tanker (either fishpond or mains water). The exact source would depend on conditions at the time, although water quality and availability will inevitably drive the decision making process. The preferred source is most likely to be fish pond water, however, either pumped in from nearby ponds or imported by tanker. The project proponent would enter into commercial agreements with pond operators if required.

5.3.5 Operational water levels will be between 1.5 and 2.5 m. This is based on the deepest parts of site being 2.5 m deep when the wetland is at full water capacity and reflects the need to prevent water levels being too shallow, leading to both low dissolved oxygen levels and higher temperatures, which can have profoundly negative impacts on fish and shrimp stocks and other wetland fauna. During normal operation water will be shed from the site into the adjacent Mai Po River once maximum operational levels are reached and water will be added before levels drop below 1.5 m. Adjacent streams are tidal and grossly polluted; as such they are unsuitable as an alternate water supply. However, should water quality improve over time water could be extracted when salinity levels were sufficiently low (e.g. following heavy rainfall events).

5.3.6 Regular checking of water quality will be required to ensure that water quality remains within the limits acceptable to fish, dragonflies and amphibians. In general, water pH is a frequent management issue within created wetlands as most such wetlands are formed on acid sulphate soils and as such have a natural tendency to become more acidic over time. This is especially the case when wetlands soils are exposed and then reflooded. The addition of lime or peanut residue is frequently used to combat this issue. Other issues which may be an issue are low dissolved oxygen levels (which can be resolved through pumping water around the WRA) or high salinity (which can be resolved through water exchange)..

5.4 Fish stocking

5.4.1 Fish stocks will fulfill three complementary functions: provision of food for birds, control of vegetation and maintenance of water quality. Fish can be effective predators of amphibian eggs and tadpoles and of dragonfly larvae (AEC 2005), however, and in recognition that wetland-dependent dragonflies and amphibians were recorded within the Project Area during baseline surveys (albeit with no species qualifying as targets), the habitat needs of dragonflies and amphibians will be met by providing ponds which will not be linked to the main water bodies, will be rain-fed and maintained fish free. The locations of these are shown in **Figure H1**. With the inclusion of these fish-free areas, it is not anticipated that dragonflies and amphibians would be adversely affected by the proposed development.

5.4.2 In addition, the shrimp species *Macrobrachium nipponese* will be stocked as a prey species of several of the bird targets.

5.4.3 The aim of stocking is to establish and maintain self-sustaining fish and shrimp communities within the restored wetland. An initial stocking as part of the wetland restoration process will be required because the wetland will be devoid of fish following construction. Following this, fish and shrimp stocks will be monitored regularly and additional stocking will only be undertaken if these are found to be low. Although this may be required on an annual basis regular stocking of ‘trash fish’ to attract large waterbirds will not be part of the routine management of the restored wetland.

5.4.4 Stocking will be undertaken as follows:

- Grass Carp Ctenopharyngodon idellus for vegetation control;
- Edible Goldfish Carassius auratus to provide food for birds and to maintain water quality;
- Macrobranchium nipponense to provide food for birds;
- Small native fish (exact species will depend upon commercial availability at time of stocking) to provide food for birds.

5.4.5 Fish and shrimp species and stocks will be monitored regularly and if fish removal, transfer or supplementary stocking is required this will be undertaken within one month of the problem being identified.

5.4.6 Fish will not be artificially fed, nor will the water be mechanically aerated; rather fish stocks will be permitted to reach a level that is sustainable given the naturally-available food and oxygen levels within the recreated wetlands.

5.5 Vegetation management

5.5.1 Vegetation management will be required to achieve two fundamental aims; to maintain a suitable wetland plant community and to prevent colonization of terrestrial plants and/or unwanted exotics.

5.5.2 In general this will be achieved through careful maintenance of water levels and the removal of unwanted plant species as required. In addition, emergent vegetation will be controlled in the open water and reedbed fringes by Grass Carp (which consume grasses in preference to reeds). The maximum water depth of 2.5 m within each of the wetland cells is sufficiently deep for this species.

5.5.3 The control of vegetation on the bunds and islands will be required on a monthly basis in order to maintain the habitat characteristics described in section 5.2.1. Without such frequent management common and rapidly colonizing fishpond bund grasses such as *Brachiaria mutica* and *Echinochloa crusgalli*, pantropical weeds such as *Bidens alba* and *B. pilosa* and exotic creepers such as *Mikania micrantha* will become established and these would in time out-compete or smother most of the species to be planted in these areas during the wetland restoration process. Some of these may also invade the reedbed where they would be more difficult to control should they become established. Such frequent vegetation management is also required to minimise disturbance as it is preferable to have low levels of regular disturbance than intermittent high levels of disturbance.

5.5.4 Frequent cutting of the areas of short grass (as shown in **Figure H1**) will be required to maintain the required height and to prevent unwanted grass species and exotics becoming established. This would be undertaken at a minimum frequency of one per month, but may be required more frequently during the wet season. Cutting will be undertaken mechanically, with the cut grass being removed to prevent a build up dry grasses which can become a fire hazard and may also inhibit grass growth, encouraging the spread of unwanted weed species such as *Mikania micrantha*. Cut grass will be placed into open water areas where it will be consumed by Grass Carp and can be useful in maintaining water quality.

5.5.5 Pruning of trees and shrubs will be required to prevent them encroaching onto adjacent habitats. This will be required on an annual basis and will be undertaken at the end of the wet season. Wherever possible, dead trees, branches and shrubs will be retained. Cuttings from trees and shrubs will be placed in neat piles where they will be permitted to decompose naturally, providing refugia for reptiles and amphibians.

5.5.6 One aim of the vegetation management will be for all cut vegetation to be recycled on site with no vegetation being sent to landfills; as discussed above this be achieved through a combination of consumption by fish and decomposition.

5.6 Control of human access and disturbance

5.6.1 The wetland has the potential to be highly disturbed by human activities: both legitimate activities outside the wetland area and unauthorized human intrusion to the wetland. Accordingly, the wetland requires to be secured to prevent unauthorized access and actual and visual barriers will be required to prevent disturbance.

5.6.2 Along the eastern, southern and western sides the wetland will directly abut onto areas of residential development. Along these boundaries it is proposed to erect a 2 m high solid wall. This will prevent direct human intrusion, visual disturbance, and adverse effects of human activities (e.g. litter dumping and fires) and will reduce disturbance caused by noise. This solid wall would be buffered from the wetland by the planting of tall trees and shrubs along the southern perimeter of the wetland as shown in **Figure H1**. The aim of tree and shrub planting would be to minimise the visual impact of the wall to the wetland and areas to the north. It would also provide habitat for less disturbance-sensitive species utilising the wetland.

5.6.3 Access will be required, however, to facilitate monitoring and management. As far as possible monitoring activities not required to be undertaken during the morning (for example monitoring of water quality and fish stocks) will be undertaken during the early afternoon, with only those activities that must be undertaken during the morning (for example bird monitoring) being scheduled for the early morning in order to reduce disturbance during the period when bird activity is typically highest. Likewise, management (including weeding and vegetation management) activities will avoid the early morning period and will be scheduled so as to concentrate work in a small part of the area at any one time (to avoid disturbing large areas of the site). Routine management activities (such as grass cutting) will be conducted on a monthly basis to avoid the need for large scale and/or intensive vegetation management.

5.6.4 Along the northern side of the wetland, which is contiguous with the Deep Bay fishpond system, a low chain link fence 1 m high will be erected to delineate the site boundary and to prevent access and disturbance from outside the site whilst maintaining ecological linkages with the Deep Bay fishpond system. It is noted that such a fence may exclude larger wild mammals, however the need to exclude dogs from the site (which cause extensive disturbance to wildlife and may prey upon waterbirds) override this disadvantage.

5.7 Standard Management Actions

5.7.1 A list of standard management actions that must be undertaken for the wetland is provided in **Table H5–2**.

Table H5-2 Regular management actions for the Wo Shang Wai WRA.

Action	**Frequency**	**Notes**
Water Control		
Measure water levels and adjust sluice heights/other water control structures or pump accordingly to meet target levels	Weekly and/or within 24 hours of heavy rainfall events or during addition of water other than from rainfall.	Target levels to be set and reviewed monthly in accordance with management regime. Water to be added if required.
Measure water quality to cover most critical concerns for short term management (pH, BOD, salinity)	Monthly or more frequently if required.	More frequent measurements required when active steps to adjust water quality are being taken.
Inspect condition of water control structures and water courses and repair / maintain as necessary	Monthly or more frequently if required.	Also to be inspected after lowering of Typhoon Signal No. 3 or Rainstorm Warning.
Inspect condition of pumps and water supply structures and repair / maintain as necessary	Every six months at start of wet and dry season or more frequently if required.	
Clear sluices and uPVC pipes	Weekly or more frequently if required.	Also after flooding / heavy rainfall and lowering of Typhoon Signal No. 3 or Rainstorm Warning.
Structural maintenance		
Inspect condition of tracks / paths and repair / maintain as necessary	Every 6 months or more frequently if required.	Also after any flood events and lowering of Typhoon Signal No. 3 or Rainstorm Warning.
Inspect condition of bunds and repair / maintain as necessary	Monthly or more frequently if required.	Also after any flood events.
Vegetation management		
Supplemental planting	Requirement to be assessed on a monthly basis.	Planting to be restricted to the wet season.
Cutting or pruning and removal	Monthly grass cutting and weeding across the entire site.	
Removal of exotic / undesirable invasive plants (including	Monthly checking with removal to be scheduled for subsequent	Aggressive exotics such as Water Hyacinth to be removed

Action	Frequency	Notes
algae) (weeding)	30 days.	immediately.
Pest control	Monthly checking for Red Imported Fire Ants, Apple Snails with necessary treatment to be scheduled for subsequent 30 days. Control of domestic dogs required whenever noted on site.	Additional pests to monitored and treated if required.
Fish Stocks		
Monitoring of fish numbers and species	Quarterly, with sampling techniques to allow for different behaviour of large fish, small fish and crustaceans.	
Fish transfer, clearance and stocking	Annually or more frequently if required.	

6 IMPLEMENTATION

6.1 Wetland Restoration

6.1.1 The detailed construction programme for the wetland restoration will be finalized upon approval of the Section 16 Application but will involve the following fundamental steps:

- Temporary Fencing/Hoarding: To define the site and prevent unauthorized access, prior to commencement of other works.

- Nursery Provision: a nursery with suitable shading and an adequate freshwater supply will be provided on-site in advance of the construction works to house any trees awaiting transplantation and for the establishment and temporary storage of terrestrial and wetlands plants. The nursery will be located within the wetland restoration area but will avoid any areas, either on- or off-site, of moderate to high ecological value. It is expected that the vast majority of plants will be imported from commercial plant nurseries prior to planting. As such the primary function of the on-site nursery will be as a temporary holding facility where imported plants can be stored, watered and kept out of direct sunlight until they can be planted within the recreated wetland.

- Reuse Substrate: If suitable, substrate (pond mud) within the Project Area will be retained and will form the base of some or all of the wetland area. Mud depth of 6cm to 10cm is considered sufficient for the growth of herbaceous wetland plants. Initial site investigations indicate that pond mud below the filled areas varies in depth from 0.5 to 2.0 m; this may need to be stockpiled on site at the site clearance stage.

- If insufficient substrate is available on site, wetland soils will be imported.

- Remove all existing structures, concrete, hardcore or asphalt pavements, solid waste and rubble from the Project Area.

- Re-contour the wetland area.

- Install water control features: this will enable regulation of water to the desired depth. Regulation of water depth will be critical at the early stages to aid plant establishment.

- Plant or introduce wetland vegetation: whilst some wetland plants would be expected to colonise the recreated wetlands, planting is essential to ensure rapid establishment of a diverse plant community.

- Introduce fishes and crustaceans, primarily Grass Carp, Edible Goldfish, small fish and shrimps.

- Supplemental planting: some die-off of plants is to be expected and this will require replacing through supplemental planting.

6.2 Implementation Programme

6.2.1 It is expected that from commencement of construction of the wetland to it being fully operational will take approximately 2.5 years. This is based on the assumption that site clearance and site formation works would be undertaken during the wet season to avoid disturbance to birds during the dry season. During the subsequent wet season, planting and initial plant maintenance would be undertaken, in addition to retention of rainwater within the wetland. During the second dry season, plant maintenance and control of unwanted plants would be required. Any replacement planting would be undertaken during early stages of the second wet season and further plant maintenance would be undertaken during this period. By the start of the third dry season all plants would be established and water levels would be at the operational maximum; at this point the wetland itself should be established and fully functional:

6.2.2 Because the proposed wetland restoration site and the area proposed for residential development is of such limited ecological value, it is not considered that construction period ecological mitigation measures are required. Accordingly the wetland restoration works will be implemented in parallel with the residential development. Works will be completed and the wetland will be established prior to occupancy of the residential units.

7 ECOLOGICAL MONITORING

7.1 Baseline Ecological Monitoring

7.1.1 Baseline Ecological Monitoring was conducted during the preparation of the EcolIA for the proposed development, data collected during these surveys will provide the baseline for evaluation of the success in achieving numerical targets for the Target Species. Target levels will be discussed and agreed with EPD and AFCD prior to the operation of the WRA. As a minimum, the target levels will be determined so that the mean number of individuals of each species recorded in the Project Area during a twelve-month period will be no lower than the mean number recorded during baseline surveys. The mean used for this calculation will be number of individuals recorded on surveys, divided by the number of surveys; baseline data collected for this EIA would provide a mean number of 5.5 Little Egret, 1.3 Cattle Egret and 1.3 Chinese Pond Heron (i.e. a total of at least 66 Little Egret, 16 Cattle Egret and 16 Chinese Pond Heron during monthly surveys over a 12-month period. These will be used as the minimum target levels for these three target species.

7.2 Construction Phase Ecological Monitoring

7.2.1 Target species and other wetland-dependent fauna will be monitored within the Project Area and Assessment Area during the wetland and residential construction phase. This will be important to ensure that any unexpected events or impacts either on- or off-site are quickly identified so that remedial action can be taken. The frequency of monitoring is given in **Table H7-1** and the methodology for each survey is detailed below under Operational Phase Monitoring. Identification of impacts from construction activity, and required response, will be based on action and limit levels in Table H7-2.

7.3 Operational Phase Ecological Monitoring

7.3.1 Monitoring will be conducted to cover the ecological attributes detailed below:

Monitoring of target bird species

7.3.2 Monitoring of the 3 target bird species listed in **Table H4–1** is required in order to demonstrate success in reaching the target of the recreated wetland supporting, as a minimum, the number of birds recorded during the Baseline Ecological Survey.

Site transects

7.3.3 Surveys will be undertaken monthly. During each survey visit, the surveyor will walk slower around the perimeter of the wetland and along each bund, and identify all birds to species level. Surveys will commence within one hour of sunrise and last for approximately two hours. Surveys covering the Assessment Area will follow a transect that includes all habitats potentially impacted, and will survey each fishpond within this area.

Monitoring of Dragonflies and Butterflies

7.3.4 Transect surveys for dragonflies and butterflies will be undertaken once per month during March and September to November and twice per month during the peak period of adult emergence in April to August, at which time the number of individual adults observed varies considerably according to prevailing weather, and monthly surveys may not cover the range of variability. Survey duration will be approximately 2 hours, commencing at 08.00 hours, and both groups will be surveyed during the same survey.

7.3.5 During the surveys a fixed survey route will be followed. All dragonfly species observed will be identified and all sexually mature male and ovipositing female individuals counted. Dragonfly exuviae will be recorded qualitatively. Habitat use and breeding activity is recorded, as well as evidence of breeding success in the form of final instar larval exuviae, which are collected and identified. All butterfly species will be identified and numbers estimated quantitatively or semi-quantitatively.

7.3.6 For dragonflies, transect surveys will be supplemented by quantitative monitoring of emergence using of exuviae emergence traps, six traps will be used and inspected once per week during March to August. Emergence traps are highly effective in detecting breeding activity of dragonflies. The frequency and on-going requirement for this monitoring will be reviewed on an annual basis.

Monitoring of Herpetofauna

7.3.7 Herpetofauna surveys focus on breeding amphibians and the reptile community. One half-day day-time survey (primarily aimed at detecting reptiles) will be conducted each month during April to November. Surveys will take place during 10.00 – 14.00 hours, the peak period of reptile activity. One half-day night-time survey (primarily aimed at detecting breeding amphibians) will be conducted each month during the period from March to August. Night time surveys will be undertaken during 18.00 – 22.00 hours and focus on the detection of vocalising amphibians. During the surveys a fixed survey route will be walked. All reptiles and amphibians observed or heard will be identified, and their abundance estimated. Habitat use and breeding activity are recorded.

Monitoring of aquatic invertebrates

7.3.8 Monitoring of aquatic invertebrates will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). Sweep-netting will be used to sample aquatic species in the water column and clinging to vegetation at the water-bund interface. The sweep-net will be a D-shaped net of 30 cm diameter with a 1 mm mesh. Each sample will comprise two 2-metre sweeps of the net from which all captured specimens are removed. The first sweep will be carried out at the water surface and the second as close to the wetland bed as possible. Each set of sweeps will be taken along the water-bund interface. Two randomly located replicate samples will be taken from each cell (giving eight samples in total).

7.3.9 Samples will be placed in labelled containers together with preservative for transporting to the laboratory. Once in the laboratory, specimens will be rinsed in water, placed on a white sorting tray and sorted for identification to species level using a binocular microscope. Where partial body parts are identified, only heads will be counted.

7.3.10 The number of each macro-invertebrate species will be ascertained for each replicate sample for all taxa groups. A total dry weight biomass will be determined for each of the above groups.

7.3.11 The number and species of any fish captured incidentally during the sampling will be recorded.

Methodology for monitoring benthic invertebrates

7.3.12 Monitoring of benthic invertebrates will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). Cylindrical benthic cores 10 cm in diameter and 10 cm in depth will be taken from the substrate at the base of the wetland to obtain quantitative data on benthic invertebrate populations. Five randomly located replicate cores will be collected from the shallows of each cell (with a total of 20 cores samples being collected). Core contents will be bagged and stored in a cooler for subsequent sorting. Samples will analysed in the same way as for sweep netting.

Methodology for monitoring freshwater fish and crustaceans

7.3.13 Monitoring of freshwater fish and crustaceans will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). Throw and drag-netting will be undertaken once every two months in each cell. A fishing throw-net with a mesh size of 30 mm, a diameter of about 4 m and a surface area of about 14 m^2 will be used to catch larger fish and a drag net of mesh size < 10 mm will be used to sample smaller fish and shrimps. Five randomly-placed replicates with each net are conducted in each cell. Fish will be identified to species and the weight and length recorded (if fish length is greater than 10 cm) and then released back into the wetland.

Monitoring of habitats types

7.3.14 Habitat monitoring will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March).

Monitoring of vegetation cover

7.3.15 Detailed floristic surveys will be conducted in each habitat type (reedbed, vegetated islands, tall trees/shrubs, tall grass/shrubs and short grass) at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). Transects will run through each habitat area with a fixed number of quadrats in each. 10m x 10m quadrats will be used vegetated islands, in areas of tall trees/shrubs and tall grass/shrubs, while 2m x 2m quadrats in the habitats of reedbed and short grass.

7.3.16 Within each 10m x 10m quadrat, all plant species, including both planted and naturally invaded species, will be identified to species level. Height, growth form and conditions of all woody plants will be measured and recorded. Any rare or protected species will also be identified.

7.3.17 Within each 2m x 2m quadrat, all plant species and their densities will be identified to species-level and estimated respectively. The percentage cover of bare ground, leaf litter cover and coverage by each species will also be measured. The tallest height of each plant species will be measured to be the nearest cm. Any rare or protected species will also be identified within the quadrats.

Pedology Monitoring

7.3.18 Sediment in each cell will monitored yearly in the early wet season. Three sediment samples will be collected from each cell and sent to a HOKLAS-accredited laboratory for analysis. The following parameters will be monitored:

- % volatile solids
- Oxidation/Reduction (Redox) potential
- pH
- Total nitrogen
- Total oxidized carbon
- Total phosphorus
- Total reactive phosphorus

Monitoring of Water Quality

7.3.19 In-situ water quality will be measured in each cell once per month. The following parameters will be monitored:

- Temperature
- pH
- Salinity
- Turbidity
- Dissolved oxygen

7.3.20 Additional measurements of these parameters should also be made in order to inform management decisions (e.g. fish re-stocking programme) and in response to unexpected events (e.g. algal blooms or fish die-offs).

7.3.21 In addition, every six months (end of the wet season and end of the dry season) water samples will be sent to a HOKLAS-accredited laboratory for analysis. The following parameters will be monitored:

- Ammoniacal nitrogen
- Biochemical oxygen demand
- Total oxidized nitrogen
- Total phosphorus
- Total reactive phosphorus (orthophosphate)

Table H7-1 Summary of Construction and Operational Phase Ecological Monitoring for the Wo Shang Wai WRA.

	Construction Phase Ecological Monitoring	Operational Phase Ecological Monitoring
Birds	Weekly (including Assessment Area).	Monthly (excluding Assessment Area).

	Construction Phase Ecological Monitoring	Operational Phase Ecological Monitoring
Dragonflies and Butterflies	Once per month during March and September to November and twice per month during April to August.	Once per month during March and September to November and twice per month during April to August.
Herpetofauna	Once per month during April to November.	Once per month during April to November.
Aquatic invertebrates	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.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Freshwater fish	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.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Vegetation cover	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.	Yearly in the early wet season.
Water Quality	Following filling with water monthly for in situ water quality and every six months (end of the wet season and end of the dry season) for laboratory testing.	Monthly for in situ water quality and every six months (end of the wet season and end of the dry season) for laboratory testing.
Site Inspections	Weekly.	Twice per month.

7.4 Review of wildlife and habitat monitoring programme and consequent adaptive management

7.4.1 Findings of the wildlife and habitat monitoring programme detailed above will be reviewed on a monthly basis (or more frequently if species' or habitat targets are not being met) by a Wetland Ecologist to identify necessary adjustments to the management regime.

7.4.2 In addition, weekly inspections of the WRA and adjacent areas will be conducted during the construction and establishment phase, any events detrimental to the operation of the wetlands highlighted and suitable remedial action taken.

7.4.3 The monitoring programme will be sufficiently flexible to allow additional inspections in the event of events which may materially affect wetland function (e.g. typhoons, flooding, pollution events) and the monitoring of subsequent remedial actions.

7.5 Contingency Plan

7.5.1 Should the monitoring programme identify that certain criteria (e.g. number of target species, area of preferred habitats) are not being met; actions will be conducted to improve the habitats. **Table H7–2** describes the action and limit levels and the action plan.

Table H7-2 Contingency Plan

Parameters	Action Level	Limit Level	Action
Flooding/storm damage	N.A.	N.A.	Review damage in conjunction with short-term weather forecast. Shed water from site or transfer internally if possible using combination of sluices, pipes and pumps. Review damage and determine severity and undertake repairs/modifications to the design.
Area of water in the open water pond – wet season levels	< 70 & > 95%	< 60 & 100 %	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: adjust water level by pumping to reinstate the area/ re-profiling/ other measures.
Area of water in the open water pond – dry season levels	< 50 & >95%	<40 & 100%	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: adjust water level by pumping to reinstate the area/ re-profiling/ other measures.
Emergent or floating vegetation in the open water pond (although it is not proposed to plant emergent or floating vegetation as part of the restoration process, it is to be expected that these will colonise the wetland over time)	> 10 %	> 20 %	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: manual or mechanical vegetation clearance; check nutrient levels and fish stocks; adjust water quality and fish numbers (in case water quality is affecting herbivorous fish stock levels or there are low levels of herbivorous fish).
Wooded island tree canopy cover	< 70%	< 50%	Action level exceedance: review tree status and growth. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: undertake supplemental tree planting.
Gravel island vegetation cover	> 20%	> 30%	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: manual or mechanical vegetation clearance.
Reedbed reed cover	< 80%	< 60%	Action level exceedance: double the

Parameters	Action Level	Limit Level	Action
			monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: carry out weeding or planting.
Reedbed water cover	< 25% & > 80%	<15% & > 95%	Action level exceedance: pump to restore water levels. Limit level exceedance: pump to restore water levels; review water management regime in medium term..
Undesirable plant species (all wetland)	> 10% of vegetation in WRA or in any cell	> 20% of vegetation in WRA or in any cell	Action level exceedance: removal by weeding. Limit level exceedance: removal by weeding, if problem is likely to return/deteriorate review design and management regime.
Undesirable fauna including invasive/exotic aquatic invertebrates	Presence	Negatively impacting wetland function	Action level exceedance: treatment or removal (or other method if suitable). Limit level exceedance: increase frequency of treatment or removal (or other method if suitable), review management protocols and design.
Salinity	> 2 ppt	> 5 ppt	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: water exchange/ add water/ remove identified contamination source/ other measures.
pH	pH outside the range between 6.5 – 8.0	pH outside the range between 6.0 – 8.5	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: lime/ add peanut residue/ mix with other water sources/ drain and lime/ other measures.
Dissolved oxygen	< 2 mg/l	< 1 mg/l	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: pump and mix water/ aeration/ remove identified contamination source/ other measures.
Total oxidized nitrogen (nitrite and nitrate) concentration	> 5 mg/l	> 10 mg/l	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: water exchange/ add water/ remove identified contamination source/ other measures.
Total phosphorus concentration	> 5 mg/l	> 10 mg/l	Action level exceedance: double the monitoring frequency, identify and review the

Parameters	Action Level	Limit Level	Action
			problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: water exchange/ add water/ remove identified contamination source/ other measures.
Total ammonia concentration	> 3 mg/l	> 6 mg/l	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: water exchange/ add water/ remove identified contamination source/ other measures.
Target species abundance	Abundances of all target species < specified target levels in two successive monitoring periods	Abundances of all target species < specified target levels in four successive monitoring periods	Action level exceedance: Review the monitoring data and reasons for low numbers of target species. If the reduction in abundance is attributable to activities within the site, stop/ reduce such activity or carry out other measures (e.g. erect buffering screen or buffer planting). If the reduction in abundance is attributable to disturbance from outside the site (e.g. intense construction activity outside the site), increase buffering screen (short-term) and/or buffer planting (long-term) or carry out other measures. If the reduction in abundance is attributable to external factors (e.g. natural population fluctuation) or other man-made factors increase the monitoring frequency, identify and review the problem, and review the management regime. If the problem is likely to worsen, the action plan for limit level exceedance should be carried out. Limit level exceedance: Review the management regime and carry out restocking/ erect buffering screen (short-term)/ increase buffer planting (long-term)/ other measures

7.6 Resources Requirement for Wetland Construction and Operating

Construction

7.6.1 The resources requirement given in **Table H7–3** below is based on the assumption that the construction is undertaken by a landscape contactor; detailed design, project management and contract supervision by the developer or his representative are not included. It is assumed that no electricity supply is required (i.e. no lighting). Water management will be primarily by manually operated weirs or sluices with diesel pumps as back-up. It is assumed that any items required on the fringes of the Wetland Restoration Area for the benefit of residents (paths, chairs, rain shelter, viewing platform etc.) would be funded from the landscape budget. All estimates are indicative at this stage and are subject to detailed design.

Table H7-3 Construction Phase Resources Requirement

Item	Notes
Site formation	May require import or export of fill material from site. Bulldozer and/or backhoe. Includes clearance/removal of vegetation and structures.
Wetland plants & planting	Approx 2 ha planting area, mainly of reeds
Tree/shrub/grasses planting	Approx. 1.1 ha planting, trees planted as whips, pot grown shrubs and hydroseeding of grasses required.
Sluices/ weirs	As shown in **Figure H2**,
Pipework	Material and installation cost. Dependent upon detailed design.
Tracks	Grasscrete or similar finish.

Annual Management and Maintenance Resources Requirement

7.6.2 The estimated Annual Management and Maintenance Resources Requirement is shown in **Table H7–4**. This is based upon the requirement that a wetland contractor will undertake the instructed management actions. The wetland contractor may be the same landscape or horticultural contractor appointed to undertake landscape works in the residential part of the Project Area. If the same contractor is employed some equipment may be utilized in both the wetland and for landscape maintenance on the residential site.

7.6.3 Annual Monitoring Resource Requirements are stated in **Table H7-1**.

Table H7-4 Annual Management and Maintenance Phase Resources Requirement

Item	Quantity	Notes
Site Foreman	One	Full-time
Labourer	Two	Full-time
Small backhoe	10 days	Hired as needed for maintenance.
Open top truck	10 days	Hired as needed for delivery/removal of bulky material or could be shared with requirement for maintenance of residential areas.
Mobile pumps	2 (600 l/minute capacity)	Assume annual replacement.
Pipe for pumps	100 m	Assume annual replacement.
Fuel for pumps	As required	Annual budget required.
Strimmer	3	Assume annual replacement
Misc. hand tools	Four sets of general hand tools (rakes, shears, etc)	
Protective equipment	Four sets of suitable protection equipment (including goggles, gloves etc.)	
Lime	3000 kg	Est. 0.1 kg/m^3 of water
Peanut residue	1500 kg	Est. 0.05 kg/m^3 of water
Plant material	1000 m^2	Replacement planting

Fencing repairs	As required	Annual budget required.
Sluice repairs	As required	
Misc. materials	As required	Annual budget required.

7.7 Trust management system, financial arrangements and management agents

Issues to Consider

7.7.1 The establishment of a wetland in concert with residential development is a relatively new proposition for Hong Kong; however it has been successfully applied elsewhere, most notably in the United States and United Kingdom. The requirement is that the restored wetland be sustainable for the long term and this not only relates to the ecological component but also to the financial and management basis on which it is established.

7.8 Management and Maintenance Options – 3 different approaches

7.8.1 One option would be for the Wetland Restoration Area to be placed in the ownership of an independent Trust which would be established to own, manage and maintain the distinctive portion of the Project Area which is defined as "Wetland". In addition to the land, the Trust would receive an endowment fund which would be specifically managed by an Investment Bank to provide a long-term source of funding to cover all of the costs of maintaining the Wetland Restoration Area in accordance with all of the approval requirements placed on the Project Proponent by Government through the EIA approval, the Town Planning Board approval and under the new land grant.

7.8.2 The second option would be for the Project Proponent to retain that part of the Project Area demarcated as Wetland Restoration Area in accordance with all of the approval requirements placed on the Project Proponent by Government through the EIA approval, the Town Planning Board approval and under the new land grant.

7.8.3 The third option would be to have the land retained as 'common area' by the future owners of the residential development. They would then have collective responsibility to manage and maintain the Wetland Restoration Area in accordance with the various approvals given by Government and as required by the Deed of Mutual Covenant (DMC). This could be done in conjunction with managing the other communal areas within the development such as the Club House.

7.8.4 Irrespective of which option is selected, the Project Proponent shall be responsible for the construction of the Wetland Restoration Area as part of the development and shall provide an undertaking to take sole responsibility for management until a successor can be found to the satisfaction of EPD or its agents.

8 REPORTING

8.1 Monitoring Reports

8.1.1 The data obtained from the monitoring programme will be used to inform adaptive management measures. Monitoring data and information regarding adaptive management measures undertaken will be submitted to relevant authorities, i.e. the stakeholders and relevant Government Departments e.g. AFCD and EPD. The frequency of reporting will conform to the requirements of the Environmental Permit.

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ANNEX 1. PROPOSED PLANTING LIST FOR WO SHANG WAI WETLAND RESTORATION AREA.

Plant mixes for the habitat types shown in **Figure H1** of this report are as follows:

Mix 1 (For reedbed areas)

Reedbed species	**Percentage of individuals**
Phragmites spp. (e.g. *Phragmites australis*) (Herb)	100
Total	**100%**

Mix 2 (For Vegetated islands and areas of Tall trees/shrubs)

Tree/tall shrub mix	**Percentage of individuals**
Ficus hispida (Tree)	10
Ficus microcarpa (Tree)	15
Ficus variegata var. *chlorocarpa* (Tree)	10
Macaranga tanarius (Tree)	10
Melia azedarach (Tree)	20
Syzygium jambos (Tree)	10
Bridelia tomentosa (Shrub)	10
Trema orientalis (Tall shrub)	10
Viburnum odoratissimum (Shrub)	5
Total	**100%**

Mix 3 (For areas of tall grass/shrubs)

Grass and shrub mix	**Percentage of individuals**
Bridelia tomentosa (Shrub)	5
Gardenia jasminoides (Shrub)	5
Melastoma candidum (Shrub)	5
Rhaphiolepis indica (Shrub)	5
Cynodon dactylon (Grass)	5
Panicum maximum (Grass)	40
Paspalum paspaloides (Grass)	35
Total	**100%**

Mix 4 (For areas of Short grass)

Short grass mix	**Percentage of individuals**
Commelina diffusa	50
Cynodon dactylon	40
Eleusine indica	10
Total	**100%**

Mix 5 (For shallow margins of fish-free ponds)

Marginal vegetation mix	**Percentage of individuals**
Polygonum barbatum	20
Polygonum glabra	20
Ludwigia octovalvis	15
Ludwigia perennis	20
Cyperus malaccensis	10
Eleocharis spiralis	15
Total	**100%**

Note:

1) The proposed tree/shrub species are suitable for planting near permanent or in seasonally damp areas.

2) No vegetation will be planted in the areas of Open water and on Non-vegetated islands

ANNEX 2. SUMMARY OF STATUS OF SPECIES WITHIN THE PROJECT AREA.

Annex 2.1. *Mean number of individuals and maximum number of individuals of bird species of conservation importance recorded on morning transect counts in Project Area (PA), April 2005-June 2006. (Level of importance based on Fellowes* et al. *2002).*

Species	Wetland-dependent	Level of Concern	Mean in PA	Maximum in PA
Great Cormorant *Phalacrocorax carbo*	Y	PRC	0.5	5
Grey Heron *Ardea cinerea*	Y	PRC	0.1	2
Little Egret *Egretta garzetta*	Y	PRC (RC)	5.5	48
Cattle Egret *Bubulcus ibis*	Y	(LC)	1.3	14
Chinese Pond Heron *Ardeola bacchus*	Y	PRC (RC)	1.3	4
Black-crowned Night Heron *Nycticorax nycticorax*	Y	(LC)	0.2	4
Black Kite *Milvus migrans*	N	(RC)	1.2	5
White-breasted Waterhen *Amaurornis phoenicurus*	Y	-	0.2	2
Little Ringed Plover *Charadrius dubius*	Y	(LC)	0.1	1
Common Sandpiper *Actitis hypoleucos*	Y	-	0.2	1
Common Snipe *Gallinago gallinago*	Y	-	0.1	1
White Wagtail *Motacilla alba*	(Y)	-	0.9	3
Grey Wagtail *Motacilla cinerea*	Y	-	2.2	3
Yellow Wagtail *Motacilla flava*	Y	-	10.0	151
Zitting Cisticola *Cisticola juncidis*	(Y)	LC	0.1	1
Oriental Reed Warbler *Acrocephalus orientalis*	Y	-	0.1	1
Red-billed Starling *Sturnus sericeus*	(Y)	(RC)*	0.9	15
White-shouldered Starling *Sturnus sinensis*	(Y)	(LC)	0.1	2

* 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 threatened. A listing of Regional Concern (RC), based on the importance of the large roosts present near Deep Bay, is considered to be more appropriate.

Annex 2.2. *Butterfly species recorded in the Project Area (PA) during surveys, May 2005 – June 2006.*

Species	**Level of concern**	**Mean in PA**	**Maximum in PA**
Formosan Swift *Borbo cinnara*		0.1	1
Common Jay *Graphium doson*		0.1	1
Common Mime *Chilasa clytia*		0.1	1
Great Mormon *Papilio memnon*		0.1	1
Paris Peacock *Papilio paris*		0.2	1
Red-base Jezebel *Delias pasithoe*		0.1	1
Indian Cabbage White *Pieris canidia*		7.7	33
Yellow Orange Tip *Ixias pyrene*		0.1	1
Mottled Emigrant *Catopsilia pyranthe*		0.3	1
Lemon Emigrant *Catopsilia pomona*		0.2	2
Common Grass Yellow *Eurema hecabe*		3.1	18
Pale Grass Blue *Zizeeria maha*		0.3	3
Lime Blue *Chilades lajus*		0.3	4
Dark-brand Bush Brown *Mycalesis mineus*		0.2	2
Straight Five-ring *Ypthima lisandra*		0.1	1
Large Faun *Faunis eumeus*		0.2	1
Angled Castor *Ariadne ariadne*		0.1	1
Great Egg-fly *Hypolimnas bolina*		0.1	1
Danaid Egg-fly *Hypolimnas misippus*	LC	0.1	1
White-edged BlueBaron *Euthalia phemius*		0.1	1
Blue-spotted Crow *Euploea midamus*		0.1	1

Annex 2.3. *Dragonfly species recorded in Project Area (PA) during surveys, May 2005 – June 2006.*

Species	**Level of concern**	**Mean in PA**	**Maximum in PA**
Orange-tailed Midget *Agiocnemis femina*		0.7	4
Orange-tailed Sprite *Ceriagrion auranticum*		0.4	3
Common Bluetail *Ischnura senegalensis*		3.0	13
Black Threadtail *Prodasineura autumnalis*		0.5	5
Lesser Emperor *Anax parthenope*		0.2	2
Asian Widow *Palpopleura sexmaculata*		0.2	1
Asian Amberwing *Brachythemis contaminata*		4.5	41
Crimson Darter *Crocothemis servilia*		1.1	7
Blue Percher *Diplacodes trivialis*		0.3	3
Pied Percher *Neurothemis tullia*		8.1	67
Blue Skimmer sp.* *Orthetrum* sp.		1.4	12
Common Red Skimmer *Orthetrum pruinosum*		1.5	6
Green Skimmer *Orthetrum sabina*		4.5	15
Wandering Glider *Pantala flavescens*		4.5	29
Variegated Flutterer *Rhyothemis variegata*		5.5	17
Evening Skimmer *Tholymis tillarga*		0.1	1
Crimson Dropwing *Trithemis aurora*		0.9	6
Scarlet Basker *Urothemis signata*	LC	0.3	2

* Three species of blue skimmer may occur on site: Common Blue Skimmer *Orthetrum glaucum*, Lesser Blue Skimmer *Orthetrum triangulare* and Marsh Skimmer *Orthetrum luzonicum*.

ANNEX 3. ADDITIONAL SPECIES OF WETLAND RESTORATION PLAN

A3.1 Additional Species of Conservation Importance

A3.1.1 Under the terms of the EIAO the recreated wetlands are required as mitigation for the species to be significantly impacted by the proposed development (see Section 4 for target species selection). However, it is recognised that in addition to the target species many other species, including species of conservation importance, could also utilise the wetlands if suitable habitat were provided.

A3.1.2 This Annex details Species of Conservation Importance which are expected to utilise the site based on the following:

- They are recognized as being of Conservation Importance based upon criteria provided by BirdLife International (2006 and web updates), IUCN Species Survival Commission (2001) and Fellowes *et al.* (2002);
- It is realistic to expect them to use the rehabilitated wetlands given the size, location and expected level of human activity within the Project Area;
- They are either present on Project Area, in the nearby wetland system or are sufficiently vagile to locate and utilize the Project Area;
- The design of the wetland can accommodate each species without reducing the overall value of the Project Area for the Target Species.

A3.1.3 Based upon this selection process 18 species have been identified; these are detailed in Table A3.1.

Table A3.1. *Additional Species of Conservation Importance expected to utilise the recreated Wetlands.*

Species	Status	Reference
Birds		
Great Cormorant *Phalacrocorax carbo**	Potential Regional Concern	Fellowes *et al.* (2002)
Night Heron *Nycticorax nycticorax**	Local Concern	Fellowes *et al.* (2002)
Grey Heron *Ardea cinerea**	Potential Regional Concern	Fellowes *et al.* (2002)
Purple Heron *Ardea purpurea*	Regional Concern	Fellowes *et al.* (2002)
Great Bittern *Botaurus stellaris*	Regional Concern	Fellowes *et al.* (2002)
Great Egret *Egretta alba**	Potential Regional Concern	Fellowes *et al.* (2002)
Yellow Bittern *Ixobrychus sinensis*	Local Concern	Fellowes *et al.* (2002)
Black Kite *Milvus migrans**	Regional Concern	Fellowes *et al.* (2002)
White-throated Kingfisher *Halycon smyrnensis**	Local Concern	Fellowes *et al.* (2002)
Zitting Cisticola *Cisticola juncidis**	Local Concern	Fellowes *et al.* (2002)
Pallas's Grasshopper Warbler *Locustella certhiola*	Local Concern	Fellowes *et al.* (2002)
Red-throated Pipit *Anthus cervinus*	Local Concern	Fellowes *et al.* (2002)
Bluethroat *Luscinia svecica*	Local Concern	Fellowes *et al.* (2002)
Chinese Penduline Tit *Remiz consobrinus*	Regional Concern	Fellowes *et al.* (2002)
Red-billed Starling *Sturnus sericeus**	Global Concern**	Fellowes *et al.* (2002)
White-cheeked Starling *Sturnus cineraceus*	Potential Regional Concern	Fellowes *et al.* (2002)
White-shouldered Starling *Sturnus sinensis**	Local Concern	Fellowes *et al.* (2002)

Species	Status	Reference
Yellow-breasted Bunting *Emberiza aureola*	Near-threatened	BirdLife International (2006)
Dragonflies		
Coastal Glider *Macrodiplax cora*	Local Concern	Fellowes *et al.* (2002)
Scarlet Basker *Urothemis signata**	Local Concern	Fellowes *et al.* (2002)

* Recorded within the Assessment Area during the baseline ecological surveys

** 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 threatened. A listing of Regional Concern (RC), based on the importance of the large roosts present near Deep Bay, is considered to be more appropriate.

A3.2 Habitat Requirements for Additional Species of Conservation Importance

Great Cormorant

A3.2.1 Great Cormorants are winter visitors to Hong Kong. They roost communally and disperse to feed, either in Deep Bay or on fishponds. They use both active and inactive ponds, but avoid small ponds, especially those completely surrounded by trees or adjacent to human activity. They feed by catching fish whilst swimming (usually underwater). Accordingly, they will utilise ponds when they are full or partly full of water, but not drained. During the day, when not feeding, some birds return to the night time roosts whilst others use daytime loafing sites, which are usually in isolated trees or tree lines or on bare bunds or banks, especially those which are isolated from disturbance and ground predators by being surrounded by water (AEC 2007, Carey *et al.* 2001).

A3.2.2 Foraging opportunities will be provided in the deeper open water areas, which will be stocked with fish suitable for this species. Suitable areas for roosting will be available on the non-vegetated islands and the areas of tall trees and shrubs.

Grey Heron

A3.2.3 Grey Heron is an abundant winter visitor to Deep Bay but is rare at other times of year and elsewhere in Hong Kong (Carey *et al.* 2001). Habitat utilisation has been studied in Hong Kong by Young (1994) who noted that this species is predominantly a crepuscular feeder and primarily uses *gei wai* as a daytime roost; but also utilises fish ponds for feeding. Grey Herons usually feed on fish, preferentially selecting those 10 – 16 cm in length (Cramp and Simmons 1977) and usually hunt by wading in water up to c. 70 cm depth. If undisturbed, they loaf during the day on bunds and islands.

A3.2.4 Foraging opportunities will be provided in the shallower open water areas and on the fringes of the reedbed. The wetland will be stocked with fish suitable for this species. Suitable areas for roosting will be available on the non-vegetated islands and the areas of tall trees and shrubs.

Black-crowned Night Heron

A3.2.5 Black-crowned Night Heron is a widespread resident and winter visitor to Hong Kong. It occurs in most wetland habitats, including fishponds, marshes, reedbeds, streams, etc. This is a predominantly nocturnal species which regularly roosts communally during the day, especially in trees and bamboo next to or overhanging water. They feed mainly on small fish (Carey *et al.* 2001, Voisin 1991).

A3.2.6 Black-crowned Night Heron is thought to have declined as a breeding species in the Deep Bay area in recent years although it is present there throughout the year.

A3.2.7 Day time roosting sites will be provided in the form of tall trees, which on parts of the site will be overhanging water, a combination which seems extremely attractive to roosting Black-crowned Night Herons.

A3.2.8 This species forages mainly at night in areas of shallow water with aquatic vegetation, which will be provided within the fringes of the reedbed areas. This species feeds primarily upon small fish and these will be stocked in the restored wetlands to ensure that suitable food items are available for this species.

Purple Heron

A3.2.9 Purple Heron is an uncommon autumn passage migrant, is scarce in spring and winter, and probably also breeds in the Deep Bay area. Most Hong Kong records are from the Deep Bay area and the highest numbers occur in reedbeds (Carey *et al.* 2001). Purple Herons feed mostly on small fish. They also take amphibians, snakes, lizards, birds, small mammals and insects (Voisin 1991).

A3.2.10 Foraging and roosting opportunities for this species will provided within and on the fringes of the reed bed.

Great Bittern

A3.2.11 Great Bittern is a scarce winter visitor and passage migrant to Deep Bay, with the highest numbers occurring in spring, especially late March. This species has a strong preference for reedbeds, an association which is found throughout most of its range (Voisin 1991). They feed predominantly on fish, eels and amphibians (Cramp and Simmons 1977).

A3.2.12 Foraging and roosting opportunities for this species will be provided within and on the fringes of the reed bed.

Great Egret

A3.2.13 Great Egret is a common to abundant bird in Hong Kong with small numbers breeding. It is largely found in the Deep Bay area, at Starling Inlet and at Shuen Wan. Habitat utilisation has previously been studied in Hong Kong by Young (1994) who showed that whilst this species regularly fed on drained ponds and *gei wai*, intertidal mudflats are typically more important as feeding habitat. They feed mainly on fish, but also on small mammals, birds, amphibians, crustaceans, molluscs, worms and insects (Voisin 1991).

A3.2.14 Foraging opportunities will be provided in the shallower open water areas and on the fringes of the reedbed. The wetland will be stocked with fish suitable for this species. Suitable areas for roosting will be available on the non-vegetated islands and the areas of tall trees and shrubs.

Yellow Bittern

A3.2.15 Yellow Bittern is an uncommon summer visitor and passage migrant to Hong Kong and has greatly declined in numbers in recent years. In Hong Kong it occurs in a variety of wetland habitats but especially mangroves (particularly during the breeding season), reedbeds, and freshwater marshes. It requires areas with extensive emergent vegetation. Yellow Bitterns forage primarily on small fish and amphibians (Carey *et al.* 2001).

A3.2.16 Foraging and roosting opportunities for this species will provided within and on the fringes of the reed bed.

Black Kite

A3.2.17 Black Kite is a winter visitor and scarce breeding bird in Hong. It is far more widespread and numerous in winter than in summer, especially in the Deep Bay area where it is largely absent during the summer months. It occurs across a wide variety of coastal and inland habitats including fishponds where it consumes dead fish and little else. Day time roosts are regularly noted, especially in groups of tall trees close to water.

A3.2.18 Day time roosting habitat will be provided for this species in the areas of tall trees and shrubs.

White-throated Kingfisher

A3.2.19 White-throated Kingfisher is a resident bird in Hong Kong which is locally common in autumn and winter. It occurs in a variety of wetland and non-wetland habitats but especially mudflats, mangroves, fishponds and wet agriculture. It feeds on small fish, crustaceans, invertebrates, lizards and small snakes (Carey *et al.* 2001).

A3.2.20 Day time roosting habitat will be provided for this species in the areas of tall trees and shrubs, and suitable foraging habitat in areas of shallow water.

Zitting Cisticola

A3.2.21 Zitting Cisticola is a common winter visitor and passage migrant in Hong Kong and a rare breeding species. It favours areas of grass, especially in lowland wetland areas such as active and disused fishponds. Small numbers breed in Hong Kong, primarily in the Deep Bay area (Carey *et al*. 2001).

A3.2.22 Areas of tall grass and shrubs and reedbed will provide suitable foraging habitat for this species.

Pallas's Grasshopper Warbler

A3.2.23 Pallas's Grasshopper Warbler is primarily an autumn passage migrant to Hong Kong, with occasional winter and spring records. It occurs in most wetland habitats but most notably in areas of abandoned or inactive wet agriculture, along the bunds of fishponds and in reedbeds. It is insectivorous (Carey *et al.* 2001).

A3.2.24 Areas of tall grass and shrubs and reedbed will provide suitable foraging habitat for this species.

Red-throated Pipit

A3.2.25 Red-throated Pipit is a common winter visitor and passage migrant to Hong Kong. It is found in low lying marshes or open grassy areas, wet and dry agriculture and, especially during migration, on bunds between fishponds. Most records are from the northwest New Territories.

A3.2.26 Areas of short grass will provide suitable foraging habitat for this species.

Bluethroat

A3.2.27 Bluethroat is a winter visitor and spring migrant to Hong Kong; it is largely restricted to the northwest New Territories, where it frequents wet agricultural areas, well vegetated fishponds, freshwater ditches and reedbeds. It is insectivorous (Carey *et al.* 2001).

A3.2.28 The areas of reedbed will provide suitable foraging areas for this species.

Chinese Penduline Tit

A3.2.29 Chinese Penduline Tit is a fairly common passage migrant and winter visitor to the Deep Bay area. It is insectivorous and forages almost exclusively in reedbeds (Carey *et al.* 2001).

A3.2.30 The areas of reedbed will provide optimum foraging habitat for this species.

Red-billed Starling

A3.2.31 Red-billed Starling is a winter visitor to Hong Kong, occurring in large flocks in the northwest New Territories. The wintering population in Hong Kong is considered probably to be of international importance for this species (Carey *et al*. 2001). Red-billed Starlings are omnivores and feed around fishponds, wet agricultural areas (especially where these are contaminated by effluent from pig farms), edges of reedbeds and both natural and artificial drainage channels. They readily take advantage of spilled food provided for fish or ducks. Much food is obtained on the ground but they also frequently feed in trees where they consume insects and fruit.

A3.2.32 The areas of tall trees and shrubs will provide suitable foraging habitat for this species.

White-cheeked Starling

A3.2.33 White-cheeked Starling is a common but localised winter visitor which is most common in the Deep Bay area and in other nearby wetland areas such as Kam Tin. It often scavenges on food waste around fishponds and pig and poultry farms and is especially fond of the fruit of Persian Lilac *Melia azaderach* (Carey *et al.* 2001).

A3.2.34 The areas of tall trees and shrubs will provide suitable foraging habitat for this species.

White-shouldered Starling

A3.2.35 White-shouldered Starling is a common passage migrant and scarce and localised breeding summer visitor and winter visitor. The breeding population is considered to be less than 50 pairs (Carey *et al.* 2001). Whilst historically this species nested in old buildings or village houses it has adapted in recent years and has, very recently, been successfully attracted to artificial nest boxes at Lok Ma Chau (AEC 2007).

A3.2.36 The areas of tall trees and shrubs will provide suitable foraging habitat for this species; in addition nest boxes suitable for this species will be placed in taller trees around the site to encourage this species to breed on site.

Yellow-breasted Bunting

A3.2.37 Yellow-breasted Bunting is an uncommon to common passage migrant with small numbers occurring in winter. It occurs in a wide variety of habitats in Hong Kong, including wet and dry farmland, grassland, the edges of reedbeds and fishpond bunds. It is largely gramnivorous, but will also take small insects (Carey *et al.* 2001).

A3.2.38 Areas of tall grass and shrubs and reedbed will provide suitable foraging habitat for this species.

Coastal Glider

A3.2.39 This species is considered to be of 'Local Concern' by Fellowes *et al.* (2002). It was first discovered in Hong Kong in 1997. It is known to occur at Mai Po marshes, Kam Tin, San Tin and Lok Ma Chau. The species breeds in brackish lagoons and estuaries, but adults will utilise nearby ponds and marshes for foraging.

A3.2.40 The fish-free ponds and reedbed area will provide suitable foraging habitat for adults of this species.

Scarlet Basker

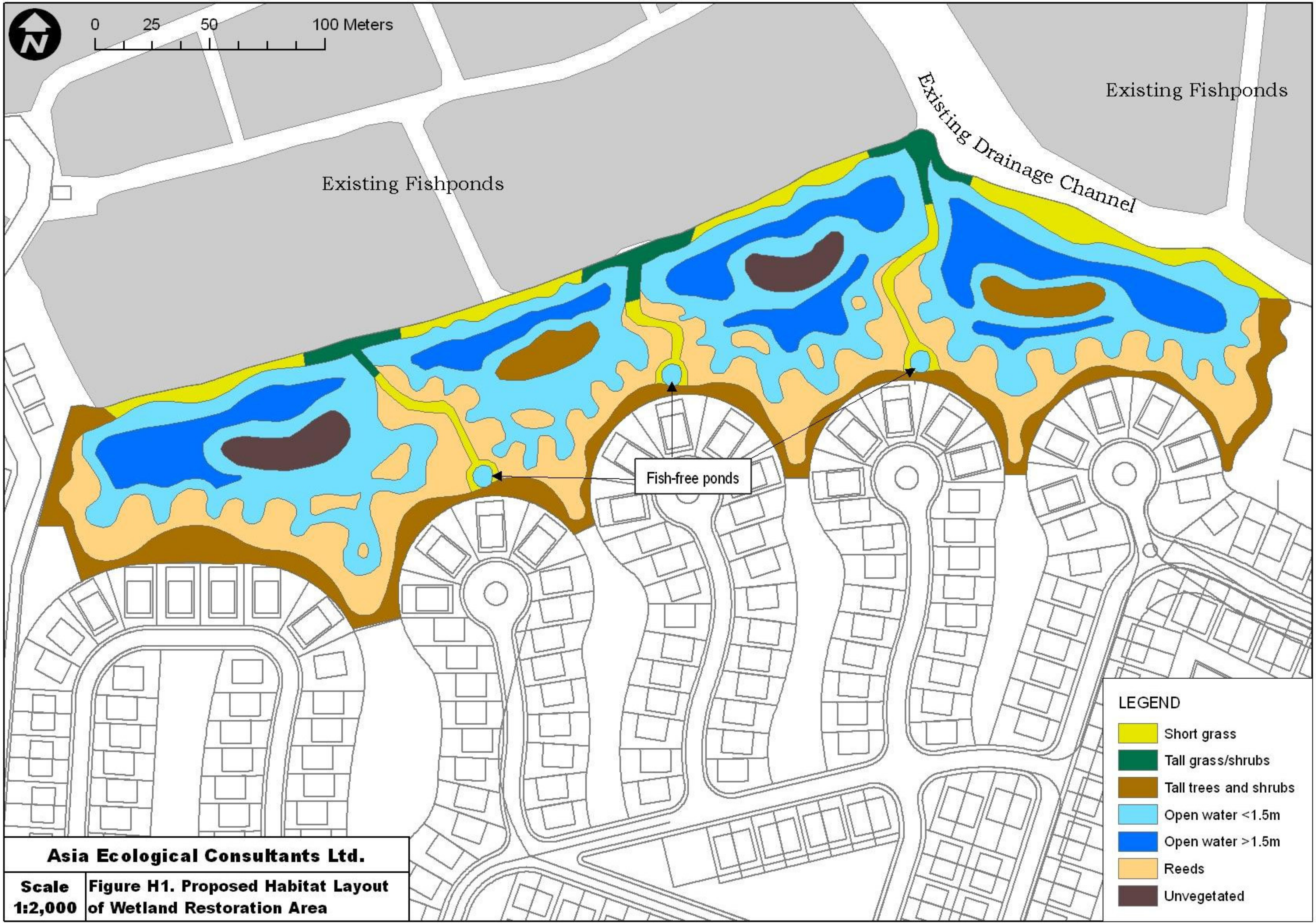
A3.2.41 This species is considered to be of 'Local Concern' by Fellowes *et al.* (2002). It is quite widespread in the New Territories, and has been recorded at Mai Po, Lok Ma Chau and Kam Tin.

A3.2.42 The fish free ponds will provide suitable breeding habitat for this species.

Table A3.2 . *Summary of the Habitat to be provided for Additional Species of Conservation Importance.*

Species	Short grass	Tall Grass and shrubs	Tall trees and shrubs	Open water	Reedbed	Non-vegetated islands	Fish-free ponds
Great Cormorant			R	F		R	
Grey Heron			R	F	F	R	
Black-crowned Night Heron			R		F, R		
Purple Heron					F, R		
Great Bittern					F, R		
Great Egret			R		F	R	
Yellow Bittern					F, R		
Black Kite			R				
White-throated Kingfisher			R	F			
Zitting Cisticola		F			F		
Pallas's Grasshopper Warbler		F			F		
Red-throated Pipit	F						
Bluethroat					F		
Chinese Penduline Tit					F		
Red-billed Starling			F				
White-cheeked Starling			F				
White-shouldered Starling			F, B				
Yellow-breasted Bunting		F			F		
Coastal Glider *Macrodiplax cora*				F	F, B		F,R,B
Scarlet Basker *Urothemis signata*				F	F		F,R,B

Key: habitat important for F = Foraging; R = Roosting; B = Breeding.



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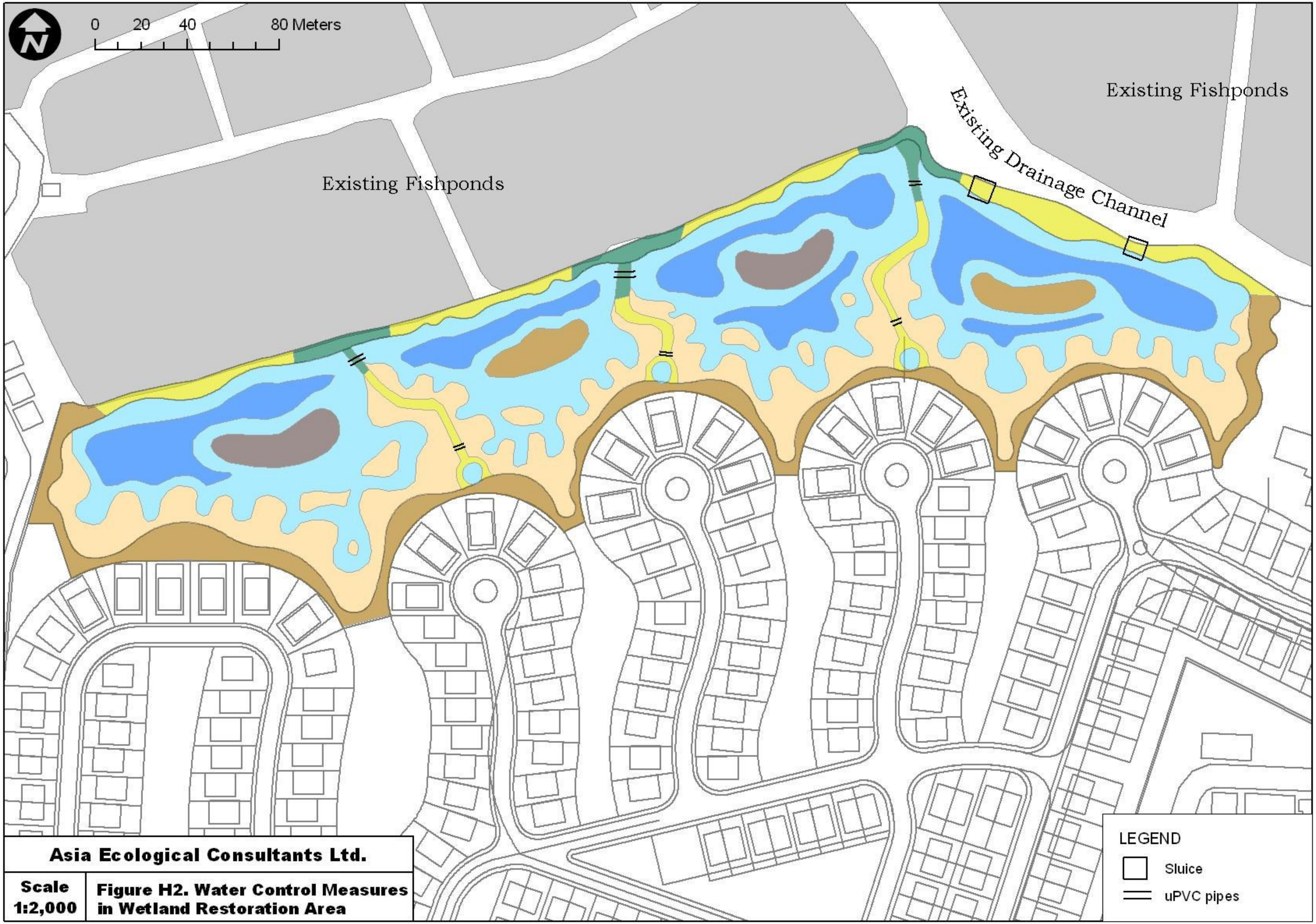
Scale 1:2,000	Figure H1. Proposed Habitat Layout of Wetland Restoration Area



Asia Ecological Consultants Ltd.

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Figure H2. Water Control Measures in Wetland Restoration Area

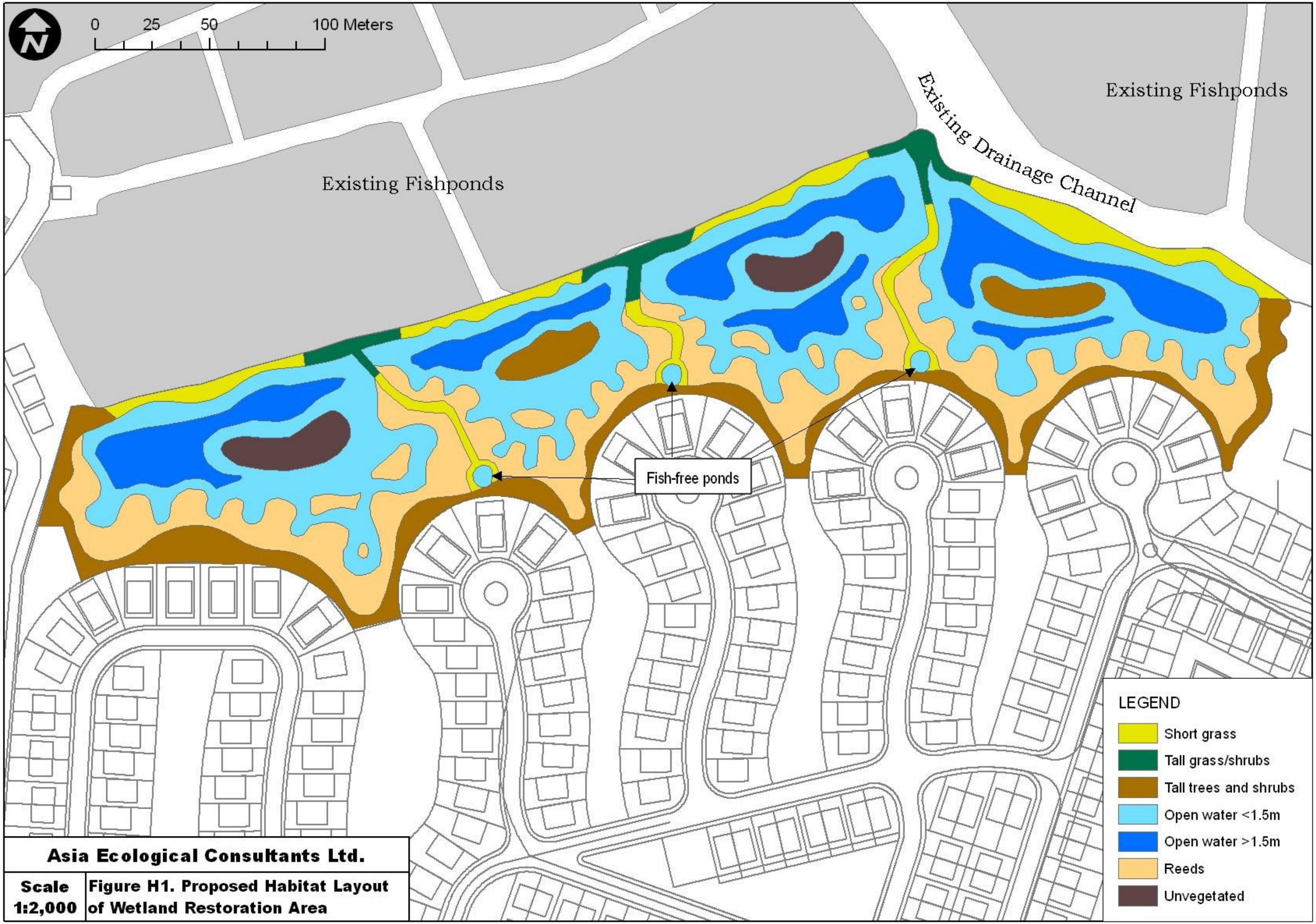

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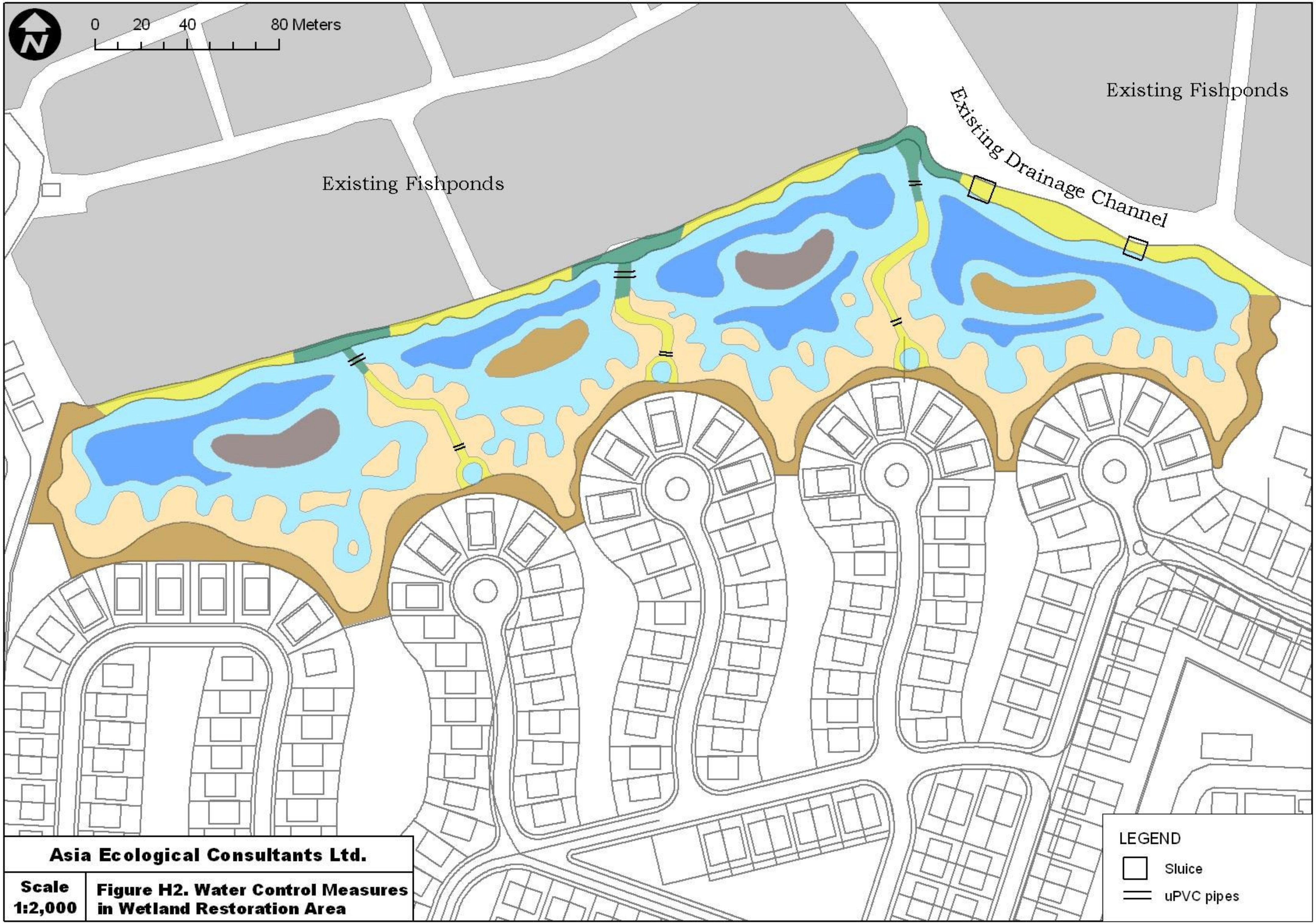
Figure H1. Proposed Habitat Layout of Wetland Restoration Area



Asia Ecological Consultants Ltd.

Scale 1:2,000	Figure H2. Water Control Measures in Wetland Restoration Area