Halcrow China Limited

AGREEMENT NO. CE 59/2005 (EP)
Development of a Bathing Beach at Lung Mei, Tai Po
Environmental, Drainage and Traffic Impact Assessments - Investigation
Environmental Impact Assessment Report
Volume I – Main Text

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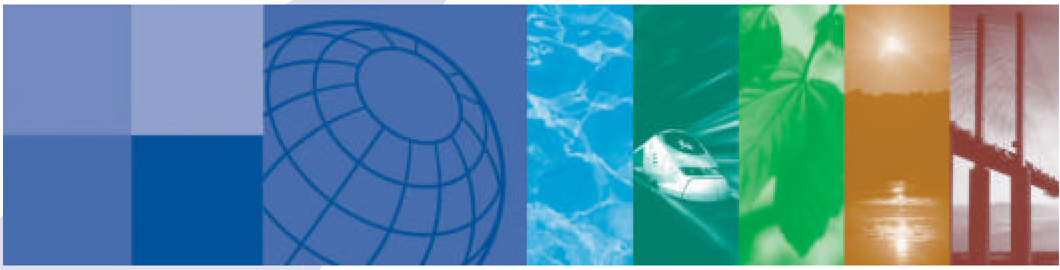

The Government of Hong Kong Special Administrative Region
Civil Engineering and Development Department
Port Works Division

Volume I – MAIN TEXT

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1 INTRODUCTION

1.1 Background

The ex-Provisional Regional Council (ex-PRC) understood that there was no beach facility at the east region of the New Territories, except in the Sai Kung District which is quite distant from Tai Po District. Hence it was suggested developing a bathing beach at Lung Mei, Tai Po. Therefore, in May 1998 the ex-PRC's Culture, Recreation and Sports Committee endorsed the implementation of a feasibility study commissioned by the Architectural Services Department (ArchSD), which commenced in late 1999 and completed in mid-2001, which concluded that it was technically feasible to construct a bathing beach at Lung Mei.

Lung Mei is an easy accessible location adjacent to a prominent leisure area, Tai Mei Tuk, with well-established facilities for holiday-makers and water-based recreation activities, which has attracted many visitors, in particular during public holidays. It is anticipated that the proposed bathing beach would complement the facilities already provided in the Tai Mei Tuk area. It is also noted that Drainage Services Department (DSD) plans to establish a new sewerage system (under The Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94)) allowing the residents in Lung Mei to connect their sewers to the public sewer. This public sewer will deliver the sewage to the Tai Po STW for further treatment. It is anticipated that the sewerage system will be completed prior to the operation of the Proposed Beach Development. In addition, with the gazette of the Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94), as part of the Sewerage Master Plan (SMP) Works, under Road (Works, Use and Compensation) Ordinances as applied by Water Pollution Control (Sewerage) Regulation, which covers the Lung Mei area and is scheduled to be completed before 2010, it is compulsory for any new development to connect their sewers to the public sewer and resulting improvement of water quality in the region. According to the information provided by DSD, although the connection rate varies from village to village, a 60% connection rate would be more likely to be implemented.

The scope of the Project as given in the Project Profile and in the Assignment Brief comprises:

a. a 200m long beach with a groyne at each end of the beach;

b. a beach building with associated beach facilities, including:

    i. public changing rooms and toilets;

    ii. shower rooms;

    iii. equipment / machinery stores for catamarans, motorized boats, beach transporters, beach cleansing and sand levelling machines, etc;

    iv. dangerous goods stores including paint and thinner for painting maintenance as well as kerosene and petrol for operation of machinery; and

   v. ancillary facilities including management office, lookout/surveillance post, first aid room, staff changing room/toilets, staff room/pantry, fast food kiosk, open seating out area, store rooms, etc;

c. retaining structures;

d. refuse collection point;

e. outdoor shower facilities;

f. lookout towers;

g. shark prevention net;

h. a public car park including 113 fee-paying parking spaces for 100 private cars, 10 motorcycles and 3 coaches, 2 coach loading/unloading bays and 2 passenger car/taxi unloading bays;

i. landscaped areas;

j. drainage diversion of an existing box culvert and at Lo Tsz River;

k. sewerage construction works; and

l. sand replenishment during the operation phase for maintenance of the beach, when necessary, such as after extreme storm conditions.

The location and general layout of the bathing beach development is shown on *Figure 1.1*.

This Assignment is classified as a Designated Project according to Items C.2 and C.12 of Part I, Schedule 2 under the *Environmental Impact Assessment Ordinance* (*EIAO*) and therefore, an Environmental Permit is required under the *EIAO*. Port Works Division (PWD) of Civil Engineering and Development Department (CEDD) is the project vote controller.

CEDD is also responsible for the overall planning, design and civil engineering construction of the Project. However, Architectural Services Department is responsible for design and construction of the beach building, car park and landscaping works. On 26 May 2006, CEDD appointed Halcrow China Limited (Halcrow), under Agreement No. CE 59/2005 (EP), to provide professional services in respect of "Development of a Bathing Beach at Lung Mei, Tai Po – Environmental, Drainage and Traffic Impact Assessments – Investigation" (hereafter called "the Assignment"). Halcrow has appointed their sub-consultant, Environmental Resources Management (ERM) to provide the environmental services in respect of the Assignment.

1.2 Public Consultations

Public consultations have been commenced in the early stages of this Assignment and continuous throughout the Project Study, in order to understand and address the public concerns of the preliminary designs related to the Bathing Beach Development. The consultation parties included green groups, fisherman societies, Tai Po District Council and the general public through the District Office (Tai Po). The major concerns comprise of potential environmental impacts during construction and operation of the proposed beach, long-term traffic impact arsing from the proposed development and drainage impact on the existing natural stream "Lo Tsz River". The key environmental comments received and the proposed measures in the studies and designs are summarised *Table 1.1* below:

Table 1.1 Summary of Key Environmental Comments and Proposed Measures

Comments	**Proposed Measures in Studies and Design**
Beach Development	*Beach Development*
• Concern on the permanent lose in natural habitats due to the bathing beach development.	• Alternative to the Project should be detail assessed in the studies. If it cannot be avoided, any alternatives to designs and construction works should be investigated to avoid/minimise any adverse environmental impacts. (Please refer to *Section 2* for the details)
• Concern on increase in the reclamation area of 1.02ha, which has been approved through the Planning Board in 2006.	• The initial beach requirements and facilities have been reviewed with LCSD. Moreover, building and car park layouts are optimized to minimise the reclamation requirement. There is no change of reclamation area (Please refer to *Section 2* for alternative to layout option)
Water Quality	*Water Quality*
• Concern on water quality at Lung Mei during beach operation.	• A DSD's "Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC" project has been tentatively scheduled for completion by 2010 to cover the village areas in proximity of the proposed beach development at Lung Mei. The purpose of the DSD project is to connect the existing improper sewerage discharge and improve the water quality in the Tolo Harbour.
• Connection percentage of the DSD's "Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC" would affect the long-term water quality of the proposed bathing beach.	• The connection percentage assumption in water quality impact assessment would be established based on the DSD past project experiences. Moreover, a sensitive analysis would be carried out to simulate different scenarios of the connection percentages.
• Potential impacts on the nearby fisheries and marine ecology during dredging and sandfilling operations	• As advised by the fisherman societies, the dredging works has been scheduled to be conducted in the period of December to January. Moreover, the proposed water quality monitoring stations have been agreed with the fisherman societies. Close coordination/liaisons with the stakeholders would be also maintained during construction. The potential water quality impacts arising from the proposed construction works would be assessed and any mitigation measures, such as installation of silt curtain, would be recommended as necessary. (Please refer to *Section 6* for the details)

Comments	**Proposed Measures in Studies and Design**
Drainage Diversion Scheme for Downstream of Existing Lo Tsz River • Disagree to combine the drainage diversion works for Lo Tsz River and the existing box culvert due to the potential poor water quality of runoff in the box culvert; • Suggest to leave the existing estuary of Lo Tsz River in place and no works to be proposed there; • Concern on the effect on the many mangroves in the area.	*Drainage Diversion Scheme for Downstream of Existing Lo Tsz River* • The combined drainage diversion option has been cancelled in the early investigation stage and separate drainage diversion works for Lo Tsz River and the existing box culvert have been adopted; • No works are proposed to the estuary of Lo Tsz River; • The ecological survey showed that the Project Site located away from the mangrove habitats (approximately 500 m) but there were some mangrove seedlings found in the concerned area and any potential impacts would be assessed in this EIA study. (Please refer to Section 8 for details).
Landscape Issue • Suggest the preservation of existing native trees but there is no need for the exotic trees, as they will be difficult to maintain; • Suggest the inclusion of some tree species with fruits in the landscape proposal to provide food for birds; • Recommend monitoring of *Mikania micrantha* (? ? ?) to avoid any overgrowth and as such, protect other species in the western open channel areas.	*Landscape Issue* • Suggestion has been taken into account in the landscape proposal; • Tree species with fruits would be included in the proposal. • Recommendations for monitoring of *Mikania micrantha* would be included in the EIA report.
Beach Stability • Concerns about the beach stability due to typhoon influences.	*Beach Stability* • The beach site is preferred to be well sheltered with low tidal current. Moreover, the shoreline stability would be confirmed by modelling in this Assignment.

In the light of the Public concerns, alternatives to the Project, designs and construction methods have been assessed, taking into account practicality, reliability, cost-effectiveness and environmental and social acceptability of the study options. Details will be further discussed in *Section 2*.

1.3 Purpose and Objective of this EIA Report

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 development of a bathing beach at Lung Mei, Tai Po and all related activities taking place concurrently.

The specific objectives for the EIA Study are set out in the *EIA Study Brief* (*No. ESB-138/2006*), as listed below:

a. To describe the Project and associated works together with the requirements for carrying out the Project;

b. 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 natural and man-made environment and the associated environmental constraints;

c. To provide information on the consideration of alternatives to avoid and minimize potential environmental impacts to environmentally sensitive areas and other sensitive uses; to compare the environmental benefits and dis-benefits of each of different options; to provide reasons for selecting the preferred option(s) and to describe the part environmental factors played in the selection of preferred option(s);

d. To identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;

e. To identify and quantify any potential landscape and visual impacts and to propose measures to mitigate these impacts;

f. To propose provision of mitigation measures so as to minimize pollution, environmental disturbance & nuisance during construction & operation of Project;

g. To investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;

h. To identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) 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;

i. 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 cumulative effects and reduce them to acceptable levels;

j. To investigate the extent of the 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; and

k. To design and specify environmental monitoring and audit requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures.

1.4 Structure of this EIA Report

Structure of this report is divided in the following sections:

- Section 2 discusses on the consideration of alternatives
- Section 3 describes the Project Description
- Section 4 presents the Air Quality Impact Assessment
- Section 5 presents the Noise Impact Assessment
- Section 6 discusses on the Waste Management Implications
- Section 7 presents the Water Quality Impact Assessment
- Section 8 presents the Ecological Impact Assessment
- Section 9 presents the Fisheries Impact Assessment
- Section 10 presents the Landscape and Visual Impact Assessment
- Section 11 discusses the Summary of Environmental Outcomes
- Section 12 contains the Environmental Monitoring and Audit Requirements

2 CONSIDERATIONS OF ALTERNATIVES

2.1 Introduction

As stated in *Section 1.1*, there are no gazetted beaches provided at the east region of the New Territories, apart from the beaches in the Sai Kung District. As such, Tai Po District Council (TPDC) has been requesting repeatedly for a beach development in Tai Po District Council for over the 10 years. Consequently, a Feasibility Study(1) was carried out and identified the current project site at Lung Mei, Tai Po as the location for the bathing beach. In accordance with the requirements of Sections 3.3.1 to 3.3.4 of the *EIA Study Brief*, this Section describes the need of the Assignment and site selection process for the identification of the site for the development of the bathing beach. Consideration of alternatives includes project locations, construction methods and sequences of works and justification for the adopted scenario.

2.2 The Need of the Project

2.2.1 General

As mentioned above, there is no beach facility in the east region of the New Territories, except in the Sai Kung District, which is very far from Tai Po District. Moreover, the existing swimming facility in the Tai Po areas could not satisfy the demand for a bathing beach. Therefore, the public has been requesting repeatedly to the LCSD for a beach development in the Tai Po District. Consequently, the Feasibility Study was carried out and identified in 2001 that the current project site as a feasible location for developing a bathing beach.

In light of the above, the TPDC strongly requested the development of a bathing beach at Lung Mei and members of the TPDC urged for early implementation of the Project. In a Legislative Council case conference on 20 April 2004, Members requested the Government to accord priority to this Assignment. This project was one of the 25 projects identified for priority implementation in the Chief Executive's 2005 Policy Address and has the support of Home Affairs Bureau. It is considered that this Proposed Beach Development at Lung Mei will meet the increasing demand for swimming facilities, particularly the site located being next to Ting Kok Road, which is highly convenient to the public. The site is partly situated on an area zoned for open space use and there is a large piece of hinterland to accommodate various ancillary facilities of the proposed beach development. Moreover, the beach can be served as a recreational function even during non-bathing season, i.e., the public playing in the sand, sunbathing and other beach activities.

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(1) ArchSD(2001). 128ML – Feasibility Study for Proposed Beach Improvement Work at Lung Mei Beach, Tai Po – Final Report.

2.2.2 *Alternatives to the Project*

The following options have been investigated before arriving to a conclusion that a bathing beach development should be proposed:

Option 1 – Do Nothing. No extra swimming facilities in the Tai Po area under this option.

Option 2 – Provision of Swimming Pool Facilities, such as the construction of a Sports Centre in Area 33, Tai Po, comprising a public indoor swimming pool with associated facilities. No engineering works to any coastal area in Tai Po under this option.

Option 3 – Construction of a Bathing Beach with bathing facilities in the coastal area of Tai Po.

The above alternatives have been investigated and evaluated from different perspectives and the results are presented in *Table 2.1* below.

Table 2.1: Evaluation of Alternatives to the Project

Options	**Evaluation**	**Practicality of the Option**
Do nothing	The public and TPDC's request for beach facilities near Tai Po areas can not be satisfied.	Not practicable
Provision of Swimming Pool Facilities	It is understood that there will be a Sports Centre in Area 33, Tai Po proposed to be constructed, currently anticipated to be around mid-2009 to end-2011, which will comprise a public indoor swimming pool (25m long, 25m wide) with associated facilities. This project was also one of the 25 projects identified for priority implementation in the Chief Executive's 2005 Policy Address. Even so, the added swimming pool would not satisfy the current demand for beach facilities in the Tai Po areas.	Not practicable
Provision of Bathing Beach at Alternative Locations within the Tai Po areas	The community demand for beach facilities can be met. The design criteria and environmental and engineering considerations in site selection will be further discussed in *Section 2.3.*	Practicable

In the view of the above, only the provision of bathing beach is considered practicable in satisfying the demand of the public and the TPDC for a beach facility in Tai Po. In addition to serve swimmers, the beach can also act all the year round as a recreational ground for non-swimmers, ie sand playing/sculpture activities, sunbathing and other beach activities etc.

2.2.3 Scenarios with and without the Project

There are a number of bathing sites considered in the Tai Po area and they are discussed in *Section 2.3* but the preferred proposed Beach Development sited at Lung Mei would serve many local residents as well as residents from other parts of New Territories. The Proposed Beach Development would compliment and enhance the popular leisure area at Tai Mei Tuk, where there are numerous outdoor activities such as cycling, barbecue, windsurfing, boating and other water sports. It would be an additional and needed attraction for the local and Hong Kong residents, in particularly for family outings, not only to have fun swimming but also to enjoy the beach (ie sand playing/sculpture activities, sunbathing and other beach activities), the facilities and the natural environment. It is a project that has the support of the government and the Chief Executive as well as the local people. It will also meet the demand for more popular facilities and for a greater diversity of recreational activities in the Tai Mei Tuk area.

However, without this bathing beach, the community demand of beach swimming would not be met as there are no such facilities at Tai Po. The opportunity for such an attraction would be lost for the locals, residents' afar and tourist alike. On top, the prospect to enhance the leisure area of Tai Mei Tuk area in Tai Po will never be realised. It should also be noted that Lung Mei is a non-gazetted beach and currently utilised by swimmers. Without this proposed bathing beach, the swimmers will still insecurely use this non-gazetted beach. Therefore, we conclude that the bathing beach development should be supported in light of strong public expectation for such an attraction and lack of beach facilities in the area.

2.3 Consideration of Alternative Project Locations

2.3.1 Site Selection Consideration

The basic requirements of the Proposed Beach Development agreed with LCSD are as follows:

- It should be located within the Tai Po District;
- It should have sufficient area for a development of a 200m long beach with a minimum beach area of 6,000m^2, serving 4,000 bathers during the swimming peak season; and
- The beach should preferably have no less than 10m wide sand part during very high tide so that the sufficient sun bathing area can be achieved. Ideally, there should be sufficient space in its hinterlands to accommodate other beach facilities such as changing room, toilets, shower area, storerooms, beach office, refreshment kiosk, etc.

From environmental and engineering points of view, the following criteria are also taken into account in the preliminary site selection process:

- The new bathing beach should be located along the shore with acceptable water quality (*E. Coli* concentration below 180 cfu per 100mL). It is preferable to be sited away from the industrial areas (ie Tai Po Industrial Estate) due to water quality concern;

- It is preferable to be located within a sheltered area (not subject to wave actions) to avoid sediment drift during operation and minimize the future maintenance requirement;
- It is preferred to have a soft bottom (ie sand, but not muddy bottom such as mudflat) and gentle slope to minimise dredging and sandfilling requirements during the development;
- It should be away from the existing fairway/navigation channel for bathing safety concerns;
- It is preferable to be located away from the Fish Culture Zone;
- It is preferred to have nearby existing infrastructure (such as road and drainage systems) and supporting facilities to avoid extensive development works, causing environmental impacts to the surrounding areas.

Figure 2.1 shows all of the potential sites located within Tai Po District and geophysically suitable to be developed as a bathing beach. The potential bathing beach sites are mainly located in Plover Cove, Tolo Channel, Hoi Ha Wan and Long Harbour. To avoid impacts on the environmental sensitive areas, any potential bathing beach sites located in adjacent to or adjoining to the Country Park, Marine Park, Site of Special Scientific Interest, Special Area, Coastal Protection Area and identified key mangrove habitat have been eliminated for further consideration (*Figure 2.2*).

Therefore, with consideration of the above criteria, all of the potential bathing beach sites at the eastern region of Tai Po District including Long Harbour, Hoi Ha Wan and Tolo Channel were eliminated (*Figure 2.2*). It should also be noted that no potential bathing beach sites can be found at Tolo Harbour, the southeast of Tai Po District (particularly Tai Po town centre and along the coastline parallel to Tolo Harbour Highway). Comparison of the potential bathing beach sites (geophysically suitable) identified within the four regions including Plover Cove, Tolo Channel, Hoi Ha Wan and Long Harbour was summarised in *Table 2.2*.

Table 2.2: Comparison of the Potential Bathing Beach Sites (Geophysically Suitable) identified in Plover Cove, Tolo Channel, Hoi Ha Wan and Long Harbour within Tai Po District

	Plover Cove	**Tolo Channel**	**Hoi Ha Wan**	**Long Harbour**
Adjoining to Country Park (1)	No	Yes	Yes	Yes
Adjacent to Marine Park (1)	No	No	Yes	No
Adjoining to Site of Special Scientific Interest (1)	Yes, some of the potential sites	Yes	Yes	No
Adjacent to Special Area (1)	Yes, some of the potential sites	No	No	No
Adjoining to Coastal Protection Area (1)	Yes, some of the potential sites	No	No	No
Adjoining to identified key mangrove habitat (1)	Yes, some of the potential sites	Yes, some of the potential sites	No	Yes, some of the potential sites
Adjacent to Fish Culture Zone (1)	Yes, some of the potential sites	Yes, some of the potential sites	No	No
Having nearby existing infrastructure (such as road and drainage systems) (2)	Yes	No	No	No
Shortlisted Sites Identified	**Yes**	**No**	**No**	**No**

Note: (1) Any potential sites locate adjoining to Country Park, Marine Park, Site of Special Scientific Interest, Special Area, Coastal Protection Area, identified key mangrove habitat and Fish Culture Zone will not be considered further due to environmental concern.

(2) Only potential sites of nearby existing infrastructure (such as road and drainage systems) will be considered as those sites can avoid environmental impacts due to the development of additional infrastructure.

Areas within Plover Cove are the remaining region in the Tai Po District considered to be suitable for the Proposed Beach Development (*Figure 2.2*). There are some potential sites identified within Plover Cove that avoid environmental sensitive areas, including Country Park, Marine Park, Site of Special Scientific Interest, Special Area, Coastal Protection Area, identified key mangrove habitat and Fish Culture Zone. In addition, those potential sites within Plover Cove have existing infrastructure which avoid additional development and associated environmental impacts. Apart from the suitable shore environment, Plover Cove can also be easy accessed by the public through the existing Ting Kok Road. The preferred site for the Proposed Beach Development should be situated away from the following environmental sensitive areas within Plover Cove:

- Plover Cove Country Park;
- Ma Shi Chau Special Area;
- Ting Kok Special Site of Scientific Interest (SSSI); and
- Yim Tin Tsai (East) Fish Culture Zones (FCZs).

Further to the review of the coastal environment along the coastline of Plover Cove, three potential sites, including Lung Mei, Shuen Wan and Sha Lan, are shortlisted for the Proposed Beach Development (*Figure 2.3*). All of the three sites are located in sheltered bay and therefore substantial sediment drift/ sand loss during operation would not expect to be anticipated.

2.3.2 Potential Site Examined

i. Lung Mei

Lung Mei is currently a non-gazetted beach located adjacent to Tai Mei Tuk which is a popular leisure area, and well away from the Ting Kok SSSI (about 500 m). From planning perspective, development of a bathing beach in adjacent to the existing leisure area can further enhance the recreational functions of the area. Part of the existing government land near the shore can be utilised and thereby minimise the reclamation area. It is also situated along the existing Ting Kok road and therefore additional transportation access or extensive associated infrastructure would not be required. However, drainage diversion of an existing box culvert and at lower course of Lo Tsz River is required.

ii. Shuen Wan

Shuen Wan is located to the north of Shuen Chim Uk and to the south of Ting Kok SSSI (less than 100 m). As this potential site situated along the existing Ting Kok road, additional transportation access or extensive associated infrastructure would not be required. However, more reclamation as compared with Lung Mei will be expected as there is no existing government land that could be utilised building the bathing beach facilities. Due to the proximity of Ting Kok SSSI and mangrove habitats, the associated ecological and water quality impacts during the construction and operation of the Proposed Beach Development would be a concern. In addition, drainage diversion of Shuen Wan River is also required to adhere to the requirements of gazetted beaches.

iii. Sha Lan

Sha Lan is currently a non-gazetted beach and is over 500 m away from the Ting Kok SSSI towards the northeast. However, there is only one road (Sha Lan Road – two way single carriageway) leading into this area but ends up with a single lane access sloping into the village. The traffic flow along Sam Mun Tsai Road and Sha Lan Road would be expected to increase significantly due to the development of the beach. Upgrade of the exiting road access will be required for the proposed beach development should the site be selected. More reclamation as compared with Lung Mei will be expected as there is no existing government land that could be utilised for the bathing beach facilities. Drainage diversion of existing box culvert is also required to adhere to the requirements of gazetted beaches. In addition, this site would be closer to the Yin Tin Tsai East Fish Culture Zone in comparison with the proposed site at Lung Mei and therefore might be a greater concern to the fishermen.

2.3.3 *Comparison of the Environmental Benefits and Dis-benefits of the Potential Sites*

i. Lung Mei

Environmental benefits

- The bathing beach location is well sited away from Ting Kok SSSI, as well as the mangrove habitat, and the existing waterpond at Tai Mei Tuk, which has been designated as a Conservation Area.
- It is sited far from the Yim Tin Tsai East FCZ.
- It has limited dredging and reclamation, and so there is lower potential for environmental impacts particularly regarding water quality and waste management.
- There is an existing piece of land for building the beach facilities and the area of reclamation required can be minimised.

Environmental dis-benefits

- There are potentially more trees to be affected due to the use of existing private land.
- Diversion of lower course of Lo Tsz River causing impacts on the stream (naturalness and ecological significance to be confirmed during detailed survey) cannot be avoided, but no unacceptable impacts will be anticipated due to the small scale of the works.
- Beach facilities are close to village houses causing potential air, noise and visual impacts, but no unacceptable impacts will be anticipated due to the small scale of the works.

ii. Shuen Wan

Environmental benefits

- It is sited away from the Yim Tin Tsai East FCZ

Environmental dis-benefits

- It is sited in the proximity of Ting Kok SSSI and Shuen Wan Egretry SSSI, as well as the mangrove habitat. The SSSI and mangrove habitats are potentially affected due to the construction and operation of the Proposed Beach Development.
- More reclamation is required, so that there is greater potential for environmental impacts particularly regarding water quality and waste management compared with Lung Mei.

- Diversion of lower course of Shuen Wan River is required and potential impacts on stream (naturalness and ecological significance to be confirmed during detailed survey) cannot be avoided.
- Beach facilities are close to village houses causing potential air, noise and visual impacts, but no unacceptable impacts will be anticipated due to the small scale of the works.

iii. Sha Lan

Environmental benefits

- The bathing beach location is well sited away from the Ting Kok SSSI, as well as the mangrove habitat.
- Diversion of stream/ river is not required, therefore no impacts on natural stream.

Environmental dis-benefits

- It is close to the Sam Mun Tsai Egretry SSSI, Yim Tin Tsai & Ma Shi Chau SSSI, Ma Shi Chau Special Area and Yim Tin Tsai East FCZ. The FCZ is potentially affected due to the construction and operation of the Proposed Bathing Beach Development.
- More reclamation is required, so there is greater potential for environmental impacts particularly regarding water quality and waste management compared with Lung Mei.
- Provision of additional or enhancement of transportation access including road upgrading and provision of longer sewer connection (to local sewer) would be required. Impacts on terrestrial ecological resources will be comparatively larger.
- Beach facilities are close to village houses causing potential air, noise and visual impacts, but no unacceptable impacts will be anticipated due to the small scale of the works.

The key environmental concerns of the site comparisons are the extent of reclamation and dredging which will be unavoidable to induce water quality, marine ecology and fisheries impacts. With consideration of the extent of dredging and reclamation, proximity of sensitive receivers such as Yim Tin Tsai East FCZ, provision of additional transport infrastructure and potential impacts (particularly water quality, waste management, marine and terrestrial ecology, and fisheries) to the environment, Lung Mei is considered to be the most suitable site for the proposed beach development in Tai Po (*Table 2.3*). Although the beach facilities will be located close to village houses causing potential air, noise and visual impacts, no unacceptable impacts will be anticipated due to the small scale of the works and with the implementation of good construction practices.

In summary, Lung Mei is considered to be the best location for the proposed beach development, which is located next to the existing road (Ting Kok Road) and at the sea front and having the least environmental impacts as discussed above. It should be noted that with the 60% sewerage connection rate and the gazette of the Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94), as part of the Sewerage Master Plan Works for Tolo Harbour Catchment, prior to the operation of the Proposed Beach Development, the water quality in the Lung Mei region will be improved and guaranteed. In addition to serving swimmers during the bathing season, the beach at Lung Mei can also provide all year round recreational ground for non-swimmers, ie playing in the sand, sunbathing and other beach activities. Consequently the Proposed Beach Development at Lung Mei would complement the existing amenity facilities and further diversify the recreational activities in the Tai Mei Tuk area.

Table 2.3: Comparison of Likely Overall Environmental Impacts on the Three Potential Sites

	Lung Mei	**Shuen Wan**	**Sha Lan**
Environmental Benefits and Dis-benefits			
Estimated Reclamation Size	Approximately 1 ha	Approximately 2 ha(1)	Approximately 2 ha(1)
Extent of Dredging	Approximately 5 ha and 10,000m^3	Approximately 5 ha and 10,000m^3 (2)	Approximately 5 ha and 10,000m^3 (2)
Distance to -			
Plover Cove Country Park	Approximately 350m	> 2km	> 2.3km
Ting Kok SSSI	Approximately 500m	< 40m	Approximately 700m
Shuen Wan Egretry SSSI	Approximately 2km	< 10m	< 300m
Sam Mun Tsai Egretry SSSI	Approximately 1.7km	Approximately 1km	Approximately 650m
Yim Tin Tsai & Ma Shi Chau SSSI	Approximately 1.2km	Approximately 1.9km	Approximately 1.4km
Mangrove Habitat	Approximately 500m	< 40m	Approximately 700m
Ma Shi Chau Special Area	Approximately 820m	Approximately 1km	Approximately 1km
Yim Tin Tsai East FCZ	Approximately 1.5km	Approximately 1.5km	Approximately 1km
Conservation Area	Approximately 400m	> 2km	> 2.5km
Requirement of diversion of stream/ river	Yes, lower course of Lo Tsz River	Yes, lower course of Shuen Wan River	No
Requirement of additional/ enhancement of transportation access longer sewer connection	No	No	No
Likely Environmental Impacts			
Air Quality	Low	Low	Low
Noise	Low	Low	Low
Waste	Low	Moderate	Moderate
Water Quality	Low	Moderate	Moderate
Terrestrial Ecology	Low	Negligible	Low
Marine Ecology	Low	Moderate	Moderate
Fisheries	Low	Low	Moderate
Landscape and Visual (including tree felling)	Low to Moderate	Low	Low
Overall Likely Environmental Impacts	**Low**	**Low to Moderate**	**Low to Moderate**

Note:

1. Reclamation sizes of Shuen Wan and Sha Lan sites are estimated by provision of same carpark and beach building size as at Lung Mei site, taking into account any available existing land for the development.
2. Dredging extents and volumes of Shuen Wan and Sha Lan sites are estimated under an assumption that their dredging depth and beach size will be very similar as Lung Mei site.

2.4 Consideration of Alternative Design

The feasibility of following alternative designs has been investigated in this Assignment as discussed below for the preferred option at Lung Mei. In addition, the design and construction of each element of the works were considered in light of construction methods and sequencing of works:

2.4.1 Option Layout

Option Layout Assessment during Feasibility Study

4 options of the bathing beach configuration at Lung Mei have been investigated in the Feasibility Study and are shown in *Appendix A*. The option layouts were developed to study different orientations of car park, beach building, seawall requirements, etc in order to facilitate the beach users, reduce construction cost and minimise the environmental and engineering impacts. An option evaluation was also carried out on each layout and its location, which were based on the following criteria:

- Utilisation of beach area and facilities
- Extent of sand filling work on the seaward
- Sand stability control
- Construction cost
- Impacts on environment
- Air pollution to beach users
- Traffic circulation
- Channelisation of natural stream and maintenance.

Considering the various pros and cons of each option as shown on *Table 2.4*, it was recommended that Option 1 would be adopted for further investigation and development. From Option 1, the car park site and beach building were shifted eastward to avoid decking over the Lo Tsz River. The final recommended beach layout in feasibility study stage is shown on Figure 3.5 of *Appendix A*.

Table 2.4: Evaluation of Beach Option Layouts Proposed during Feasibility Study

Review on	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Utilisation of beach area and facilities	As the car park sets back from the beach area, a longer waterline is provided, this may be of interest from recreation point of view. Eastern half of parking area to be probably occupied first, as it is closer to the facilities house and the beach area. Longer walk is required for other users coming late.	The car park is close to the main beach area. It is more convenient for beach users. As compared to Option 1, the facilities house has a longer distance to the main beach area. Also a shorter waterline is provided.	The car park is split into two portions and the facilities house is located at midway between the two parking areas. It is convenient for beach users to park their cars and access to the facilities house. The facilities house is close to the main beach area; however, a shorter waterline is provided as compared to Option 1.	Two rows instead of four car pots are provided. This provides more usable beach area, and results in a long waterline. Eastern half of parking area to be probably occupied first. Longer walk from west of the car park area for other users coming late
Extent of sand filling work on seaward	Approximate 2,000m^2	Approximate 4,000m^2	Approximate 4,000m^2	Approximate 2,000m^2
Sand stability control	Better because of presence of revetment or groyne.	Wave turbulence likely created at southeast corner of car park resulting in local scouring and increasing the loss of sand. A groyne may be required to overcome this situation.	Same as Option 2	A groyne likely to be required to prevent the loss of sand.
Construction cost	Moderate; groyne construction is required.	Expensive because of seawall construction and either regular replenishment of sand or provision of a groyne.	Same as Option 2	Cheaper
Impact on environment	Construction of car park decking close to the SSSI and wetland	A longer distance to the SSSI and wetland.	Same as Option 2	Same as Option 1
Air pollution to beach user due to traffic at Ting Kok Road	Poor because sand area close to Ting Kok Road	Better because of car park area and the facilities house shifted away the Road.	Same as Option 2	Same as Option 2
Traffic control	Better traffic circulation flow inside car park. Alternative route available for diversion traffic flow if one of the routes is blocked.	Same as Option 1	Same as Option 1 but increase in junctions of car park exit and entrance interface the traffic flow at Ting Kok Road.	Poor traffic circulation inside car park.
Channelisation of natural stream and maintenance	A section of some 35m long channel will be decked. Maintenance of the decked channel may be of concern.	Channel will not be decked.	Same as Option 2	Same as Option 1

Option Layout Assessment during Investigation Stage

The option layout for this Assignment is developed based on the recommended option in the Feasibility Study. Although the requirements of the bathing beach development specified in this Investigation Stage have been revised, which resulted in the change of configuration for the car park, building facilities and beach layout, the proposed outcome conclusion is similar to that expressed in the Feasibility Study.

The current requirements are to provide a minimum beach area of 6,000m^2 above the higher water mark for a maximum of 4,000 bathers at peak period, a parking area for 100 cars, 10 motorcycles and 3 coaches and beach building facilities. The proposed layout of the beach facilities are shown on *Figure 2.4*.

A review on the location of the proposed bathing beach layout has been carried out to consider the alternative of locating the proposed beach further to the west, east and south as follow:

Option A: Shifting the Bathing Beach towards the West of its Existing Location

Option B: Shifting the Bathing Beach towards the East of its Existing Location

Option C: Shifting the Bathing Beach towards the South of its Existing Location

A comparison of the Preferred Options with Options A, B and C has been carried out and shown on *Table 2.5*. It shows that the current layout location is the comparatively preferable in terms of environmental impact, cost impact and technical viability, whilst meeting the design requirements. It should be noted that the lower course of Lo Tsz River has been modified in certain extent (details refer to *Section 8*) and subject to tidal influence. The impacts on the environment due to reclamation is considered to be more significant compare with the diversion of lower course of Lo Tsz River, and therefore the Preferred Option is selected which minimised the reclamation area. Moreover, the current proposed location is remote from the Fish Culture Zone at Yim Tin Tsai (East), thereby minimising potential conflicts with fishermen. By selecting the current site at Lung Mei impacts to these ecologically and conservation sensitive areas have been minimised.

Table 2.5: Comparison of Layout Options During Investigation Stage

Considerations	**Preferred Option**	**Option A (West)**	**Option B (East)**	**Option C (South)**
Environmental Issues				
Extent of Reclamation	Approximate 1.02ha	Similar to the Preferred Option	Greater than the Preferred Option (could be up to around 40% more)	Greater reclamation area than the Preferred Option; (could be up to around 50%) Longer groynes to be required to ensure shoreline stability
Extent and Quantity of Dredging	Approximate 5 ha and 10,000 m^3	Extent similar to the Preferred Option; Dredging quantity to be larger than the Preferred Option due to shallow water at the west	Extent and quantity similar to the Preferred Option	Extent and quantity to be more than the Preferred Option, as there is a sudden level drop further out the sea.
Sandfilling requirement	Approximate 37,500m^3	Slightly less than the Preferred Option	Slightly greater than the Preferred Option due to deeper water at the east	Greater than the Preferred Option due to deeper water at the south
Distances from Environmental Sensitive Receivers	About 500m from the Ting Kok SSSI; About 400m from Conservation Area	Closer to the Ting Kok SSSI and away from Conservation Area compared with the Preferred Option	Away from the Ting Kok SSSI but closer to Conservation Area compared with the Preferred Option	Similar to the Preferred Option but comparatively closer to the Fish Culture Zone
Impacts on Trees	157 trees identified within the Project site and 119 to be affected	More trees to be affected due to occupation of the existing private land	Affected trees to be slightly less than the Preferred Option	Similar to the Preferred Option
Impacts on the estuary of Lo Tsz River	No works	Decking of the Lo Tsz River required	No diversion works of Lo Tsz River	Similar to the Preferred Option
Impacts on the existing infrastructures	One existing box culvert to be affected, requiring drainage diversion works;	Similar to the Preferred Option	Extensive impacts on the existing box culverts, other drainage outlets and the existing seawall, which will require modification or diversion works	Similar to the Preferred Option
Land Resumption	Approximately 1ha	More private land resumption required	Slightly less than the Preferred Option	Similar to the Preferred Option
Impacts on marine facilities and transportation	12 existing mooring buoys to be affected	Similar to the Preferred Option	Numbers of the affected existing mooring buoys similar to the Preferred Option; Conflict with and limiting the existing leisure activities	More existing mooring buoys to be affected; Closer to the existing activity zone designated by the Tai Mei Tuk Water Sports Centre
Overall Construction Cost	N/A	Higher than the Preferred Option	Higher than the Preferred Option	Higher than the Preferred Option
Preferability	**Preferred Option to achieve a balance with different considerations**	**Not Preferred due to encroaching into the Ting Kok SSSI and decking required at Lo Tsz River**	**Not Preferred due to involving greater reclamation, extensive modification/diversion works for the existing box culverts and seawall with significant potential environmental impacts during construction**	**Not Preferred due to greater reclamation area required, as well as longer groynes and larger site boundary. Minimising reclamation is one of the key requirements of this Project**

Furthermore, several configurations of the proposed beach, carpark and building layout have been investigated, in order to identify an optimal solution to fulfil all the environmental and engineering requirements as listed below:

Several configurations of the proposed beach, carpark and building layout have been investigated, in order to identify an optimal solution to fulfil all the environmental and engineering requirements as listed below:

- Hydrodynamic Analysis

This was carried out for the proposed groynes and beach profiles to study their stability and recommend a suitable beach orientation, which would minimise sand loss, long-term sandfilling maintenance requirements and optimise the proposed groyne lengths.

- Optimisation of Land Uses

The studies were carried out to minimize the overall reclamation requirement with consideration of the following development scenarios:

– The level of the car park and ground compound of the proposed bathing beach facilities and administration building is restricted by matching in with the existing level of Ting Kok Road. The general road level of Ting Kok Road connecting the car park is from around +5.8mPD (east of project site boundary) to +6.6mPD (west of project site boundary) with the road level at the car park entrance at around +6.3mPD. Therefore, with a slight gradient for drainage and kerb height, a general level of +6.6mPD has been set for the level of the beach buildings.

– There was an agreed requirement to maintain a buffer zone of 10m between the beach building and the high water mark at extreme storm conditions of 1 in 100 years, maintaining a beach level at +4.6mPD. However, this would have meant a larger reclamation area and increased area for the bathers at high water mark conditions. This requirement was subsequently reduced to a modelling of a design wave condition for a 1 in 20 years return period and it was ascertained that under this condition an area of 6,000m^2 above the high water mark (HWM) was achieved. This also reduced the length of the groynes.

– With the 1 in 20 years return period, the top level of the beach at equilibrium will be at +3.8mPD while the mean higher high water level at the project site is +2.0 mPD. Moreover, the proposed beach will provide an area of 6,000m^2 above HWM to accommodate 4,000 beach goers in the peak season. In addition, the minimum clearance of 10m between the high water level and beach building will be maintained at about +3.1mPD, which corresponds to 1 in 4 years return period.

– A decked car park was proposed, thereby reducing the footprint of the parking area but this option was not preferred as it would have an increased visual impact. Conversely, most of the beach buildings are located towards the beach, away from the Ting Kok Road, which will introduce fewer disturbances to the environment. In addition, the proposed car park has to be designed to accommodate manoeuvrings of coaches around the car park as they require a large turning cycle.

- The distances between buildings for the Proposed Beach Development were limited to the requirement of the Fire Services Department for EVA, which is 6m minimum.

- Designing the buildings closer together or align them side by side, such as the gents and ladies changing rooms and toilets. However, this would limit the circulation movement for the bathers inside the changing rooms and also limit the movement of bathers on the paved areas going to and fro from the east side of the beach and the car park. Therefore this was not preferred.

- The building for the equipment / machinery stores for catamarans, motorized boats and beach transporters had to be situated close to the centre of the beach paved area, as this would be the ideal location for emergencies within the beach area.

- Minimisation of Dredging

To minimise the environmental impact, the removal of large quantities of sediment had to be avoided. Therefore, a minimum of 500mm depth of sediment removal has been proposed, so as to remove all boulders, cobbles, stones and silty material within the proposed beach area prior to sand filing. The above materials and debris are required to be removed as they may be exposed during seasonal changes of the beach profile and platform, which would be dangerous to the beach users. Moreover, the proposed dredging depth at the groynes is around 0.5m to 1m for the levelling of the groyne foundation which is essential for the groyne stability and safety of the beach users.

Therefore, in light of the above, it is considered that the present arrangement and layout is the most optimal in terms of environmental impact, cost impact and technical viability, whilst meeting the requirement of the LCSD and the Brief.

2.4.2 Road Access

Different scenarios of ingress/egress to the proposed car park have been investigated and it is considered that the current arrangement best suits the site constraints and requirements. The proposed ingress/egress is constrained by the requirement of the Transport Planning Design Manual, where it states that new access should be situated at least 40m away from existing accesses on the near or far side of the road. Therefore, as there are two existing accesses leading from Lo Tsz Tin village, the current access layout is the most preferred.

On the west side, there is the existing Lo Tsz River. The development has been designed to avoid encroaching into that area as much as possible for environmental reasons. However, there will be a proposed culvert, at the upstream end of Lo Tsz River where it meets the Ting Kok Road, designed as a transition to connect the existing culvert and the proposed open channel with gabion baskets. The paved area above the proposed culvert will allow a footpath to be constructed there. On the other hand, at the east side of the beach development, there is an existing bus layby and the beginning of an existing retaining wall, retaining the Ting Kok Road, which the development was designed to avoid as this could have meant the demolishing of the retaining wall and therefore, would affect the construction duration and cause disturbance to the public. The overall road access configuration was designed in light of the constraints above and is shown on *Figure 2.4*.

It is envisaged that the construction method for the road works will be conventional; however, 4 stages of temporary traffic arrangement are anticipated to complete the roadworks, drainage, sewerage and utilities works.

2.4.3 Open Channel with Gabion Embankments at Western End of Bathing Beach

To comply with the clause 5.3.2 under Chapter 10 of the Hong Kong Planning Standards and Guidelines, that no discharge outlets for effluent disposal should be located within 100m of any gazetted beach, there is the need to divert the flow from the existing culvert, at the western section of the bathing beach development. Therefore, different designs for the diversion were studied, such as a 6.8m rectangular diversion channel that was proposed in the feasibility study, a culvert and a trapezoidal reinforced concrete channel. However, in accordance with the Technical Memorandum on EIA process (EPD, 1997), the general policy or approach for mitigating impacts on natural streams/rivers is in the order of priority, avoidance, minimisation and compensation, therefore, an open channel with gabion embankments is proposed as shown on *Figure 2.5*.

Planters will be provided along the top of the gabion embankments to mitigate visual impacts from Ting Kok Road and to re-creat a greening environment of the existing Lo Tsz River. The option of providing more planters on the gabion steps has been considered. However, it may affect the drainage performance but planters on the top of the embankments are adopted.

It is anticipated that the sheet piling as temporary works for the gabion channel will be carried out using a silent piler, to minimise the construction noise impact. In addition, the construction of the gabion baskets for the channel wall and channel bed will be mostly manual and therefore be more environmentally friendly than the conventional reinforced concrete open channels.

2.4.4 Culvert at Eastern End of Bathing Beach

As discussed in *Section 2.4.3*, the culvert at the east side of the beach development had to be diverted as well in order to comply with clause 5.3.2 under Chapter 10 of the Hong Kong Planning Standards and Guidelines. We have looked at the preliminary design carried out in the feasibility study and consider that the proposal of constructing a culvert within the carriageway will slow down the progress of construction. Therefore, we propose to reprofile the existing culvert at the outlet and divert a new culvert with a right angle turn to the east by around 90m and parallel with the existing sea wall as shown on *Figure 2.6*.

This proposal will not necessitate the digging up of the existing road and therefore, avoid longer and more extensive temporary traffic management periods as well as reducing the dust and noise impacts. To ease construction difficulties and minimize the environmental impacts, we propose that the box culvert be constructed as pre-cast and cast in-situ segments and therefore the pre-cast segments can be lifted onto the coast from the Ting Kok Road.

2.4.5 Design of Groynes

The preferred groyne layout option include two rock armour groynes comprising a western groyne length 100m and an eastern groyne length 120m, both from the building line as shown on *Figure 2.7* to protect the proposed sandy beach. The design beach to be constructed consists of a 1:12.5 upper slope above +2.0mPD and 1:15 below, with the beach recharge offshore of the natural step consisting of a 1:25. The crest height of beach at design is +4.6mPD and the height of groyne at crest is also +4.6mPD for 5m and then basically falls towards the sea at 1 in 25 as shown on *Figures 2.8 and 2.9*. The groynes are designed to retain the beach sand, with the sand profile at construction as shown on *Figures 2.7* to *2.9*. During the natural course of events; the beach will reach an equilibrium profile, also shown on *Figures 2.7* to *2.9.*

The proposed groynes will be constructed with a primary rock armour layer and a rock fill core as shown on *Figure 2.10*. To enhance the landscaping areas within the Project site, a planter is proposed on each groyne with minimum dimensions of 1.5m (H) x 1.5m (W). The proposed arrangement of the groyne and planter is also depicted on *Figure 2.10*.

Apart from the preferred beach layout, other options for increasing the groyne lengths have also been examined. Two other options were to have the groynes (both east and west groynes) extended to 135m as well as 180m to the sea, so that the beach material at the toe of the beach slope would be less susceptible to movement under extreme storm conditions. However, this would increase the construction quantities, which would not be justified in consideration of environmental and cost impacts for a longer groyne as well as more dredging and sand filling required.

In addition, wave and sediment modelling was conducted for the above scenarios as presented in *Appendix B* and it was demonstrated that the beach material would basically be retained by the groynes for the preferred layout scheme, due to the current location of the beach.

Other options for the groyne construction were investigated, such as concrete blocks and timber. However, rock armour was chosen as it would be simpler and more natural in appearance. Armour rock will be more ecological beneficial and require little or no maintenance.

It is anticipated that the groyne construction will commence prior to the sand filling. The west groyne will most probably be constructed first. Dredging for the groyne would be carried out by land plants for locations above the low water mark, whereas a grab dredger will dredge the seabed for the groyne below the low water mark. The placing of sand is expected to be carried out using a backfilling barge with a conveyor belt, most probably from west to east.

2.5 Consideration of Alternative Construction Methods and Sequence of Works

2.5.1 The basic construction methods were discussed in *Section 2.4*; however, the following alternative construction methods were also looked into:

- Silent piler for the installation of sheet piles as temporary works in the construction of the gabion channel and for deep excavation for drainage works was proposed to reduce the noise impact;

- Pre-cast sections for the lower half of the culvert at the east end of the beach, to minimise temporary traffic management as well as noise, dust and material (formwork) on site. The duration of the construction works could also be reduced;

- Precast concrete units for the retaining walls for the boundary of the car park and bathing beach building to minimise noise, dust and material on site. The duration of the construction works could also be reduced;

- Gabion baskets are used for the channel diversion at the west end of the bathing beach, and therefore less construction plants will be used for the channel wall and bedding. This will reduce the construction noise impact as well as material used on site.

- The justifications for dredging are addressed in Section *2.4.1*. All dredged material is proposed to be disposed by sea (either to South Cheung Chau dumping ground or East Sha Chau mud pits subject to the results of sediment testing) and thereby reducing the land transport by trucks; and

- It is proposed to use the existing rocks on site for the gabions and groyne construction if the specifications of the rocks are met.

2.5.2 During the construction phase, the estimated quantities have generally been reduced since the feasibility stage for the overall construction works, which was due to alternative construction designs and revising some of the requirements of the *EIA Study Brief*, as shown below:

i. Estimated quantity of land-based excavated materials is summarised below:

Description for Construction Works	**Volume (m^3)**	
	Excavation	**Demolition**
Building & Landscaping	800	10
Works along Ting Kok Road (including local road widening, drainage, sewerage, watermain & utilities connections)	600	450
Works at Carpark (including drainage & sewerage works, and carpark formation)	4,000	-
Vertical Seawall/Retaining Wall	2,000	-
Western Drainage Channel (1) (i.e. Open channel and box culvert)	4,500	10
Eastern Box Culvert (1)	1,900	-
Total	**13,800**	**470**

Note 1: Construction of the proposed western drainage channel and eastern box culvert will be carried out above high water mark (HWM) and therefore considered as land-based construction activities. No dredging will be required for the proposed drainage diversion works.

It has been estimated that about 60% of the above land-based excavation can be reused, that is around 8,280 m^3.

ii. Estimated Dredging Quantities:

- Dredged plan area is approximately 5.0ha.
- Dredging volume for the seabed, groynes and seawall is 10,500m^3.

iii. Estimated Reclamation Area for the overall development is about 1.02ha (or 10,200m^2**)** and comprises the following:

Description	**Reclamation Area (m^2)**
For bathing beach area	9,500
For groynes	700
Total	**10,200**

iv. Estimated Rocks and Filling Quantities:

Marine Works

Description	**Volume (m^3)**	
	Rock/Rockfill	**Sand Fill**
Beach Construction	-	37,500
Groyne construction		
• Armour layers	3,000	-
• Rockfill core	1,600	-
Total	**4,600**	**37,500**

Land Works

Description	**Volume (m^3)**		
	Rock/Rockfill	Granular Fill /Aggregates	Soil /Sand Fill
Carpark & Beach Buildings			
• Backfill of retaining wall*	-	-	21,000
• Building construction	-	-	100
• Sub-base of carpark	-	2,000	-
Western Drainage Channel			
• Foundation of box culvert	40	-	-
• Rip-rap bedding of open channel	300	-	-
• Gabion embankments	1,400	-	-
• Armour layers at outfall	120	-	-
• Rockfill slopes at outfall	120	-	-
• Backfill of box culvert and embankments	-	-	1,900
Eastern Box Culvert			
• Foundation	800	-	-
• Backfill of box culvert	-	900	-
• Filling of Planter Wall	-	-	600
• Sandfill for temporary excavation	-	-	600
Works along Ting Kok Road			
• Sub-base for local road widening	-	400	-
• Drainage, sewerage and utilities	-	-	500
Total	**2,800**	**3,300**	**24,700**

Note: * Land formation for the proposed carpark and beach building.

v. GFA of new building/structure according to Building Ordinance = 2,245m^2.

2.5.3 The sequences of works for the construction works.

The comparison of different sequence of works, together with the environmental benefits and dis-benefits are presented in *Appendix C1*. The following sequences of works are discussed;

1. Site Formation for Car Park & Beach Building Area
2. Road Widening, Roadworks, Utilities, Drainage and Sewerage Works
3. Groyne Construction, Dredging and Sand Filling

The preferred sequences of works for each element of construction works are presented in *Appendix C2* and summarised below:

1. The construction of ramp, staircase, vertical seawalls, retaining walls and their foundations.
2. Construction of beach buildings and their foundations
3. Construction of paving area for car park.
4. Road pavement construction (this work will be carried out concurrently or in stages with the construction works for utilities, watermain, drainage and sewerage):
    - 4.1 Construction of new sewage pipeline and manholes
    - 4.2 Construction of new drainage pipeline gullies
    - 4.3 Laying of watermains and utilities
5. Construction of western box culvert.
6. Construction of western drainage open channel.
7. Construction of modification works on existing box culvert
8. Construction of 90m long eastern box culvert.
9. Groyne construction.
10. Dredging and sand filling.

2.6 Selection of Preferred Scenario

The current Project site is situated along the existing coastline of Ting Kok Road and opposite to the Lung Mei Village at Tai Po. Part of the original proposed site is vegetated with grass, shrubs and trees; however, the other part comprises of an existing sandy beach assessable from the southbound of Ting Kok Road. There are no residential dwellings at the proposed beach site and the general environment of the existing beach is very pleasant, with Ma Shi Chau to the south and the picturesque Pat Sin Country Park towards the north.

The existing site area above high water mark (HWM) is about $8000m^2$. The beach water is very shallow over a long distance from the current high water mark. However, based on the Wave and Sediment Modelling Report, the normal wave condition at Lung Mei area is considered as very mild. Our study concluded that the proposed bathing beach location and layout would be less susceptible to erosion due to surge overwash and longshore sediment transport, such that the sediment transport and siltation under the influence of environmental forces during the operational phases will be minimal.

Moreover, the present site location (at Lung Mei) is ideal in consideration of environmental factors as discussed in *Section 2.3* (including minimised extent of dredging and reclamation, and located away from sensitive receivers, including Ting Kok SSSI and FCZ), and which will complement and be conveniently located to the existing facilities/activities in the Tai Mei Tuk area. Given the discussion in *Sections 2.4 & 2.5*, the proposed construction method and sequences of works, detailed in *Section 3*, are the preferred scenario that will maximise environmental benefits and minimised adverse environmental effects arising from the Project.

3 PROJECT DESCRIPTION

3.1 General

The proposed development of the bathing beach at Lung Mei, Tai Po was established under this Assignment, through liaison with ArchSD, LCSD and CEDD. The current development layout and arrangement has been selected through critical review of key issues such as traffic, road safety, drainage impacts, sewerage impacts, beach building facilities, topography, marine, environmental impacts, reclamation, current and future development and design standards.

3.2 Land Formation for Car Park and Beach Building

The current land area opposite Lo Tsz Tin, south of Ting Kok Road, where the car park and beach building are to be located on are basically at the correct formation level and therefore, to completely form the land for the above facilities, there will be a need of around 21,000 m^3 backfill material. The backfill will mostly come from outside sources but around 8,300 m^3 will be available from within the site, which will mainly come from the insitu material in constructing the eastern box culvert and for the western drainage channel.

3.3 Traffic

The proposed Lung Mei beach facilities and carpark area will be accessible off Ting Kok Road. A single ingress/egress point will be provided. The proposed works involve local road widening, construction of drainage and sewerage pipelines and laying of utilities along the existing Ting Kok Road in the vicinity of the Project site. Therefore excavation works will be required along the existing Ting Kok Road. However, to minimize interruption to traffic flow, temporary traffic management will be implemented during the construction stages as discussed in *Section 2.2.2*.

Based on an estimate of the quantities of sand, public fill and other construction materials and equipments required for the construction of this project, and taking into consideration that some of the construction materials would be transported to the site by barge, it has been estimated that the maximum construction traffic generated by this project would be about 50 trucks per day each way.

3.4 Proposed Drainage Diversion Works for Lo Tsz River

The downstream of the existing Lo Tsz River is proposed to be diverted to the west of the Project site by about 70m. The diversion scheme comprises a 3.7m wide drainage channel and a reinforced concrete box culvert, which will function as a transition for connecting the existing box culvert and the proposed drainage channel. The drainage channel is proposed to be formed with sloping gabion embankments and rip-rap bedding. The proposed open channel is approximate 59m long with 5 layers gabion baskets. To enhance the environmental values and mitigate visual impact from Ting Kok Road, an L-shaped wall is proposed on top of the gabion baskets to provide additional spacing for vegetation. Moreover, a minimum 2 layers of Type IV rock amours are proposed at the channel outfall for scour protection. The landscape issues along the proposed gabion channel will be discussed in *Section 10*.

3.5 Proposed Drainage Diversion Works for Existing Box Culvert

The existing single cell box culvert at Lung Mei is proposed to be diverted with a right angle turn to the east by around 90m. The proposed diversion works include construction of a reinforced concrete box culvert, and also the re-profile of a section of the existing box culvert invert level with concrete.

To consider the visual impact from Tai Mei Tuk, the finishing of the proposed eastern box culvert will be consistent with its adjacent vertical seawall. Moreover, additional planting area is proposed on the top of box culvert to enhance the environmental aspects of the works.

For ease of construction and minimize the environmental impacts, the box culvert is proposed to be constructed as pre-cast and cast in-situ segments with toe protection along the proposed culvert.

3.6 Other Proposed Drainage Works

Seven existing gullies in the proximity of Lo Tsz Tin are proposed to be re-constructed for local widening of Ting Kok Road.

A separate stormwater drainage system is proposed within the beach carpark. The proposed system comprises a petrol interceptor in compliance with EPD regulations, and a pipeline with diameters varying from 375mm to 750mm. The collected runoff within the carpark is proposed to be finally discharged to the sea through the proposed box culvert at Lo Tsz River.

3.7 Sewerage Works

It is proposed to collect all sewer and wastewater flow from the beach development. There will be 4 foul sewer manholes and one sewage holding tank proposed with a proposed sewer of 225mm diameter that will be aligned across the car park, across the existing Ting Kok Road and eventually connect to the existing trunk sewer by tapping into an existing foul sewer manhole.

3.8 Preliminary Design of Beach and Groyne Structures

The most appropriate orientation of the beach and groyne structures has been determined from mathematical modelling. The design beach profile has also been determined from modelling studies that examined the beach response to normal and storm wave conditions. From current assessment of grain size for the available beach sand sources and with reference to relevant design guidelines, the proposed designed slope of the beach will be constructed consisting of a 1:12.5 upper slope above +2.0mPD and 1:15 below, with the beach recharge offshore of the natural step consisting of a 1:25, as shown on *Figures 2.8* and *2.9*.

A wave modelling was carried out to assess the storm response upon a design construction profile and a design equilibrium profile. The sediment sizes used for the modelling were focused upon 0.4mm (although grain sizes of 0.2mm, 0.3mm and 0.5mm were also modelled) as this had been identified as the most probable sediment size to be used, which is an average representative of the random sieve analysis taken from samples taken from beaches in Hong Kong in late 2006, namely Lung Mei, Tai Po, Lower and Upper Cheung Sha Beach, Lantau Island, Golden Beach and Ping Chau Beach. However, Fill Management Division of CEDD has confirmed that sand sources from Hong Kong SAR should not be considered on environmental and political grounds. Therefore, sand sources from outside Hong Kong SAR should be investigated in the detailed design stage.

Sand source distributors for the proposed beach have been contracted and it was ascertained that sand sources of D_{50}, from 0.2mm to 0.5mm, are currently available from Haikou, Hainan Province, NanSha, Guangdong Province, and Weihai, Shangdong province in Mainland China, as well as in Vietnam. However, the above distributors will not provide any particle size distribution results until they receive confirmation of any sand order, which should be further investigated in the Detailed Design stage. The sand source distributors understand the requirements specified in the WBTC 10/95 & WBTC 10/95A for the importation of sand from Mainland China by barges.

Notwithstanding the above, it is understood that the sand source for the Cheung Sha Replenishment in Lantau Island during the period from late 2006 to the first quarter of 2007 have been acquired from Zhujiang estuary (Shajiao) in Mainland China. Port Works Division of CEDD has also recently completed some sand replenishment works at Peng Chau where the sand was sourced from Ma Wan and Zhujiang estuary (Shajiao), Mainland China.

The sand quality will be based on similar requirements in respect to sand for a recreational beach as set out in Section 3.6 of the Port Works Design Manual: Part 5 – Guide to Design of Beaches and shall comply with the requirements as promulgated in WBTC No. 10/1995.

It has been ascertained that the required sand fill required for beach is 37,500m^3 of sand.

The extreme wave conditions established by the modelling studies were used to determine an appropriate armour rock size, beach crest height, and groyne cross-section. Therefore, there will be two rock groynes, one 100m on the east and the other 120m on the western end of the beach. The groynes will be protecting the bathing beach using natural rock armour construction. It is anticipated the recharging of the beach with sand and the groyne construction under low water mark will be carried by marine based plant and equipments.

During the construction works, there will be a silt curtain to minimise the water quality impact due to the sand filling and dredging works.

Finally, at the operation stage, there will be a shark prevention net at the perimeter of the bathing beach, surrounding the toe and side of the beach.

3.9 Beach Layout

The proposed orientation of the beach is aligned at 145^{o} to the north and the wave and sediment modelling results presented in *Appendix B* shows that the net longshore drift of the sediment is not significant (10 to 150m^{3} per year) for sediment sizes of 0.25mm, 0.3mm and 0.5mm. However, with the groynes in position, the sediment will eventually drift towards the western groyne and in general be contained by the groynes as shown on *Figures 2.7* to *2.9*. In addition, there is no significant problem with cross-shore sediment movement under storm wave conditions. Therefore, no sand loss is anticipated for the proposed bathing beach and as such, no environmental impact would be induced on the adjacent environmental sensitive areas.

Therefore, under the operational phase of the beach development, the two groynes at either end of the beach will contain the small net drift amount that has been identified in the wave and sediment modelling results presented under *Appendix B*. Consequently, the assessment demonstrated that there will be no ecological impacts to the environment, in particularly the SSSI on the west of the Project site and those corals identified in the EIA study.

3.10 Beach Building Facilities

The bathing facilities for this development have designed by ArchSD and will mainly consist of 3 building structures as discussed below and shown on *Figure 2.4*:

- There will be a one level building near the Ting Kok Road and it will comprise of the male changing rooms, toilets and shower rooms, this will also include all the associated E&M facilities. It will have a terrace roof planted with trees. This building will also accommodate the refuse collection point ;

- The other two structures will be adjacent to the beach, facing the sea. The building on the eastern side will have one level, which will comprise of the family and female changing rooms, toilets and shower rooms; this will also include all the associated E&M facilities. Outdoor shower facilities will be situated at the side of this building; and

- The third building on the west will basically be a two storey structure, which will comprise of the ancillary facilities including management office, lookout/surveillance post, first aid room, solar water tank & pump room, fire services tank room, water tank room, fast food kiosk, etc. It will also have equipment / machinery stores for catamarans, motorized boats, beach transporters, beach cleansing and sand levelling machines, etc., as well as goods stores. A sun shading will be situated at the west of the building to accommodate a seating area.

A Category 5 (Substances Giving Off Inflammable Vapour) dangerous good (DG) store is required for storing Oil dispersant, Motor spirit, petrol, Kerosene and Lubricant for operation of machinery. In addition, lacquers, varnish and paint thinner will also be stored for painting maintenance. The DG store will be located within the administrative building at the carpark level, which can be reached directly by DG vehicle for delivery of DG and by fire appliances during emergency. The storage of containerized LPG and containerized chlorine are not expected, but small quantity of bleaching solution (Sodium hypochlorite, Cat. 4 D.G.), less than 250 litres which are below the FSD exempted quantities, will be stored at beach for cleansing purpose e.g. toilet/changing room.

The Water/FS Pumps and the Mechanical Ventilation of plant rooms would be in operation for 24 hours. There are 3 numbers of pumps in the water tank room and 3 numbers of pumps in the FS pump room. Both of the pump rooms would be on Level 2 (see *Appendix I* for building elevation) and mechanical ventilation fans would be provided at each plant room.

There will also be a fee paying car park, which will accommodate 100 private cars, 10 motorcycles and 3 coaches, with drop off arrangements. In addition, there will be two lookout towers at the beach level.

Landscaping works are planned around the perimeter of the car park as well as the roof terraces above the changing rooms, along the groynes and also above the proposed culvert at the east section of the bathing beach.

3.11 Preliminary Proposed Marine Facilities

There are 38 mooring buoys for the leisure yachts, which are located in the vicinity of the proposed footprint of the beach development. For the beach operation, it was suggested to Marine Department (MD) that 12 of the existing mooring buoys should be permanently relocated as shown on *Figure 3.1*. The relocations are proposed in the vicinity of the Lung Mei waters taking into account the following criteria:

- Provision of about 50m clearance from the Shark Prevention Net, which should be sufficient clearance from the leisure yachts in light of the information provided by MD on the chain lengths attached to the buoy and will also be sufficient clearance for future maintenance of the Shark Prevention Net;
- Sufficient clearance between the leisure yachts, which are also determined according to the chain lengths of the affected buoys;
- Away from the Ting Kok SSSI as far as possible;
- Sufficient water depth for yachts access (the proposed relocation will be further confirmed with the latest sounding survey records);
- Avoid disturbances to the waterway for access to the existing landing steps at Tak Mei Tuk;
- Minimizing interfaces with the existing water sports activity area of Tai Mei Tuk Water Sports Centre (Approximate extent of the area is shown on *Figure 3.1*).

Moreover, the marine facilities arrangement proposal as shown on *Figure 3.1* will be subject to the agreement with the relevant government departments as well as to the latest sounding survey prior to commencement of the construction works.

3.12 Operation Phase

The operation phase of the Proposed Beach Development is considered as commencement of the handover date to LSCD so that the proposed measures recommended under EM&A should be carried out as appropriate after the handover. However, there may be a time lapse between the handover date and the formal opening for public use due to the application of the beach gazette by LCSD.

Furthermore, the proposed swimming area, which will be about 200m long and 200m wide, will be protected with shark prevention net located at the perimeter of the swimming area. The proposed swimming area together with a buffer zone will fall within the gazette beach boundary.

The normal beach operating hours as well as the PA system operating hours are as follows –

Period	Time	Remark
April, May, September, October	9:00 a.m. - 6:00 p.m.	Daily
June, July, August	9:00 a.m. - 6:00 p.m.	Weekdays
	8:00 a.m. - 7:00 p.m.	Saturdays, Sundays & Public Holidays
November, December, January, February, March	8:00 a.m. - 5:00 p.m.	Daily

3.13 Maintenance of Sandy Beach

As discussed in *Section 3.9*, the arrangement of the beach groynes will prevent any sand loss and therefore, regular sand replenishment is not anticipated. However if sand replenishment on the proposed beach is required in the future due to possible sand loss occurring after extreme storm conditions, such as the passing of extreme typhoons, it is anticipated that in such case, sand replenishment will be carried out using land plant and the sand will be placed above the mean high water level. Eventually, the beach will reprofile due to naturally occurring environmental factors such as wave actions, current movements and wind.

3.14 Construction Programme

The Proposed Bathing Beach Development will be carried out under two construction contracts. The beach buildings and associated facilities will be constructed under one construction contract, whilst the other civil engineering works will under a separate contract.

The construction works are currently programmed to commence in December 2008 and the works are scheduled to be completed within two years, exclusive of delays due to issues such as inclement weather. The programme is shown on *Figure 3.2*.

3.15 Project Interface

The Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94) will carry out works connecting the unsewered areas from Ting Kok village to Lung Mei village, which are in the vicinity of the bathing beach development. The current programme for the sewerage construction works is November 2008 to November 2010, which coincidently will be concurrent with the anticipated construction period for this Proposed Bathing Beach Development project. Therefore, it is anticipated that the construction works for Assignment No. CE 18/94 might have influence on the EIA of this proposed bathing beach, in particular the construction phase. As such, cumulative impacts from the above project, if any, will be assessed in this EIA Report. With the implementation of the sewerage connection (expect to be up to a 60% connection rate) and the gazette of the Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94) including Lung Mei area, as part of the Sewerage Master Plan Works for Tolo Harbour Catchment, the water quality at Lung Mei will be improved and guaranteed, thereby facilitating the operation of this bathing beach.

4 CONSTRUCTION PHASE AIR QUALITY IMPACT ASSESSMENT

4.1 Introduction

This section presents the assessment of potential air quality impact arising from the construction of the Proposed Beach Development at Lung Mei in Tai Po. Dust generated from the construction activities and gaseous emissions from construction plant are potential concerns during the construction phase. Representative Air Sensitive Receivers (ASRs) have been identified and control measures have been recommended to minimise the impact.

4.2 Relevant Legislation and Guidelines

4.2.1 *Air Pollution Control Ordinance* (*APCO*) and *Air Quality Objectives* (*AQOs*)

The principal legislation for the management of air quality in Hong Kong is the *Air Pollution Control Ordinance* (*APCO*) (Cap 311). Under the *APCO*, a set of *Air Quality Objectives* (AQOs) was established for seven key air pollutants (*Table 4.1*). As stipulated in *Annex 4* of the *Technical Memorandum on Environmental Impact Assessment Process* (*EIAO-TM*), the AQOs and other relevant standards established under the *APCO* should be met.

Table 4.1: Hong Kong Air Quality Objectives (mg m^{-3}) (a)

Air Pollutant	**Averaging Time**				
	1 Hour (b)	**8 Hour** (c)	**24 Hour** (c)	**3 Months** (d)	**1 Year** (d)
Total Suspended Particulates (TSP)	-	-	260	-	80
Respirable Suspended Particulates (RSP) (e)	-	-	180	-	55
Sulphur Dioxide (SO_2)	800	-	350	-	80
Nitrogen Dioxide (NO_2)	300	-	150	-	80
Carbon Monoxide (CO)	30,000	10,000	-	-	-
Photochemical Oxidants (as ozone (O_3)) (f)	240	-	-	-	-
Lead (Pb)	-	-	-	1.5	-

Notes:
(a) Measured at 298K (25°C) and 101.325 kPa (one atmosphere)
(b) Not to be exceeded more than three times per year
(c) Not to be exceeded more than once per year
(d) Arithmetic means
(e) Suspended airborne particulates with a nominal aerodynamic diameter of 10 micrometres or smaller
(f) Photochemical oxidants are determined by measurement of ozone only

4.2.2 *Other Relevant Requirements under the Environmental Impact Assessment Ordinance*

Annex 4 of the *EIAO-TM* also requires that a maximum hourly level of TSP of 500 µg m^{-3} at ASRs be met for the purpose of assessing potential construction dust impacts.

4.3 Baseline Conditions and Identification of Air Sensitive Receivers

4.3.1 Baseline Conditions

The Proposed Beach Development is located at Lung Mei in Tai Po. The area around Lung Mei is served by Ting Kok Road and a bicycle track is also provided along Ting Kok Road. Two villages, Lung Mei Tsuen and Lo Tsz Tin Tsuen, are located to the north of the Project Site. The Plover Cove Reservoir and a number of water activity centres are located at Tai Mei Tuk at a distance of about 360 m to the east of the Project Site. The population density of the area is generally low but an influx of visitors to the barbecue/picnic areas and water activity centres located at Tai Mei Tuk normally occurs during weekends and public holidays, with a significant rise in the road traffic along Ting Kok Road as it is the only roadway providing vehicular access to the above-mentioned recreational facilities. As a result, the local air quality is mainly influenced by vehicular emissions from Ting Kok Road. No other major air pollutant sources are found in the immediate area.

There is currently no Air Quality Monitoring Station (AQMS) operated by the Environmental Protection Department (EPD) in the immediate vicinity of Lung Mei. The nearest EPD AQMS is located at Tai Po Town Centre. The annual average concentrations of air pollutants measured at EPD's AQMS at Tai Po Town Centre in 2005 have been adopted as the background air quality (*Table 4.2*).

Table 4.2: Background Air Quality in Tai Po (2005)

Air Pollutant	**Background Concentration (mg m^{-3})**
Total Suspended Particulates (TSP)	61
Respirable Suspended Particulates (RSP)	51
Nitrogen Dioxide (NO_2)	49
Sulphur Dioxide (SO_2)	19
Carbon Monoxide (CO)	759 (a)

Note:

(a) Carbon monoxide was not measured at Tai Po EPD AQMS, and carbon monoxide concentration measured at Tap Mun, which is the next nearest EPD AQMS to the Project Site, is referenced instead.

4.3.2 Identification of Representative Air Sensitive Receivers (ASRs)

In accordance with the *EIA Study Brief Section 3.4.1.3*, the Study Area for the air quality assessment is defined by a distance of 500 m from the boundary of the Project Site. Within 500 m of the Project Site boundary, ASRs were identified through a site visit following the definition of ASRs in *Annex 12* of the *EIAO-TM*. Future or committed ASRs were also identified according to the latest Outline Zoning Plan (OZP), Outline Development Plan (ODP) and relevant published land use plans published by Lands Department. The identified representative ASRs are summarised in *Table 4.3* and shown in *Figure 4.1*.

Table 4.3: Identified Representative Air Sensitive Receivers

ASR	Description	Type of Uses	Approximate Separation Distance from the Nearest Site Boundary (m)
A1	Lau Wong Fat Sea Activity Centre	Recreational	360
A2	Proposed Temporary Depositing of Two Containers for Selling of Refreshment, Hiring of Fishing related Accessories and Storage	Commercial	380
A3	No. 16A Wong Chuk Tsuen	Residential	185
A4	No. 101 Lung Mei Tsuen	Residential	23
A5	No. 69 Lo Tsz Tin Tsuen	Residential	50
A6	No. 79 Lo Tsz Tin Tsuen	Residential	50
A7	Hong Kong Eco-Farm	Recreational	50
A8	Public Barbecue Area	Recreational	135

4.4 Evaluation of Impacts

Nuisance from dust generating activities and gaseous emission from diesel-driven construction plant may potentially arise from the construction works. The key construction activities for the Proposed Beach Development are as follows:

- construction works on land including site formation, localised widening of Ting Kok Road, construction of vertical seawall/retaining walls, construction of drainage and sewerage, and building works;
- construction of the groynes;
- construction of western drainage channel and eastern box culverts; and
- sand filling to form the beach.

Excavation and filling, dredging, materials handling, truck and barge movements and wind erosion of temporary stockpiles of dusty materials are identified to be the major dust generating activities.

The construction works will last for about 2 years tentatively from December 2008 to November 2010 (see construction programme in *Figure 3.2*).

Details of each type of construction works are discussed in the following sections.

4.4.1 Construction Works on Land

The land-based construction works include site formation, localised widening of Ting Kok Road, construction of box culvert outfall, construction of drainage and sewerage, construction of gabion channel and building works. Excavation and filling will be required for the construction works.

Excavation

A total of 6,600 m^3 of soft materials (mainly soil) will be generated from levelling of the existing land (4,000 m^3), construction of vertical seawall/retaining wall (2,000 m^3) and localised widening of Ting Kok Road (600 m^3). The excavation works will be carried out in the first three months from December 2008 to July 2009. Road widening works will be carried out in sections and the excavation for site formation will be carried out in the general direction of west to east. About 60% of the total excavated soil (3,960 m^3) will be temporarily stockpiled on-site for subsequent backfilling and the remaining portion of excavated soil (2,640 m^3), which is unsuitable for backfilling, will be disposed of offsite by trucks. The location of the temporarily open stockpile area is shown in *Figure 4.2*. Within the three-month period for excavation works, assuming 24 working days a month and a capacity of 6 m^3 per truck, the daily soft materials generation rate is estimated to be about 92 m^3 per day (1) and about 7 trucks (2) are expected to be required per day to dispose of the unused excavated soil at appropriate locations offsite.

During the building and landscaping works, about 800 m^3 of excavated spoil and 10m^3 of demolition waste such as wasted concrete are expected to be generated during in the first three months between March and November 2010. About 60% of the total excavated soil (480 m^3) will be temporarily stockpiled on-site for subsequent backfilling and the remaining portion of excavated soil (320 m^3) will be disposed of offsite by trucks. Within the three-month period, the daily soft materials generation rate is estimated to be about 11 m^3 per day (3) and about 1 trucks (4) on average are expected to be required per day to dispose of offsite. In view of the small quantity of excavated spoil to be generated, the associated fugitive dust emission is expected to be minimal.

Filling

Soil and rock filling are required to form land to accommodate future beach facilities /road/buildings.

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(1) The daily excavated soil generation rate = 6,600 m^3 / 3 months / 24 days per month = 92 m^3

(2) Trucks per day = 2,640 m^3 of excavated soil to be disposed offsite / 3 months / 24 days per month / 6 m^3 per truck = 7

(3) The daily excavated soil generation rate = 800 m^3 / 3 months / 24 days per month = 11 m^3

(4) Trucks per day = 320 m^3 of excavated soil to be disposed offsite / 3 months / 24 days per month / 6 m^3 per truck = 1

The filling works for the construction of future beach facilities/road are expected to last for about three months from December 2008 to July 2009. A total of 21,500 m^3 of public fill are envisaged to be required for backfilling of construction of retaining wall and utilities (*please refer to Section 2.5.2 for breakdown of public fill required for each fill work*). A total of 2,400 m^3 of aggregate are required to be used as sub-base of carpark and road. The soil and aggregate filling rates are 299 m^3 day^{-1} and 33 m^3 day^{-1}, respectively. About 3,960 m^3 of excavated materials generated from the preceding excavation works will be reused at this stage and the shortfall of 17,540 m^3 of public fill will need to be imported. All the imported fill and aggregates will be delivered by trucks. Assuming a capacity of 6 m^3 per truck, a total of about 47 truckloads of imported fill materials (including 41 truckloads for imported soil and 6 truckloads for imported aggregates) will be required per day.

Backfilling of building construction will last for about 2.5 months tentatively from August to October 2009. It requires 100 m^3 of soil/public fill for backfilling. The excavated soil generated from the preceding excavation works will be reused and hence no public fill is required to be imported.

A summary of the volumes of excavated and fill materials is provided in *Table 4.4*.

Table 4.4: Summary of Excavated Spoil and Fill Materials during Construction of Land and Building and Landscaping Works

	Soil/Public Fill for Construction of Land			**Building and Landscaping Works**			**Aggregate for Sub-base of Carpark and Road**
	Excavation		**Filling**	**Excavation**		**Filling**	**Filling**
Duration of Activity (days)	72 (ie 3 months)		72 (ie 3 months)	72 (ie 3 months)		60 (ie 2.5 months)	72 (ie 3 months)
Total Quantity Generated or Required (m^3)	6,600		21,500	800		100	2,400
	Reuse	*Disposal offsite*		*Reuse*	*Disposal offsite*		
	3,960	*2,640*		*480*	*320*		
Materials to be Disposed of (+) / Imported (-) (m^3)	- 17,540 [(a)]			+320			- 100
Daily Generation / Filling Rate (m^3/day)	92		299	11		2	33
No. of Daily Truck Trips Required [(b)]	7 [(c)]		41 [(d)]	1 [(c)]		-	6

Notes:

(a) Taking into account the reuse of 3,960 m^3 of excavated soil from the Project for backfilling, about 17,540 m^3 (21,500 m^3 – 3,960 m^3) of soil are required to be imported.

(b) Assuming a capacity of 6 m^3 per truck.

(c) Truckloads per day are required for offsite disposal of excavated soil.

(d) Truckloads per day are required for importing fill materials.

Dust will be generated from excavation and filling, truck movements and wind erosion of open stockpiles of loose soil within the Project Site.

The excavation works for road widening will be carried out in sections. As a result, the quantity of excavated soil to be generated from each section of the road works is expected to be small. In view of the small quantity of excavated materials generated, the potential for dust generation is considered to be very low. No adverse construction dust impacts to the nearby ASRs A4, A5 and A6, despite their proximity to the Project Site, are expected to arise from the localised road widening works given the implementation of appropriate dust control measures recommended in *Section 4.5*.

During the site formation works, dust control measures recommended in *Section 4.5* should be implemented to reduce the fugitive dust emissions. In particular, 60% of excavated soil suitable for backfilling will be filled immediately after excavation to minimise the quantity of soil to be stockpiled on site. All the temporarily stockpiled dusty materials will be covered entirely or watered to keep wet all the time. The materials to be delivered offsite will be properly covered and wheel washing facility will be provided at the exit of the worksite to remove dusty materials from the body and wheels of site vehicles before leaving the construction site.

All ASRs except A4 are located at about or more than 50 m away from the nearest boundary of excavation or filling works in which the separation distances between these ASRs and the site boundary satisfy the recommendation on minimum buffer distance in the *Hong Kong Planning Standards and Guidelines* (HKPSG) and hence the dust impact is expected to be acceptable. Although the separation distance between ASR A4 and site boundary is less than 50 m (please refer to *Table 4.3*), the dust impact is anticipated to be low and within the relevant criteria (in view of the small quantity of excavated materials and with the implementation of recommended dust control measures in *Section 4.5.1*).

In view of small scale of construction works, sufficient separation distances between ASRs and the construction works area and the implementation of dust control measures recommended in *Section 4.5.1*, no fugitive dust emission is expected at the ASRs.

4.4.2 *Construction of Western Drainage Channel and Eastern Box Culvert*

A total of 6,400m^3 of soft materials and 10m^3 of demolition waste such as wasted concrete will be excavated for the construction of western drainage channel and eastern box culvert in the first six months from March 2009 to July 2010. About 60% of the total excavated soil (3,840 m^3) will be reused onsite and the remaining portion of excavated soil (2,560 m^3) will be disposed of offsite by trucks. Within the six-month period, assuming 24 working days a month and a capacity of 6 m^3 per truck, the daily soft materials generation rate is estimated to be about 45 m^3 per day (1) and about 3 trucks (2) are expected to be required per day to dispose of offsite.

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(1) The daily excavated soil generation rate = 6,400 m^3 / 6 months / 24 days per month = 45 m^3

(2) Trucks per day = 2,560 m^3 of excavated soil to be disposed offsite / 6 months / 24 days per month / 6 m^3 per truck = 3

The construction of western drainage channel and eastern box culvert will be carried out over eight months (ie 192 days) and two months (ie 48 days) immediately after the excavation works, respectively. A total volume of about 1,980 m^3 or an average of 11 m^3 per day of rock is required to be imported for western drainage channel. A total of 1,900 m^3 of soil/fill are required for construction of western box culvert. By reusing of the soil excavated (ie 3,840 m^3) from preceding excavation, no import soil/public fill is deemed necessary.

About 800m^3 of rock and 900m^3 of aggregates will be required to be imported for the construction of eastern box culvert. About 1,200m^3 of soil/public fill is required for backfilling. By reusing of the soil excavated (ie 3,840 m^3) from preceding excavation, no import soil/ public fill is deemed necessary.

Dust will be generated from excavation and filling, truck movements and wind erosion of open stockpiles of loose soil within the Project Site. In view of the large particle sizes of rock fill and aggregates, sufficient separations between nearby ASRs and the construction site and the implementation of dust control measure recommended in *Section 4.5.1*, fugitive dust emission is expected to be minor and no adverse dust impact is anticipated.

4.4.3 Construction of Groynes

Dredging and rock filling are required for the construction of the groynes. Taking into account the high moisture content of the dredged materials, no fugitive dust emission is anticipated.

About 1,600 m^3 of rock and 3,000 m^3 of armour rocks are required for the construction of the groynes. The placing of rock fill is expected to last for about 90 days from February to April 2010. Fugitive dust emission is not anticipated from rock filling owing to the large particle size of the materials to be used.

4.4.4 Sand Filling for the Beach

A total of 37,500 m^3 of sand is required to be filled for the formation of the beach between April and July 2010. The grain size for the sand to be used is expected to be between 0.2 and 0.5 mm. The sand filling will be carried out continuously for three hours per day, with the filling rate limited to 1,000 m^3 per day to minimise potential water quality impacts. The sand will be filled using a conveyor belt system installed on barges and it is expected that only one barge will operate at any one time. The height of the conveyor belt will be adjusted to minimise the dropping height for the sand fill and to avoid fugitive dust emission, especially during windy times. In addition, any sand fill above water mark will be compacted immediately. Taking into consideration the relatively large grain size of sand and the implementation of dust control measures during the filling operations, fugitive dust emission is expected to be minimal.

4.4.5 Gaseous Emissions from Diesel-powered Construction Equipment

The potential air quality impacts associated with the gaseous emissions from diesel-powered construction equipment are expected to be relatively small as only a small numbers of such equipment are expected to be operated within the limited works area at any one time, as indicated in the construction plant inventory in *Appendix D3*. In addition, all construction plant on public works sites is required to use ultra-low-sulphur diesel (ULSD) (defined as diesel fuel containing not more than 0.005% sulphur by weight) as stipulated in *Environment, Transport and Works Bureau Technical Circular* (*ETWB TC*) *No 19/2005* on *Environmental Management on Construction Sites*, the potential air quality impacts are expected to be further reduced.

4.5 Mitigation Measures and Residual Impacts

4.5.1 Mitigation Measures

The following dust control measures stipulated in the *Air Pollution Control (Construction Dust) Regulations* and good site practices should be incorporated into the Contract Specification and implemented throughout the construction period:

- Vehicle washing facilities should be provided at the designated vehicle exit point;
- Every vehicle should be washed to remove any dusty materials from its body and wheels immediately before leaving the worksite;
- The load carried by the trucks should be covered entirely to ensure no leakage from the vehicles;
- Hoarding of not less than 2.4 m high from ground level should be provided along the entire length of that portion of the site boundary adjoining a road or other area accessible to the public except for a site entrance or exit;
- The main haul road should be kept clear of dusty materials and should be sprayed with water so as to maintain the entire road surface wet at all the time;
- The stockpile of dusty materials should be either covered entirely by impervious sheets; place in an area sheltered on the top and three sides; or sprayed with water to maintain the entire surface wet at all the time;
- Belt conveyor system should be enclosed on the top and two sides;
- The height of the belt conveyor should be kept as low as possible to avoid delivery at height; and
- All the exposed area should be kept wet always to minimise dust emission.

Environmental management measures relating to air quality control as recommended in *ETWC TC No 19/2005* should also be implemented. Measures of particular relevance to the construction of the Project, other than those recommended above, are as follows:

- All dump trucks entering or leaving the Project Site should be provided with mechanical covers in good service condition; and
- ULSD should be used for all construction plant on site.

4.5.2 Residual Impacts

No residual impact is anticipated from the construction of the Project with the implementation of the recommended mitigation measures and good site practices.

4.6 Cumulative Impacts

Sewerage improvement works from Ting Kok village to Lung Mei village (Agreement no. CE 18/94) will be carried out tentatively from late 2008 to late 2010 and therefore cumulative dust impact is likely occurred in the vicinity. The sewerage improvement works typically involve excavation, laying sewerage systems and backfilling. It is anticipated that the construction works will be carried out section by section and therefore, the excavation area of each section of work will be small and hence the fugitive dust impact arising from construction of sewerage improvement works will be minor. With the small scale of works area of the sewerage improvement works and implementation of the dust control measures, the cumulative dust impacts arising from all concurrent projects in the vicinity will be minor.

4.7 Environmental Monitoring and Audit Requirements

Whilst fugitive dust impacts are not anticipated, a construction dust monitoring programme is still recommended to ensure compliance with the relevant criterion during the construction works. Monitoring of dust levels, in terms of Total Suspended Particulates (TSP), should be conducted every six days throughout the construction period at ASRs A4 (No. 101 Lung Mei Tsuen) and A6 (No. 79 Lo Tsz Tin Tsuen). Details of the dust monitoring requirement are summarised in *Section 12.2*.

In addition, regular site audits (at a frequency of not less than once every two weeks) are recommended to ensure that appropriate dust control measures are implemented and good site practices are adopted throughout the construction period.

4.8 Conclusions

Dust generating activities and gaseous emissions from construction plant for the Proposed Beach Development may potentially cause air quality impacts to adjacent ASRs. The construction of the Proposed Beach Development involves site formation, localised widening of Ting Kok Road, building works, construction of gabion, groynes and culverts and sand filling for the beach. Excavation, dredging, filling, truck movements, materials handling and wind erosion of open stockpiles of dusty materials have been identified to be the key dust generating activities. In view of the small scale of the Project and the small size of the worksite, no adverse fugitive dust impact is envisaged with the implementation of dust control measures and adoption of good site practices.

Potential air quality impacts associated with gaseous emissions of diesel-powered construction vehicles and equipment are expected to be relatively small as only a small number of diesel construction vehicles and plant will be operated in the limited works areas at any one time. The requirement for all construction plant to use ULSD will further reduce the potential air quality impacts.

Sewerage improvement works from Ting Kok village to Lung Mei village is identified to be constructed concurrently with this Project and cumulative dust impact is likely in the vicinity. The sewerage improvement works will be carried out section by section and the construction works area will be small and therefore the dust impact arising from the sewerage improvement works will be minor. With the small scale of works area of the sewerage improvement works and implementation of the dust control measures, the cumulative dust impacts arising from all concurrent projects in the vicinity will be minor.

To ensure compliance with the relevant dust criterion at the ASRs and implementation of appropriate control measures during the construction phase, a programme for dust monitoring and site audit has also been recommended.

5 NOISE IMPACT ASSESSMENT

5.1 Introduction

This Section presents the potential noise impacts associated with the Proposed Beach Development at Lung Mei during the construction and operational phases.

5.2 Relevant Legislation and Guidelines

5.2.1 Construction Phase

The principal legislation relating to the control of construction noise is the *Noise Control Ordinance* (Cap 400) (*NCO*). A number of technical memoranda (TMs) have been issued under the *NCO* to stipulate control approaches and criteria and those which may be relevant to the construction works of the Proposed Beach Development include the following:

- *Technical Memorandum on Noise from Percussive Piling (PP-TM);* and
- *Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM).*

Apart from the above, the *Environmental Impact Assessment Ordinance* (Cap 499) (*EIAO*) also provides means to assess construction noise impacts. The *Technical Memorandum on Environmental Impact Assessment Process* (*EIAO-TM*), issued under the *EIAO*, provides guidelines and daytime noise criteria for evaluating construction noise impacts.

Percussive Piling

Under the *PP-TM*, percussive piling is prohibited at any time on Sundays and general holidays and during the weekday evening and night-time hours (1900-0700 hours, Monday through Saturday). A Construction Noise Permit (CNP) is required for such works during weekday daytime hours (0700-1900 hours, Monday through Saturday).

General Construction Works

Under the *EIAO*, noise impact arising from general construction works during normal working hours (ie 0700 to 1900 hours on any day not being a Sunday or general holiday) at the openable windows of buildings is to be assessed in accordance with the noise criteria as given in the *EIAO-TM*. The *EIAO-TM* noise standards are presented in *Table 5.1*.

Table 5.1: EIAO-TM Daytime Construction Noise Standard

Use	**Noise Standard,** $L_{eq,\ 30\ min}$ dB(A)
Domestic Premises	75
Educational Institutions (normal periods) Educational Institutions (during examination periods)	70 65

When assessing a CNP application for the use of Powered Mechanical Equipment (PME) during restricted hours, the Noise Control Authority will compare the Acceptable Noise Levels (ANLs), as promulgated in *GW-TM*, and the corrected noise levels (CNLs) (after accounting for factors such as barrier effects and reflections) associated with the proposed PME operations. The ANLs are related to the noise sensitivity of the area in question and different Area Sensitivity Ratings have been established to reflect the background characteristics of different areas. The relevant ANLs are shown in *Table 5.2*.

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 *NCO*. The Noise Control Authority will take into account adjoining land uses and any previous complaints against construction activities at the site before making a decision in granting a CNP. Nothing in this EIA Report shall bind the Noise Control Authority in making his decision. The Noise Control Authority may include any conditions in a CNP that it considers appropriate. Failure to comply with any such conditions may lead to cancellation of the CNP and prosecution action under the *NCO*.

Table 5.2: Acceptable Noise Levels (ANL, $L_{eq,\ 5\ min}$ dB(A))

Time period	**Area Sensitivity Rating**		
	A	**B**	**C**
All days during the evening (1900-2300 hours) and general holidays (including Sundays) during the day and evening (0700-2300 hours)	60	65	70
All days during the night-time (2300-0700 hours)	45	50	55

5.2.2 *Operational Phase*

Fixed plant noise is controlled under *Section 13* of the *NCO* and the predictions are made in accordance with the *Technical Memorandum on Noise from Places other than Domestic Premises, Public Places or Construction Sites* (*IND-TM*). The criteria noise limits are set out in the *EIAO-TM* as follows:

- The total fixed source noise level at the facade of the nearest NSR is at least 5 dB(A) lower than the appropriate ANL (as shown in *Table 5.3*) as specified in the *IND-TM*; or

- Where the prevailing noise level in the area is 5 dB(A) or more below the appropriate ANL, the total fixed source noise level must not exceed this noise level. Future check of prevailing noise levels will be made during baseline noise measurement prior to operation of the Project.

The criteria noise limits stipulated in the *IND-TM* are dependent on the Area Sensitivity Rating (ASR) of the NSRs, as shown in *Table 5.3*.

Table 5.3: ANLs to be used as Operational Noise Criteria

Time Period	**$L_{eq\ 30min}$, dB(A)**		
	ASR "A"	**ASR "B"**	**ASR "C"**
Daytime 0700-1900	60	65	70
Evening 1900-2300	60	65	70
Night-time 2300-0700	50	55	60

As the Project Site is located in a rural area and no influencing factors affect the NSRs, an ASR "A" has been assumed for the NSRs located in the vicinity. Baseline noise measurements were made to determine the prevailing noise levels at Lung Mei and to establish the noise limit for the assessment of the operational noise impact. Details of the noise measurements are provided in *Section 5.3.3*.

The Area Sensitive Rating assumed in this Report is for the purpose of an indicative assessment only, given that there are currently no influencing factors assumed in the vicinity of the NSRs. It should be noted that fixed noise sources are controlled under *Section 13* of the *NCO*. At the time of investigation, the Noise Control Authority shall determine noise impact from concerned fixed noise sources on the basis of prevailing legislation and practices being in force, and taking account of contemporary conditions / situations of adjoining land uses. Nothing in this Report shall bind the Noise Control Authority in the context of law enforcement against all the fixed noise sources being assessed.

5.3 Baseline Conditions and NSRs

5.3.1 Baseline Condition

The Proposed Beach Development is located at Lung Mei in Tai Po (*Figure 5.1*). Two villages, Lung Mei Tsuen and Lo Tsz Tin Tsuen, are located to the north of the Project Site. The Plover Cove Reservoir and a number of water activity centres are located at Tai Mei Tuk at a distance of about 360 m to the east of the Proposed Beach Development. The background noise environment is dominated by the road traffic noise from Ting Kok Road.

5.3.2 *Noise Sensitive Receivers*

Village houses at Lung Mei and Lo Tsz Tin have been identified as noise sensitive receivers (NSRs) that may be affected by noise associated with the construction and operation of the Proposed Beach Development (*Figure 5.1*). The planned/committed noise sensitive developments and uses in the vicinity of the site have also been identified in the vicinity of the Project Site and are presented in *Figure 5.1*. Photographs showing the identified NSRs are presented in *Appendix D1*.

Assessment points have been selected to represent the identified NSRs for carrying out the noise assessment (*Appendix D1*). The village house at No. 103 Lung Mei has been used to represent an NSR instead of No. 101 Lung Mei as the latter has been converted to a restaurant and no longer considered as an NSR. However, assessment has also been conducted at No. 101 Lung Mei considering its potential change to residential use in future. The locations of the noise assessment points are shown in *Figure 5.2* and presented in *Table 5.4*.

Table 5.4: Selected Noise Assessment Points

NSR	Location	Type of Uses
N1	Village house - No. 165A Lung Mei	Residential (3-Storey)
N2	Village house - No. 103 Lung Mei	Residential (3-Storey)
N2a	House - No. 101 Lung Meu	Residential converted to Commercial (3-storey)
N3	Village house - No. 70 Lo Tsz Tin	Residential (3-Storey)
N4	Village house - No. 79 Lo Tsz Tin	Residential (3-Storey)

5.3.3 *Baseline Noise Measurement*

To investigate the prevailing noise levels at the NSRs at Lung Mei, noise measurements were conducted on 4 March 2007 at two locations, as indicated in *Figure 5.3* and *Appendix D1*. The noise measurements were conducted using a 01 dB Solo Sound Level Meter (Type 1) which was calibrated using a B&K Sound Level Calibrator Type 4231 with a calibration signal of 94.0 dB(A) at 1kHz. The measurement was logged at L_{Aeq}, in fast time weighting. Calibration and measurement procedures in the *IND-TM* were followed.

The measurement results are summarised in *Table 5.5*.

Table 5.5: Measured Prevailing Free-field Noise Levels

Noise Measurement Location	Noise Measurement Period	$L_{min, 30min}$, dB(A)	$L_{eq, 30min}$, dB(A)	$L_{max, 30min}$, dB(A)
M1	12:16:00 - 12:46:00	39.0	59.7	79
	12:46:00 - 13:16:00	39.1	59.5	75.4
	13:16:00 - 13:46:00	40.1	58	72.5
Average $L_{eq, 30min}$ = 59 dB(A)				
M2	13:47:03 - 14:17:03	36.9	52.2	63.3
	14:17:03 - 14:37:03	40.5	51.9	69.3
	14:47:03 - 15:17:03	41.5	53.1	65.8
Average $L_{eq, 30min}$ = 52 dB(A)				

A correction factor of 3dB(A) for façade effect is applied to the free-field noise measurement results to represent the noise level at building facades. With the inclusion of facade correction, the measured prevailing noise levels are in the range of 55 – 62 dB(A), and therefore a lower level of 55 dB(A) $L_{Aeq, 30min}$ is adopted as the daytime noise limit for NSRs located at Lung Mei for the operational noise assessment.

5.4 Potential Sources of Impacts

5.4.1 Construction Phase

Potential impacts to the NSRs during the construction phase of the Proposed Beach Development are expected to arise mainly from PME operating at construction work sites. The key construction activities are as follows:

- Site formation;
- Localised widening of Ting Kok Road;
- Construction of bathing facilities;
- Construction of two groynes; and
- Construction of culverts to the east and west of the Project Site.

To minimise the construction noise impacts, press-in piling method has been proposed to be used instead of percussive piling. In the event of percussive piling being required as a result of geological constraints at the Project Site, a CNP should be applied for the percussive piling works in accordance with the *PP-TM*. As the issuance of a CNP by the Noise Control Authority would depend on the information submitted in the CNP application by the Contractor, and the calculations to be conducted therein according to the PP-TM, the assessment of percussive piling noise has not been included in this assessment.

The normal working hours of the contractor will be between 0700 and 1900 hours from Monday to Saturday (except public holidays). Given the constraints of the Project Site and scale of the concurrent construction activities, there will be a limited number of plant items operating on site at any one time. The construction noise assessment has been undertaken based on the construction programme and the plant inventory presented in *Appendices D2* and *D3* respectively. All the PMEs listed in the plant inventory are checked by the CEDD to be available in the market. The validity of the inventory has also been reviewed by CEDD and confirmed to be practical and feasible for completing the works for the Proposed Beach Development within the scheduled timeframe.

5.4.2 Operational Phase

Noise associated with the operational phase of the Proposed Beach Development is expected to arise mainly from the fixed plant at the bathing facilities. The dominant noise sources are expected to include the following equipment:

- water and fire service pumps;
- mechanical ventilation for plant rooms; and
- public address (PA) systems.

The Proposed Beach Development will not have night-time operation and the operation hours of the PA systems will follow those of the Proposed Beach Development as indicated in *Table 5.6*.

Table 5.6: Operation Hours of the Proposed Beach Development

Period	Time	Remark
April, May, September and October	9:00 am - 6:00 pm	Daily
From June to August	9:00 am - 6:00 pm	Weekdays
	8:00 am - 7:00 pm	Saturdays, Sundays & Public Holidays
From November to March	8:00 am - 5:00 pm	Daily

As the detailed design of the fixed plant equipment associated with the operation of the Proposed Beach Development is not yet available at this stage, assumptions on the sound power levels (SWLs) of the equipment have been made for the operational noise assessment. These assumptions are presented in *Table 5.7*. The operational plant inventory is presented in *Appendix D6*. The maximum allowable SWLs presented in *Table 5.7* should be included in the tender specification to ensure the assumptions for the operational noise impact assessment remain valid. The suppliers of equipment should guarantee the specified SWLs, with the characteristics of tonality, impulsiveness and intermittency accounted for, by providing certificate of measurement and verify the SWL during testing and commissioning in accordance with international standard procedures. If necessary, the suppliers should apply attenuation measures (eg use of silencers) to achieve the guaranteed noise levels during the detailed design stage.

Table 5.7: Assumption on the Sound Power Levels of the Operational Equipment

Operational Equipment	Maximum Allowable Sound Power Level, dB(A)
Pumps	92
Mechanical Fan	88
PA system	100 dB(A) for the loudspeaker cluster located at car park and lifeguard lookout 98 dB(A) for the loudspeaker cluster located at building facilities

5.5 Assessment Methodology

5.5.1 Construction Phase

The methodology for the noise impact assessment follows the procedures outlined in the *GW-TM*, and is summarised as follows:

- Identify of a list of construction plant likely to be required for each construction activity;
- Assign sound power levels (SWLs) to the PME proposed based on the *GW-TM*. When the PME is not listed in the TMs, reference is made to SWLs provided in the document prepared by the Noise Control Authority (http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf) and *British Standard 5228, Noise and Vibration Control on Construction and Open Sites - Part 1* (BS5228: Part 1: 1997) (1);
- Calculate the SWLs for each construction activity. With the construction works which will not be carried out simultaneously according to the construction sequences, maximum SWL of each activity is selected to predict the maximum construction noise levels at the NSRs;
- Calculate the correction factor, using a conservative approach, based on the horizontal distance between the NSRs and the notional noise source position of the work sites. The notional source position of the work site was established in accordance with the procedures stated in the *GW-TM*;
- Apply corrections in the calculations such as potential screening effects and acoustic reflection, if any; and
- Predict the construction noise levels at NSRs in the absence of any mitigation measures.

Noise impacts at NSRs were subsequently evaluated by comparing the predicted noise levels with the *EIAO-TM* daytime construction noise limits ($L_{eq,\ 30min}$ dB(A)), as outlined in *Section 5.2.1*.

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(1) British Standard 5228, Noise and Vibration Control on Construction and Open Sites - Part 1. Code of Practice for Basic Information and Procedures for Noise and Vibration Control

In reality, some of the PME will not be operating continuously within a work site. Utilisation rates for the PME that have been adopted for the calculation of the SWL are summarised in *Table 5.8*. The utilisation rates has also been reviewed by CEDD and confirmed to be practical and feasible to achieve the construction programme.

Table 5.8: Utilisation Rates for PME

PME	Utilisation Rate
Vibratory roller, timber sawing machine, bar ender and cutter, electrical drill, vibratory compactor	50%
Mobile crane, excavator, vibratory poker, concrete lorry mixer, silent piler, road roller, lorry, piling (earth auger), pneumatic breaker, backhoe, derrick lighter	80%
Diesel generator, grab dredger, water pump, air compressor, pelican barge	100%

5.5.2 Operational Phase

The methodology for the noise impact assessment follows the procedures outlined in the *IND-TM*. The methodology for the fixed plant noise assessment is summarised as follows:

- Identify types of equipment and the number of equipment;
- Calculate the maximum SWL for each type of equipment;
- Identify representative NSRs that may be affected by the fixed plant;
- Calculate the correction factor, using a conservative approach, based on the horizontal distance between the NSRs and the fixed plant sources; and
- Present the results in terms of $L_{eq, 30min}$ dB(A), as specified in the TM.

Under normal circumstances, it is envisaged that the PA system will not be operated continuously. As advised by Leisure and Cultural Services Department (LCSD), the typical operating time for the PA system is 2 minutes in every 15 minutes, and therefore it is assumed that the operating time of the PA system will be 4 minutes in every 30 minutes and an appropriate correction is included to account for this mode of operation. The assessment has also taken into account the barrier correction and facade correction of +3 dB(A). The predicted noise levels at the NSRs are compared with the criteria set out in *Section 5.3.3*. Mitigation measures have been recommended in cases where an exceedance is predicted.

5.6 Evaluation of Impacts

5.6.1 Construction Phase

Owing to the proximity of the NSRs to the Project Site, the NSRs would be adversely affected by the construction activities. The unmitigated construction noise levels at the representative NSRs have been predicted and are summarised in *Table 5.9*. Details of the calculations are presented in *Appendix D4*.

Table 5.9: Predicted Construction Noise Levels (Unmitigated)

NSR	Location	Predicted Construction Noise Levels, dB(A)
N1	Village house - No. 165A Lung Mei	66 – 79
N2	Village house - No. 103 Lung Mei	68 – 76
N2a	House - No. 101 Lung Mei	69 – 77
N3	Village house - No. 70 Lo Tsz Tin	71 – 78
N4	Village house - No. 79 Lo Tsz Tin	67 – 80

Note:
(a) The construction noise criterion is 75 dB(A).

To mitigate the construction noise impact, practicable mitigation measures, including the use of quiet construction plant and movable noise barriers, are recommended to be implemented when works are undertaken close to the NSRs. In addition, site hoardings at the particular work site boundary may be provided for achieving screening effect, provided that the hoardings have no openings or gaps and meet the same specifications for movable noise barriers. The proposed movable noise barriers should be at least 3m high with a surface density of not less than 7 kg m^{-2}, which could provide a minimum of 5 dB(A) attenuation. Skid footing of movable noise barriers should be located at a distance not more than a few metres of stationary plant and mobile plant such that the NSRs would not have direct line of sight to the plant. The length of the barriers should also be at least five times greater than its height. The locations of the proposed movable noise barriers during construction phase are presented in *Figure 5.4*. The contractor will ensure that the hoardings and movable noise barrier are properly maintained throughout the construction period. Details of the recommended mitigation measures are presented in *Tables 5.12 and 5.13*.

The mitigated construction noise levels at the representative NSRs are summarised in *Table 5.10*. Details of the calculations are presented in *Appendix D5*. The mitigated construction noise levels are below the daytime construction noise criterion of 75 dB(A) throughout the construction period.

Table 5.10: Predicted Construction Noise Levels (Mitigated)

NSR	Location	Predicted Construction Noise Levels, dB(A)
N1	Village house - No. 165A Lung Mei	62 – 72
N2	Village house - No. 103 Lung Mei	64 – 70
N2a	House - No. 101 Lung Mei	65 – 70
N3	Village house - No. 70 Lo Tsz Tin	66 – 71
N4	Village house - No. 79 Lo Tsz Tin	63 – 72

Notes:
(a) Mitigated with quiet construction plant and noise barriers.
(b) Construction noise criterion is 75 dB(A).

The normal working hours of the contractor will be between 0700 and 1900 hours from Monday to Saturday (except public holidays). Should evening and night work between 1900 and 0700 hours or work on public holidays (including Sunday) be required, the contractor should submit a CNP application for consideration by the Noise Control Authority. Conditions stipulated in CNPs should be strictly followed.

5.6.2 Operational Phase

The predicted operational noise levels at the NSRs are summarised in *Table 5.11*. Details of calculation are presented in *Appendix D6*. With the maximum specified SWLs for the fixed plant, the predicted operational noise levels at the representative NSRs comply with the daytime noise criteria as discussed in *Section 5.3.3*.

Table 5.11: Predicted Operational Noise Levels

NSR	Location	Predicted Operational Noise Levels, dB(A)	Operational Noise Criterion, dB(A)
N1	Village house - No. 165A Lung Mei	52	55
N2	Village house - No. 103 Lung Mei	53	55
N2a	House - No. 101 Lung Mei	54	55
N3	Village house - No. 70 Lo Tsz Tin	52	55
N4	Village house - No. 79 Lo Tsz Tin	49	55

It should be noted that the operational noise assessment presented above is based on a worst-case scenario in which the equipment are assumed to be operated simultaneously, which is unlikely to occur in real situation.

5.7 Mitigation Measures and Residual Impacts

5.7.1 Construction Phase

The contractor is required to adopt the recommended mitigation measures as specified in *Tables 5.12* and *5.13* to mitigate the construction noise impact at different construction stages.

Table 5.12: Use of Quiet PME

Quiet PME	Reference	SWL, dB(A)
Mobile Crane	SWL listed in the data base of quality powered mechanical equipment prepared by the Noise Control Authority	107
Tracked Loader	British Standard 5228 – Table C3, Reference No. 16	104
Pneumatic breaker	British Standard 5228 – Table C2, Reference No. 10	110
Concrete Lorry Mixer	British Standard 5228 – Table C6, Reference No. 23	100
Excavator	British Standard 5228 – Table C3, Reference No. 97	105

Table 5.13: Summary of Recommended Use of Noise Barrier

ID	Task	Work Activity	Recommended Mitigation Measures
1a	**Construction Works on Land**	Site Formation, construction of seawall, ramp, staircase, retaining walls, sump tanks for grey water system and superstructure foundation	• Movable noise barrier should be provided for excavator and mobile crane; • Timber sawing machine should be operated behind site hoarding/ movable noise barrier; and • Concrete lorry mixer should be operated behind site hoarding/movable noise barrier.
1b		Localised road widening along Ting Kok Road	• Timber sawing machine should be operated behind movable noise barrier; and • Movable noise barrier should be provided for excavator and mobile crane.
2	**Car Park Paving**		• Movable noise barrier should be provided for excavator.
3a	**Building Works**	Piling works	-
3b		Foundation and tanking	• Movable noise barrier should be provided for excavator, mobile crane and earth auger; and • Timber sawing machine should be operated behind site hoarding/ movable noise barrier.
3c		Superstructure	• Movable noise barrier should be provided for mobile crane; and • Timber sawing machine should be operated behind site hoarding/ movable noise barrier.
3d		Building finishes & internal fitting-out	• Movable noise barrier should be provided for mobile crane.
4	**Dredging for the Groynes**		-
5	**Rock filling for the Groynes**		• Movable noise barrier should be provided for excavator and derrick lighter.
6a	**Box Culvert Construction**	Construction of gabion channel	• Movable noise barrier should be provided for excavator.
6b		Construction of western culvert	• Movable noise barrier should be provided for excavator, mobile crane; • Concrete lorry mixer should be operated behind site hoarding/movable noise barrier.
6c		Construction of eastern culvert	• Concrete lorry mixer should be operated behind site hoarding/movable noise barrier.
6d		Construction of 90m box culvert	• Site hoarding should be provided for work site.
7	**Sand Filling**		• Movable noise barrier should be provided for excavator.
Remark: (1) Movable noise barriers and site hoarding should be at least 3m high with a surface density of not less than 7 kg m^{-2}.			

In addition to the recommended mitigation measures given in *Table 5.12*, good site practices should be implemented by the contractor to minimise the construction noise impact. The site practices listed below should be adopted during the construction phase:

- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;

- Silencers or mufflers on construction equipment should be utilized and should be properly maintained during the construction programme;
- Mobile plant, if any, should be sited as far from NSRs as possible;
- Machines and plant (such as trucks) 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, wherever possible, be orientated so that the noise is directed away from the nearby NSRs; and
- Material stockpiles and other structures should be effectively utilised, wherever practicable, in screening noise from on-site construction activities.

With the implementation of recommended mitigation measures, no residual impact at the NSRs is anticipated.

5.7.2 Operational Phase

Based on the specified maximum SWLs for the fixed plant, the predicted operational noise levels at the representative NSRs are expected to comply with the daytime criteria. As discussed in *Section 5.4.2*, the suppliers of equipment should apply attenuation measures (eg silencers), if necessary, to achieve the guaranteed noise levels.

5.8 Cumulative Impact

5.8.1 Construction Phase

As mentioned in *Section 3.13*, the construction works of Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94) (Phase IIC works) is anticipated to be from November 2008 to November 2010, which coincides with construction undertaken for the Proposed Bathing Beach Development, but the details of the construction programme and associated plant inventory are not available at this stage. Phase IIC works is anticipated to involve mainly excavation and pipe laying works but will be in a smaller scale as a result of limited space at Lung Mei Village and Lo Tsz Tin Village. Using a conservative approach, the construction noise impact from Phase IIC works is assumed to be of similar magnitude as that from the Proposed Bathing Beach Development, and therefore a correction of +3 dB(A) will be included to account for an additional noise source. The maximum mitigated construction noise levels due to the construction of Proposed Bathing Beach is predicted to be 72 dB(A), with the inclusion of 3dB(A), the cumulative noise level is 75 dB(A), which complies with the construction noise criterion.

5.8.2 Operational Phase

No cumulative impact is anticipated during the operational phase.

5.9 Environmental Monitoring and Audit Requirements

5.9.1 Construction Phase

Noise monitoring is recommended during the construction phase to ensure compliance with the noise criterion at the NSRs. Weekly noise monitoring should be undertaken at the representative NSRs (N1 – N4). If house No. 101 Lung Mei (N2a) is changed to residential use, noise monitoring should be conducted at N2a instead of N2. Regular site audits at the frequency of twice a month should be conducted to ensure that the recommended mitigation measures are properly implemented during the construction stage.

5.9.2 Operational Phase

Results of operational noise assessment indicate that the NSRs will not be affected by fixed plant noise sources and therefore operational phase noise monitoring is not required.

5.10 Conclusions

Owing to the proximity of the NSRs to the Project Site, mitigation measures are required to be implemented to mitigate the construction noise impacts. Practicable mitigation measures, including use of quiet construction plant and movable noise barriers, have been recommended to be implemented for different work stages. With the implementation of mitigation measures, the mitigated construction noise levels at the representative NSRs are anticipated to comply with the construction noise criterion of 75 dB(A) throughout the construction period. Noise monitoring during the construction stage is recommended to ensure compliance with the relevant noise criteria. The potential cumulative noise impacts from the contemporary occurrence of the Phase IIC works have been considered, and the assessment result indicates that the cumulative construction noise level at the NSRs complies with the construction noise criterion of 75 dB(A).

The predicted operational noise levels at the representative NSRs are expected to comply with the daytime criteria based on the assessment using a set of specified maximum SWLs for the fixed plant to be installed at the Proposed Beach Development. Attenuation measures, if required, will be provided to the fixed plant for achieving the guaranteed noise levels during the detailed design stage, and therefore operational phase noise monitoring is not required.

6 WATER QUALITY IMPACT ASSESSMENT

6.1 Introduction

This Section describes the impacts on water quality associated with the construction and the operation of the Proposed Beach Development. The sediment transport and sedimentation resulting from dredging and sandfilling for the beach have been simulated through computer modelling. The purpose of the assessment is to evaluate the acceptability of predicted impacts to water quality from the construction and operation of the Proposed Beach Development. Impacts have been assessed with reference to the relevant environmental legislation and standards.

6.2 Relevant Legislation and Guidelines

The following relevant pieces of legislation and associated guidance are applicable to the evaluation of water quality impacts associated with the Proposed Beach Development.

- *Water Pollution Control Ordinance* (*WPCO*);
- *Environmental Impact Assessment Ordinance* (*Cap. 499. S.16*), *Technical Memorandum on Environmental Impact Assessment Process* (*EIAO-TM*), *Annexes 6 and 14*; and,
- *Practice Note for Professional Persons, Construction Site Drainage* (*ProPECC PN 1/94*).

6.2.1 Water Pollution Control Ordinance (WPCO)

Under the *WPCO*, Hong Kong waters are divided into 10 Water Control Zones (WCZs) each of which has a designated set of statutory Water Quality Objectives (WQOs) designed to protect the marine environment and its users. The Proposed Beach Development is located within the Buffer Subzone of the Tolo Harbour and Channel WCZ (which is divided into three sub-zones, Harbour, Buffer and Channel). The applicable WQOs associated with the Proposed Beach Development are presented in *Table 6.1*.

Apart from the parameters shown in *Table 6.1*, WQOs are also provided for temperature, pH and salinity. However, construction of the beach area, ie dredging and backfilling, will only result in elevation of suspended solids (SS) concentration but will not change temperature, pH and salinity. In addition, there will not be any sewage discharges from the Proposed Beach Development to the marine water in the WCZ during its construction and operation, the criteria for these parameters are therefore not considered applicable and are not discussed further.

Table 6.1: Relevant Water Quality Objectives for Tolo Harbour and Channel WCZ (Buffer Subzone)

Parameter		**Tolo Harbour and Channel WCZ**
		Buffer Subzone
Suspended Solids (SS)		No criteria established
Dissolved Oxygen (DO)	2 m above the seabed	Not less than 4 mg L^{-1}
	within 2 m above the seabed	Not less than 3 mg L^{-1}
	Fish Culture Zone [(a)]	At Fish Culture Zones the DO levels should not be less than 5 mg L^{-1}
Nutrients (measured as inorganic nitrogen)		No criteria established
Unionised Ammonia (UIA)		No criteria established
Chlorophyll-*a*		Not exceed 10 µg L^{-1} (mg m^{-3}) (calculated as a running arithmetic mean of 5 daily measurements for any location and depth) [(b)]
Toxicants		Toxicants are not to be present at levels producing significant toxic effect
E. coli		Not exceed 610 cfu per 100 mL, calculated as annual geometric mean

Notes:

(a) DO level of 5 mg L^{-1} is WQO parameter generally applied for FCZ at other WCZs but there is no specific DO level established for FCZ for Tolo Harbour and Channel WCZ.

(b) Chlorophyll-*a* WQOs at Tolo Habour and Tolo Channel Subzones are 20 µg L^{-1} and 6 µg L^{-1} respectively.

Besides the WQOs stipulated for the WCZ, a WQO for bathing beaches has been set under the *WPCO*. The WQO states that the level of *E. coli* should not exceed **180 cfu per 100 mL**, calculated as the geometric mean for all samples collected from March to October inclusive. Samples have to be taken at least 3 times a month at intervals of between 3 and 14 days. This WQO applies to all bathing beaches in Hong Kong waters.

6.2.2 *Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)*

Annexes 6 and *14* of the *EIAO-TM* provide general guidelines and criteria to be used in assessing water quality issues.

The *EIAO-TM* recognises that, in the application of the above water quality criteria, it may not be possible to achieve the WQOs at the source as there are areas which are subjected to greater impacts (which are termed by EPD as the mixing zones) where the initial dilution of a pollution input takes place. The definition of this area is determined on a case-by-case basis. In general, the criteria for acceptance of the initial dilution area is that it must not impair the integrity of the water body as a whole and must not damage the ecosystem or impact marine sensitive receivers (including migratory pathways of important species, beaches, breeding grounds or other beneficial uses).

6.2.3 Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)

Apart from the above statutory requirements, *ProPECC PN 1/94* was issued by ProPECC in 1994 and it provides useful guidance on the management of construction site drainage and the prevention of water pollution associated with construction activities.

6.3 Assessment Methodology

The construction method and sequence as described in *Section 3* were reviewed to assess the remoteness of the construction works of the Proposed Beach Development to existing and committed Water Sensitive Receivers (WSRs). The WSRs were identified according to guidance provided in the *EIAO-TM*.

The design of the beach, construction sequence, duration and activities, and the operation activities were reviewed to identify activities likely to impact upon identified WSRs and other water courses during construction and operation phases. Following the identification of WSRs and potential water quality impacts, the scale, extent and severity of potential net (ie unmitigated) construction, operation impacts were evaluated against the assessment criteria defined for this Proposed Beach Development, as discussed in the following section. The evaluation was also taken into account all potential cumulative effects including those of adjacent projects, with reference to the WPCO criteria.

Where net water quality impacts exceed the appropriate WPCO criteria, practical water pollution control measures/mitigation proposals were identified to ensure compliance with reference to the WPCO criteria. Water quality monitoring and audit requirements were developed, if necessary, to ensure the effectiveness of the water pollution control and mitigation measures.

6.3.1 Defined Assessment Criteria

The WQO for the Tolo Harbour and Channel WCZ has been discussed in *Section 6.2.1*. The WQO has stipulated criteria for pH, temperature, salinity, DO, chlorophyll-*a* and toxicants. As discussed before, no sewage will be discharged into the marine water within the WCZ and hence it is not necessary to define assessment criteria for pH, temperature and salinity. There is, however, no WQO for SS, Total Inorganic Nitrogen (TIN) and unionised ammonia (UIA) in the WCZ.

Assessment Criteria for Suspended Solids and Dissolved Oxygen

In view of the low background concentrations in the north eastern waters of Hong Kong (see discussion in *Section 6.4*), an alternate assessment criterion of allowable increases in SS concentrations of **10 mg L^{-1}** has been adopted in previous projects. These projects included the EIAs for sand dredging at the proposed Eastern Waters Marine Borrow Area (1), for uncontaminated mud disposal at the exhausted East Tung Lung Chau MBA (2), for jetting and dredging carried out in Tolo Harbour and Channel and Mirs Bay (3). In addition, a 10 mg L^{-1} criterion was used as the limit level in the EM&A programme for SS impacts to coral areas during sand dredging at the West Po Toi MBA (4) and the dredging for a gas pipeline in Tolo Harbour and Channel (5).

There are several fish culture zones (FCZ) located within the Study area and they are considered to be sensitive receivers. The FCZs within the area of expected influence of the Proposed Beach Development include Yim Tin Tsai West and Yim Tin Tsai East. The only WQO that is specific to FCZs is for dissolved oxygen. However, there is no specific DO level established for FCZs for Tolo Harbour and Channel WCZ. In addition to dissolved oxygen there is a general water quality protection guideline for SS, which has been proposed by AFCD. The guideline requires that SS levels remain below **50 mg L^{-1}**. With regard to the water quality modelling, the FCZs were included as discrete points for evaluation in the assessment against the above criteria and guideline. This criterion has been adopted in the EIA for dredging for Towngas gas pipeline (6).

It is particularly relevant to make use of the abovementioned assessment criteria for this Study because these previous projects were primarily concerned with the potential for impacts to ecologically sensitive areas (ie areas of high coral coverage, fish spawning areas, fish culture zones), which are the main concern with regard to SS impacts during the construction phase.

Assessment Criteria for Sediment Deposition

A coral site has been identified at Pak Sha Tau (*Figure 6.1*) and it was evaluated as of medium ecological value in the approved EIA for Towngas gas pipeline (7). Coral communities have been identified in the vicinity of the Project Site during the dive surveys conducted for this Proposed Beach Development. Sediment deposition is the key parameter to evaluate the impacts to these corals.

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(1) Hyder (1997). Sand Dredging and Backfilling of Borrow Pits at the Potential Eastern Waters Marine Borrow Area. EIA Report for Civil Engineering Department.

(2) ERM (1998). Environmental Impact Assessment of Backfilling Marine Borrow Areas at East Tung Lung Chau. Final EIA Report for the Civil Engineering Department.

(3) ERM (2003). The Proposed Submarine Gas Pipelines from Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal, Shenzhen to Tai Po Gas Production Plant, Hong Kong. Final EIA Report for The Hong Kong and China Gas Company Limited.

(4) ERM (2001). Focussed Cumulative Water Quality Impact Assessment of Sand Dredging at the West Po Toi Marine Borrow Area. Environmental Monitoring and Audit Manual. Updated Manual for HAM Dredging and Marine Contractors.

(5) ERM (2003). ibid

(6) ERM (2003). ibid

(7) ERM (2003). ibid

Hard or hermatypic corals are susceptible to increased rates of deposition, with the species sensitivities to sedimentation being determined largely by the particle-trapping properties of the colony and ability of individual polyps to reject settled materials. Horizontal platelike colonies and massive growth forms present large stable surfaces for the interception and retention of settling solids while vertical plates and upright branching forms are less likely to retain sediments. Tall polyps and convex colonies are also less susceptible to sediment accumulation than other growth forms. It is also acknowledged that sensitivities to sediment loads can also vary markedly between species within the same genus (1).

Information presented by Pastorok and Bilyard (1985) (2) has been regarded as the aforementioned when discussing the effects of sedimentation on corals. Pastorok and Bilyard have suggested the following criteria:

* 10 - 100 g m^{-2} day^{-1}	slight to moderate impacts
* 100 - 500 g m^{-2} day^{-1}	moderate to severe impacts
* > 500 g m^{-2} day^{-1}	severe to catastrophic impacts

Fringing and inshore reefal environments, however, are known to experience sedimentation events in exceedance of the 500 g m^{-2} day^{-1} criterion and support flourishing coral communities (3). It is clear from the above that the adoption of strict criteria for impact assessment based on Pastorok & Bilyard's system of assessment for open water communities may well be overly protective in an environment such as Hong Kong. However, using a precautionary approach, it is proposed to adopt a value of **100 g m^{-2} day^{-1}** as the assessment criterion for deposition, which is at the lower end of the range for moderate to severe impacts specified above, for the purposes of this Study. This criterion has been utilised in Hong Kong (Eastern Waters, West Po Toi) before and deemed to be sufficiently protective during EM&A (4) (5) (6). It should be noted that exceedance of this value should trigger further assessment and should not be deemed to imply that damage would necessarily occur. The results from EM&A programmes in Hong Kong that have adopted 100 g m^{-2} day^{-1} have indicated that no adverse impacts to corals have occurred.

(1) Hawker DW & Connell DW (1992). Standards and Criteria for Pollution Control in Coral Reef Areas. Chapter 7 of Pollution in Tropical Aquatic Systems. Connell DW & Hawker DW ed. CRC Press.

(2) Pastorok RA and Bilyard GR (1985). Effects of sewage pollution on coral-reef communities. Marine Ecology Progress Series 21: 175-189.

(3) Ayling AA and Ayling AK (1987). Is silt run-off affecting corals communities on the Cape Tribulation Fringing Reefs? In; Fringing Reef Workshop, GMRMPA Workshop series 9: 83-86. Ed CL Baldwyn.

(4) ERM (2003). Op cit

(5) Hyder (1997). Sand Dredging and Backfilling of Borrow Pits at the Potential Eastern Waters Marine Borrow Area, EIA Report, CED, 1997.

(6) ERM (2001). Focused Cumulative Water Quality Impact Assessment of Sand Dredging at the West Po Toi Marine Borrow Area Final Report.

Assessment Criteria for *E. coli*

In accordance with Study Brief Conditions 3.4.3.5 (xv), it is necessary to assess the suitability of Lung Mei Beach to be operated as a gazetted bathing beach. In this regard, the WQO for bathing beach, ie *E. coli* levels less than 180 cfu per 100 mL (calculated as the geometric mean for all samples collected from March to October inclusive), is used for this purpose.

Assessment Criteria for Seawater Intakes

Seawater intakes at WSD Tai Po Industrial Estate and at the Marine Science Laboratory (MSL) of Chinese University have their specific standards and these are presented in *Table 6.2*. With respect to SS, 5-day Biological Oxygen Demand (BOD_5) and *E. coli*, target quality standards for MSL seawater intake are more stringent than those of WSD due to the reported purpose of the MSL intake which supplies the MSL fish and invertebrate stock holding, culture and experimental facilities. The SS concentration for WSD and MSL intakes should not be more than 10 mg L^{-1} (with an upper tolerance level of 20 mg L^{-1}) and 5 mg L^{-1} respectively.

Table 6.2: Water Quality Criteria for Seawater to be used by MSL and WSD (for Flushing Water) Intakes

Parameter	**MSL Target Limit**	**WSD Flushing Target Limit**
Colour (HU)	-	<20
Secchi Disc Depth (m)	>2	-
Salinity (ppt)	>25	-
pH	>7.5	-
Turbidity (NTU)	-	<10
Threshold Odour Number	-	<100
Ammoniacal Nitrogen (mg L^{-1})	-	<1
Total Nitrogen (mg L^{-1})	<1	-
Total Phosphate (mg L^{-1})	<0.1	-
Suspended Solids (mg L^{-1})	<5	<10 (20 – upper threshold)
Dissolved Oxygen (mg L^{-1})	-	>2
Dissolved Oxygen (% saturation)	>10-30	-
Biochemical Oxygen Demand (mg L^{-1})	<5	<10
Synthetic Detergents (mg L^{-1})	-	<5
Chlorophyll-a (mg L^{-1})	<10-50	-
E. coli (cfu 100 mL^{-1})	<100-1,000	<20,000

Assessment Criteria for Dissolved Metals and Organic Compounds

There are no existing legislative standards or guidelines for dissolved metals and organic compounds in the marine waters of Hong Kong. It is thus proposed to make reference to the relevant water quality standards in the UK, Australia and USEPA. The proposed assessment criteria are summarised in *Table 6.3* and these values are total concentrations of the pollutants which takes the ambient concentrations into account.

In general, the proposed criterion is taken as the most stringent value among the nation's standards. When compared with the Australian Assessment Criterion, it is noted that such criteria are broken down into four categories, according to the level of protection desired (% of species). It is unclear, however, which of the above Australian criterion would be appropriate for application to Hong Kong. With exception of Polychlorinated Aromatic Hydrocarbons (PAHs), for which only Australian criterion is available, the UK and US standards are more appropriate to be adopted as the assessment criterion.

Criterion for Tributyltin (TBT) which was suggested in an international literature (see *Table 6.3*) is proposed to be used in this Study. This value has been adopted in the previous approved EIAs such as EIA for Decommissioning of Cheoy Lee Shipyard at Penny's Bay(1), EIA for Disposal of Contaminated Mud in the East Sha Chau Marine Borrow Pit (2), EIA for Wanchai Development Phase II (3) and EIA for Emissions Control Project at Castle Peak Power Station "B" Units (4).

It is also considered important to note that the assessment criteria presented in *Table 6.3* are based on long term exposure. Works associated with the construction of the Proposed Beach Development are, however, relatively short term and in localised areas. Hence USEPA's Criteria Maximum Concentration (CMC) criteria are considered to be more suitable than Criteria Continuous Concentration (CCC) since CCC is designed for the long term exposure.

(1) Maunsell (2002). EIA for Decommissioning of Cheoy Lee Shipyard at Penny's Bay. For Civil Engineering Department, Hong Kong SAR Government.

(2) ERM (1997). EIA for Disposal of Contaminated Mud in the East Sha Chau Marine Borrow Pit. For Civil Engineering Department, Hong Kong SAR Government.

(3) Maunsell (2001). EIA for Wanchai Development Phase II - Comprehensive Feasibility Study. For Territory Development Department, Hong Kong SAR Government.

(4) ERM (2006). EIA for Emissions Control Project at Castle Peak Power Station "B" Units. For Castle Peak Power Company Limited.

Table 6.3: Proposed Assessment Criteria for Dissolved Metals and Micro-Pollutants with Reference to Standards Adopted by Other Countries

Parameter	Reporting Limit ($\mu g\ L^{-1}$)	Proposed Water Quality Criterion for this Study ($\mu g\ L^{-1}$)	UK Assessment Criterion ($\mu g\ L^{-1}$)[a]	Australian Assessment Criterion ($\mu g\ L^{-1}$)[b]				USEPA Assessment Criterion ($\mu g\ L^{-1}$)[c]		International Literature ($\mu g\ L^{-1}$)[e]
				Level of Protection (% species)				*Saltwater*		
				99%	*95%*	*90%*	*80%*	*CMC*[c]	*CCC*[d]	
Arsenic	1	25	25	-	-	-	-	69	36	-
Cadmium	0.2	2.5	2.5	0.7	5.5	14	36	40	8.8	-
Chromium (III)	1	15	15	7.7	27.4	48.6	90.6	-	-	-
Chromium (VI)				0.14	4.4	20	85	1,100	50	-
Copper	1	4.8	5	0.3	1.3	3	8	4.8	3.1	-
Lead	2	25	25	2.2	4.4	6.6	12	210	8.1	-
Mercury	0.1	0.3	0.3	0.1	0.4	0.7	1.4	1.8	0.94	-
Nickel	1	30	30	7	70	200	560	74	8.2	-
Silver	1	1.9	2.3	0.8	1.4	1.8	2.6	1.9	-	-
Zinc	10	40	40	7	15	23	43	90	81	-
Total PCBs	0.01	0.03	-	-	-	-	-	-	0.03	-
PAHs	0.2	50	-	50[h]	70[h]	90[h]	120[h]	-	-	-
TBT	0.015	0.1	-	0.0004	0.006	0.02	0.05	0.42	0.0074	0.1
Alpha-BHC	0.01	0.0049	-	-	-	-	-	0.0049[f]		-
Beta BHC	0.01	0.017	-	-	-	-	-	0.017[f]		-
Gamma BHC	0.01	0.16	-	-	-	-	-	0.16	-	-
Delta-BHC	0.01	-	-	-	-	-	-	-		-
Heptachlor	0.01	0.053	-	-	-	-	-	0.053	-	-
Aldrin	0.01	1.3	-	-	-	-	-	1.3	-	-
Heptachlor epoxide	0.01	0.053	-	-	-	-	-	0.053	-	-
Alpha Endosulfan	0.01	0.034	-	-	-	-	-	0.034	-	-
p, p'-DDT	0.01	0.13	-	-	-	-	-	0.13	-	-
p, p'-DDD	0.01	0.00031	-	-	-	-	-	0.00031[f]		-
p, p'-DDE	0.01	0.00022	-	-	-	-	-	0.00022[f]		-
Endosulfan sulfate	0.01	89	-	-	-	-	-	89[f]		-

Notes:

(a) Her Majesty's Inspectorate of Pollution (HMIP) (1994). Environmental Economic and BPEO Assessment Principles for Integrated Pollution Control.

(b) Australia and New Zealand Guidelines for Fresh and Marine Water Quality (2000). Trigger values for toxicants at alternative levels of protection.

(c) National Recommended Water Quality Criteria (2006). The Criteria Maximum Concentration (CMC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. CMC is used as the criterion of the respective compounds in this study.

(d) National Recommended Water Quality Criteria (2006). The Criteria Continuous Concentration (CCC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. (Source: USEPA)

(e) Salazar, M.H. and Salazar, S.M. (1996). "Mussels as Bioindicators: Effects of TBT on Survival, Bioaccumulation, and Growth under Natural Conditions" in Organotin, edited by M.A. Champ and P.F. Seligman. Chapman & Hall, London.

(f) No saltwater criteria for this chlorinated pesticide were defined by USEPA. The water quality criterion to protect human health for the consumption of aquatic organisms is provided for reference.

(g) “-“ denotes no water quality criterion is defined in the guideline or standard.

(h) Only trigger value for naphthalene is set in the revised standard.

6.4 Baseline Conditions and Water Sensitive Receivers

6.4.1 Water Sensitive Receivers

The Project Site is located in the Tolo Harbour, near Ting Kok Sites of Special Scientific Interest (SSSI) & Coastal Protection Areas, Yim Tin Tsai East & West Fish Culture Zones, Sha Lan Non-gazetted Beach, Lung Mei & Yim Tin Tsai Mangroves, Pak Sha Tau coral, WSD Seawater Intakes for Tai Po Industrial Estate and Chinese University. *Table 6.4* shows the identified water sensitive receivers (WSRs) (including ecological sensitive receivers) in the vicinity of the Project Site and gives the WSRs' shortest distance to the Project Site. The water sensitive receivers have been identified in reference with the *Tai Po Outline Zoning Plan* (No. S/TP/19 – Tai Po), gazetted on 18th November 2005, Outline Development and Layout Plan and relevant published landuse plans. *Figure 6.1* illustrates the surrounding environment for the WSRs. These WSRs are regarded as the output points in the water quality modelling in order to quantify the impacts to these WSRs.

As aforementioned, Pak Sha Tau coral was classified as medium ecological values in the approved EIA (1). Marine ecological dive surveys for this Proposed Beach Development were undertaken in October 2006 and the results are presented in *Section 8 – Ecological Impact Assessment*. Very low number of coral colonies was found during the marine ecological study area and all of the identified coral species (totally 3 species) are either common or abundant in Hong Kong waters and they are considered to be low ecological value. Hence no specific output points are designated for these coral communities in the water quality model. However these coral communities will also be assessed by examining the contour plots of the water quality modelling results.

The WSRs, SR 8 to SR12, are marked in *Figure 6.1*. They represent the corners of the Proposed Land Requirement Boundary (SR8, SR9, SR11 and SR12) and the middle of the Project Site (SR10). The Project Site itself is not a sensitive area and hence is not defined as the WSR for construction phase impact assessment. However, the WSRs are used to predict the water quality during the operation phase of the Proposed Beach Development and to determine the suitability of being a gazetted bathing beach.

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(1) ERM (2003). Op cit

Table 6.4: Water Sensitive Receivers (WSRs) in the Vicinity of the Beach

Sensitive Receiver	**Name**	**ID**	**Shortest Distance to the Project Site (km)**
Fisheries Resources			
Fish Culture Zone	Yim Tin Tsai West Fish Culture Zone	SR1	2.8
	Yim Tin Tsai East Fish Culture Zone	SR2	1.5
Marine Ecological Resources			
SSSI/Coastal Protection Area	Ting Kok SSSI, near Ting Kok	SR3	0.5
	Ting Kok SSSI, near Shuen Wan	SR4	1.6
Mangrove	Ting Kok	SR5 (a)	0.5
	Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone	SR6	1.9
Coral	Pak Sha Tau	SR7	3
Water Resources			
Non-gazetted Beaches	Sha Lan	SR13	2.1
Seawater Intakes	MSL of Chinese University	SR14	4.4
	WSD at Tai Po Industrial Estate	SR15	4.3
Other Recreational Areas	Tai Mei Tuk Water Sports Centre	SR16	immediate vicinity
EPD Monitoring Stations	Tolo Harbour & Channel WCZ	TM3, TM5, TM6	3.5, 1.4, 3.1

Notes:

(a) The modelling station shown in *Figure 6.1* for SR5 is taken the same as SR3 which is approximately 100m offshore.

6.4.2 *Hydrodynamics*

Tolo Harbour is a long narrow tidal inlet, which expands to form a large bay at the landward end, into which a number of rivers and streams discharge. Shan Liu River and Lo Tsz River are adjacent to the Project Site. Tidal currents are generally low, 0.1 to 0.2 ms^{-1}, within Tolo Harbour, particularly towards the landward end. Along the outer, channel section, of the harbour the tidal currents are generally aligned parallel with the channel, while in the bay at the landward end large circulation patterns form. As a result of the low current speeds the flushing rate of the Tolo Harbour is low and residence times for the waters are long. Wave activity within Tolo Harbour is not significant as the waters are sheltered by the surrounding hills and because waves from the open sea are not able to propagate up the Tolo Harbour, due to the narrow seaward entrance.

6.4.3 Water Quality

EPD monitoring results (1998-2005) indicate that there is a gradient of improving water quality from the inner Tolo Harbour Subzone through to the outer Tolo Channel Subzone. Three monitoring stations are located in the vicinity of the Project Site, namely TM3, TM5 and TM6 (*Figure 6.1*). Among these three stations, TM5 is the closest to the Project Site and hence has similar characteristics to the baseline conditions in the Study Area. The water body in the vicinity of TM5 is reported as having water quality in-between TM3 and TM6 (*Table 6.5*).

At TM5, DO level at the bottom layer (2m above the seabed) has exceeded the WQO once in 1999 whereas the annual mean value was above the WQO. EPD data (1998-2005) also indicates that chlorophyll-*a* levels occasionally exceeded the WQO but no non-compliances were recorded during 2005. As mentioned above, there is no WQO for SS for the Tolo Harbour and Channel WCZ. The EPD data indicate that mean SS concentrations ranged between ~1 and 8 mg L^{-1}. Full compliance with the WQO was achieved for *E. coli* and relatively low *E. coli* levels (maximum 56 cfu $100mL^{-1}$) were recorded.

Table 6.5: EPD Routine Water Quality Monitoring Data (1998-2005) in the Vicinity of the Project Area

WQ Parameter	**Harbour Subzone**	**Buffer Subzone**	**Buffer Subzone**
	TM3	**TM5**	**TM6**
Temperature (^{o}C)	24.1	24.4	23.5
	(14.2-32.0)	(14.2-31.7)	(14.0-30.9)
Salinity (ppt)	31.2	31.1	31.8
	(25.7-34.6)	(25.2-34.3)	(25.0-35.6)
Dissolved Oxygen (Surface to 2m above Bottom) (mg L^{-1})	7.3	6.5	6.7
	(**3.7**-12.3)	(4.0-9.9)	(**2.3**-11.4)
Dissolved Oxygen (Bottom) (mg L^{-1})	6.3	6.7	5.3
	(**0.7**-11.7)	(**2.9**-13.3)	(**0.6**-11.9)
5-Day Biochemical Oxygen Demand (mg L^{-1})	2.1	1.9	1.5
	(0.2-5.6)	(0.6-5.6)	(0.1-5.5)
Suspended Solids (mg L^{-1})	2.5	2.8	2.1
	(0.5-8.0)	(0.6-8.0)	(0.5-8.2)
Total Inorganic Nitrogen (mg L^{-1})	0.10	0.07	0.08
	(0.01-0.34)	(0.01-0.37)	(0.01-0.34)
Unionised Ammonia (mg L^{-1})	0.005	0.004	0.003
	(0.000-0.017)	(0.000-0.017)	(0.000-0.016)
Chlorophyll a (µg L^{-1})	8.3	6.3	5.5
	(0.2-**27.0**)	(0.6-**25.0**)	(0.3-**23.0**)
E. coli (cfu 100mL^{-1})	3	3	1
	(1-58)	(1-56)	(1-53)

Notes:

1. Data presented are depth averaged, except as specified.
2. Data presented are annual arithmetic mean except for *E. coli*, which are geometric means.
3. Data enclosed in brackets indicate the ranges.
4. Bolded numbers indicate non-compliance with the WQOs.
5. Outliers have been removed.

6.4.4 *Beach Water Quality*

Although Lung Mei Beach is a non-gazetted beach, EPD routinely monitors the beach water quality at least twice per month during bathing seasons (March to October) and once per month during non-bathing season. During each beach monitoring visit, beach water samples are collected at three locations (see *Figure 6.2*) where the water depth is between thigh to waist depth, ie about 0.6 to 1 metre depth, for analysis of *E. coli*.

The monitoring data obtained between 2000 and 2006 are summarised in *Table 6.6*. The data showed that there is an overall increasing trend in *E. coli* concentrations throughout 2000-2005. In 2005, the level reached its highest in record but remained below the beach WQO, ie 180 cfu per 100mL. A slight decrease in *E. coli* concentrations has been recorded in 2006. According to EPD's annual ranking system, the rank of Lung Mei throughout 2000 – 2006 was classified as 'Fair', which refers to the geometric mean of *E. coli* between 25 and 180 cfu per 100mL.

Table 6.6: EPD Routine Beach Quality Monitoring Data (2000-2006) at Lung Mei Beach

Year	**Geometric Mean of *E. coli* (counts/100mL) during March to October**
2000	26.5
2001	64.1
2002	47.4
2003	91.4
2004	80.1
2005	164.6
2006	147.9

Further routine monitoring data for 2007 (up to September) was obtained from EPD. Since it does not cover the whole bathing season at the time of completion of this EIA Report, the annual geometric mean is not able to be derived and hence is not presented in *Table 6.6*. The geometric mean during March 2007 to September 2007 was calculated as 345 cfu per 100mL.

6.4.5 *Existing Watercourses and Drainage System*

Within the Study Area, there are several stormwater drainage outfalls along the coast of Lung Mei. The locations of these drains are shown in *Figure 6.3*.

There are two box culverts just beside the Project Site. One of them is a single cell box culvert, which is located at the western side of the Project Site and aligned underneath Ting Kok Road, carries surface runoff from the existing natural stream, Lo Tze River (W1-W3) and eventually discharges into the sea. Another single cell box culvert (W4), which is situated at the eastern side of the Project Site, collects surface runoff from Ting Kok Road and the natural hillside at Lung Mei.

In order to characterise the water quality of the drains and watercourses, the water from the stormwater drains (W4-W6), Lo Tsz River (W3) and upstream/midstream (W1 and W2) of Lo Tsz River has been sampled and tested. Water sampling surveys were conducted on 28 December 2006, and 4, 11, 16, 23, 31 January 2007 to measure the flow rate, temperature, pH and *E. coli* of the effluents. During these site surveys, the water in W4-W6 were found dirty and having some sewage odour. The water sampling results are summarised in *Table 6.7*. In the case that the flow could not be measured (it was too little and slow), the flow rate was recorded as less than 0.01 m s^{-1}.

Table 6.7: Water Sampling Results for the Existing Drains and Watercourses measured between December 2006 and January 2007

ID	Location	Purity	Odour	Averaged Flow Velocity [(a)] (m s^{-1})	Temperature (°C)	pH	Geometric Mean of *E. coli* (counts per 100mL)
W1	Upstream of Lo Tsz River	Clear	No	<0.01	22.0	6.8	6.9E+02
W2	Midstream of Lo Tsz River	Mostly clear but found dirty during one survey	Mostly without odour but with sewage smell during one survey	0.49	22.1	7.3	7.2E+03
W3	Downstream of Lo Tsz River	Clear	No	0.03	21.9	6.9	9.1E+02
W4	Box culvert at the immediate east of the Project Site	Dirty	With sewage smell	0.03	21.5	7.1	2.3E+04
W5	Box culvert from Lung Mei village	Dirty	With sewage smell	0.01	22.0	8.1	5.9E+03
W6	Box culvert from Tai Mei Tuk	Dirty	With sewage smell	<0.01	22.1	7.7	6.0E+01

Notes:
(a) The averaged flow velocity is taken as the mean of measured data during all surveys.

Based on the water quality sampling results, there is a potential that the identified watercourses may have contributed to *E. coli* concentrations in the existing Lung Mei Beach. As such, the beach water quality monitoring data obtained by EPD during the same period, ie from December 2006 to January 2007, have been reviewed. The EPD monitoring results are taken as geometric mean of *E. coli* data at three sampling stations within Lung Mei Beach and the *E. coli* concentrations are 3.4E+02 and 1.9E+02 counts per 100 mL in December 2006 and January 2007 respectively. These concentrations are found less than the geometric mean of *E. coli* at the two nearby drains, ie W3 and W4. This indicates that the discharges from the drains may be diluted by the seawater before reaching Lung Mei Beach.

6.4.6 *Sediment Quality*

EPD Monitoring

EPD collects sediment quality data as part of the marine water quality monitoring programme. There are two monitoring stations in the vicinity of Lung Mei Beach, namely TS3 and TS4 (see *Figure 6.1*), whereas TS4 is the closest to the Project Site. Monitoring data obtained during 1998 to 2005 for these stations have been published and are summarised in *Table 6.8*.

The routine EPD sediment quality monitoring data do not include values for TBT. The values for metals, PAHs and Total Polychlorinated Biphenyls (PCBs) can be compared to the relevant sediment quality criteria specified in *Environment Transport & Works Bureau Technical Circular No 34/2002 Management of Dredged/Excavated Sediment* (*ETWBTC 34/2002*), in order to determine whether the concentrations of these parameters is a cause for concern.

The EPD monitoring results indicate that few parameters have exceeded the Lower Chemical Exceedance Level (LCEL) in the reporting period (see *Table 6.8*). They include arsenic at TS3, chromium at TS4, copper at TS3, nickel at TS4 and lead, zinc and total PCBs at both stations. Among these, the maximum values of lead and zinc at TS3 and nickel at TS4 have exceeded Upper Chemical Exceedance Level (UCEL).

Table 6.8: EPD Routine Sediment Quality Monitoring Data (1998-2005) in the Vicinity of the Project Area

Parameters	Lower Chemical Exceedance Level (LCEL)	Upper Chemical Exceedance Level (UCEL)	Harbour Subzone TS3	Buffer Subzone TS4
Chemical Oxygen Demand	-	-	22,118	21,029
(mg/kg)			(15,000-28,000)	(15,000-26,000)
Ammoniacal Nitrogen	-	-	5.8	10.7
(mg kg^{1})			(0.0-23.0)	(0.0-24.0)
Total Kjeldahl Nitrogen	-	-	527	643
(mg kg^{1})			(330-640)	(370-850)
Total Phosphorus	-	-	162	185
(mg kg^{1})			(140-200)	(140-230)
Total Sulphide	-	-	122	130
(mg kg^{1})			(1-320)	(4-330)
Arsenic	12	42	10.3	9.2
(mg kg^{1})			(5.9-15.0)	(6.6-12.0)
Cadmium	1.5	4	0.5	0.4
(mg kg^{1})			(0.2-0.7)	(0.1-0.7)
Chromium	80	160	26	32
(mg kg^{1})			(14-36)	(19-81)
Copper	65	110	47	32
(mg kg^{1})			(22-97)	(15-42)
Lead	75	110	105	77
(mg kg^{1})			(75-**130**)	(55-93)
Mercury	0.5	1	0.07	0.07
(mg kg^{1})			(0.03-0.17)	(0.03-0.15)
Nickel	40	40	16	21
(mg kg^{1})			(8-28)	(13-**46**)
Silver	1	2	0.6	0.3
(mg kg^{1})			(0.0-1.0)	(0.0-0.5)
Zinc	200	270	233	168
(mg kg^{1})			(170-**380**)	(75-240)
Total PCBs	23	180	10	8
(µg kg^{1}) (e)			(3-52)	(3-36)
Low Molecular Wt PAHs	550	3,160	86	85
(µg kg^{1}) (f)			(60-185)	(60-191)
High Molecular Wt PAHs	1,700	9,600	47	56
(µg kg^{1}) (g)			(21-100)	(20-137)

Notes:

(a) Data presented are arithmetic mean.

(b) Data enclosed in brackets indicate the ranges.

(c) The shaded cell indicates exceedance of LCEL.

(d) The bolded text indicates exceedance of UCEL

(e) The Total PCBs results only cover 2002-2005 since the ETWB (W) No. 34/2002 was issued in 2002. If the value is below the reporting limit (RL), it will be taken as 0.5 x RL in the calculation.

(f) Low Molecular Wt PAHs include acenaphthene, acenaphthylene, anthracene, fluorine and phenanthrene. If the value is below the reporting limit (RL), it will be taken as 0.5 x RL in the calculation.
High Molecular Wt PAHs include benzo[a]anthracene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, indeno[1,2,3-c,d]pyrene and benzo[g,h,I]perylene. If the value is below the reporting limit (RL), it will be taken as 0.5 x RL in the calculation.

Marine Sediment Sampling

Sediment sampling has been undertaken to examine the quality of the sediment within the proposed dredging area. *Section 7* details the sampling programme and the sediment testing results.

Vibrocores were taken from nine sampling locations (SS1 – SS9) for chemical analysis. The locations of the sampling locations are illustrated in *Figure 7.2*. Chemical testing results indicate that all the contaminants contained in the sediment were found below the LCEL, with exception of arsenic. Arsenic concentrations in the sediment samples taken from locations SS1, SS2, SS4, SS7 and SS8 exceeded the LCEL but remained below the UCEL. These samples were classified as Category M and required biological screening. The biological tests were performed and all the sediment samples passed the biological test, with exception of SS1.

6.5 Evaluation of Impacts

6.5.1 Construction Phase

Construction methods and sequence of the Proposed Beach Development has been reviewed. During the construction phase, the following water impacts will potentially arise:

- Increase in SS, sediment deposition, and release of heavy metals and toxic chemicals from the sediment may result from dredging at the proposed beach area, two groynes and proposed new eastern box culvert;
- Increase in SS and sediment deposition may be resulted due to sandfilling at the proposed beach area;
- Change in chlorophyll-*a* levels due to dredging operations;
- Construction site runoff, if uncontrolled, may enter nearby watercourses; and
- Sewage generated from the workforce, if uncontrolled, may affect the quality of the surrounding water.

Impacts from the dispersion of fine sediment in suspension from the dredging and sandfilling have been simulated using Delft 3D Model. The construction sequence and construction methods were reviewed to work out the modelling assumptions. *Working Paper 2.0 – Methodology for Water Quality Modelling*, as enclosed in *Appendix E*, details modelling methodology and key model assumptions. The results are presented and discussed in the following sections.

Note that, “pre-development”, thereinafter, refers to the existing baseline conditions, ie there is no proposed Lung Mei beach development. “Operation phase”, thereinafter, refers to the situation that the proposed Lung Mei beach development and the bathing beach that will be operated by Leisure and Cultural Services Department (LCSD).

SS Elevations due to Dredging and Sandfilling Operations

Minimization of dredging quantities has been considered in the preliminary design of the proposed Bathing Beach Development. The rationale of the dredging requirements is elaborated in *Section 2.5.2*. The proposed dredging depth at the groynes is around 0.5 m to 1 m, which is for the levelling of the groyne foundation and ensuring groyne stability. It is assumed that one dredger will be used at a time during the dredging work.

Dredging for the beach, two groynes and the eastern box culvert will be conducted by a closed grab dredger. Half of the beach will then be filled by marine sand which will be spread out via a conveyor belt of a barge onto the filling area. The dredging and sandfilling operations were defined as two scenarios and were simulated by Delft 3D. The model results are presented in *Table 6.9*. Note that both scenarios were taken as the worst case, in which it assumed no mitigation measures have been applied. In reality a standing type silt curtain will enclose the sandfilling area whereas a cage type/ metal frame type silt curtain will enclose the dredging area, in order to reduce the maximum extent of visually intrusive sediment plume. In addition, the sandfilling works were assumed to be undertaken without any groynes in place. This is a highly conservative approach since in reality sandfilling will be conducted between the two groynes which will form a physical barrier to prohibit the transport of fine material to the surrounding from area. It is assumed that one sandfilling barge will be used at a time during the sandfilling work.

The scenarios were simulated based on the assumptions as described in *Appendix E*. The dredging was assumed to be operated at a maximum rate of 31 m^3 hr^{-1} for 8 working hours per day and 6 working days per week. The filling was assumed to be operated at a maximum rate of 1,000 m^3 day^{-1} with continuous filling operations of 3 hours per day.

Modelling results indicate that SS elevations will be compliant with the assessment criterion for all WSRs in the dry and wet seasons under both two scenarios (*Table 6.9*). *Table 6.10* shows the absolute values of the SS concentrations by adding the predicted SS elevations (from the model results) to the ambient level (the latest published EPD routine marine water monitoring data at the closest monitoring stations to the WSRs).

As mentioned in *Section 6.3.1*, AFCD's guideline requires that the SS level remains below 50 mg L^{-1} at the FCZs. *Table 6.10* shows that the SS concentrations at SR1 (Yim Tin Tsai West FCZ) and SR2 (Yim Tin Tsai East FCZ) are predicted to be lower than the assessment criterion of 50 mg L^{-1} in both dry and wet seasons. It is hence anticipated that the dredging and sandfilling operations are unlikely to impact the two FCZs.

Table 6.9: Predicted SS Elevations at WSRs due to Dredging or Sandfilling Operations

WSR	**Depth (a)**	**Assessment Criterion (mg L^{-1})**	**Elevations in Suspended Solids (mg L^{-1})**							
			Dredging				**Sandfilling**			
			Dry season		**Wet season**		**Dry season**		**Wet season**	
			Average over spring-neap	**Maximum during spring-neap**	**Average over spring-neap**	**Maximum during spring-neap**	**Average over spring-neap**	**Maximum during spring-neap**	**Average over spring-neap**	**Maximum during spring-neap**
SR1 (Yim Tin Tsai West Fish Culture Zone)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR2 (Yim Tin Tsai East Fish Culture Zone)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR3 (Ting Kok SSSI, near Ting Kok) /SR5 (Ting Kok)	S	10	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
	M	10	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
	B	10	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0
	DA	10	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0
SR4 (Ting Kok SSSI, near Shuen Wan)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR6 (Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR7 (Pak Sha Tau)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR13 (Sha Lan)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR14 (MSL of Chinese University)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WSR	**Depth (a)**	**Assessment Criterion (mg L^{-1})**	**Elevations in Suspended Solids (mg L^{-1})**							
			Dredging				**Sandfilling**			
			Dry season		**Wet season**		**Dry season**		**Wet season**	
			Average over spring-neap	**Maximum during spring-neap**	**Average over spring-neap**	**Maximum during spring-neap**	**Average over spring-neap**	**Maximum during spring-neap**	**Average over spring-neap**	**Maximum during spring-neap**
SR15 (WSD at Tai Po Industrial Estate)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SR16 (Tai Mei Tuk Water Sports Centre)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.1
	B	10	0.0	0.3	0.0	0.5	0.1	0.3	0.0	0.3
	DA	10	0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.1
TM3 (Tolo Harbour & Channel WCZ)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TM5 (Tolo Harbour & Channel WCZ)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TM6 (Tolo Harbour & Channel WCZ)	S	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DA	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:
(a) For Depth, S = near water surface, M = mid-depth, B = near seabed, DA = depth-averaged

Table 6.10: Predicted Absolute SS Concentrations at WSRs due to Dredging or Sandfilling Operations

WSR	Depth [a]	Respective EPD Monitoring Station	Ambient Level [b] (mg L^{-1})	Suspended Solids Concentration (mg L^{-1})							
				Dredging				Sandfilling			
				Dry season		Wet season		Dry season		Wet season	
				Average over spring-neap	Maximum during spring-neap	Average over spring-neap	Maximum during spring-neap	Average over spring-neap	Maximum during spring-neap	Average over spring-neap	Maximum during spring-neap
SR1 (Yim Tin Tsai West Fish Culture Zone)	S	TM5	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		nr	nd	nd	nd	nd	nd	nd	nd	nd
	B		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	DA		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
SR2 (Yim Tin Tsai East Fish Culture Zone)	S	TM5	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		nr	nd	nd	nd	nd	nd	nd	nd	nd
	B		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	DA		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
SR3 (Ting Kok SSSI, near Ting Kok) /SR5 (Ting Kok)	S	TM5	2.7	2.7	2.8	2.7	2.7	2.7	2.8	2.7	2.7
	M		nr	nd	nd	nd	nd	nd	nd	nd	nd
	B		2.8	2.8	3.0	2.8	2.8	2.8	2.9	2.8	2.8
	DA		2.8	2.8	3.0	2.8	2.8	2.8	2.9	2.8	2.8
SR4 (Ting Kok SSSI, near Shuen Wan)	S	TM5	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		nr	nd	nd	nd	nd	nd	nd	nd	nd
	B		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	DA		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
SR6 (Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone)	S	TM5	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		nr	nd	nd	nd	nd	nd	nd	nd	nd
	B		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	DA		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
SR7 (Pak Sha Tau)	S	TM6	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	M		1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
	B		2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	DA		2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
SR13 (Sha Lan)	S	TM5	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		nr	nd	nd	nd	nd	nd	nd	nd	nd
	B		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	DA		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8

WSR	**Depth** [(a)]	**Respective EPD Monitoring Station**	**Ambient Level** [(b)] **($mg L^{-1}$)**	**Suspended Solids Concentration ($mg L^{-1}$)**							
				Dredging				**Sandfilling**			
				Dry season		**Wet season**		**Dry season**		**Wet season**	
				Average over spring-neap	**Maximum during spring-neap**	**Average over spring-neap**	**Maximum during spring-neap**	**Average over spring-neap**	**Maximum during spring-neap**	**Average over spring-neap**	**Maximum during spring-neap**
SR14 (MSL of Chinese University)	S	TM3	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	B		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	DA		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
SR15 (WSD at Tai Po Industrial Estate)	S	TM3	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	B		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	DA		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
SR16 (Tai Mei Tuk Water Sports Centre)	S	TM5	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		nr	nd	nd	nd	nd	nd	nd	nd	nd
	B		2.8	2.8	3.1	2.8	3.3	2.9	3.1	2.8	3.1
	DA		2.8	2.8	2.9	2.8	3.0	2.8	2.9	2.8	2.9
TM3 (Tolo Harbour & Channel WCZ)	S	-	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	B		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	DA		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
TM5 (Tolo Harbour & Channel WCZ)	S	-	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	M		nr	nd	nd	nd	nd	nd	nd	nd	nd
	B		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	DA		2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
TM6 (Tolo Harbour & Channel WCZ)	S	-	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	M		1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
	B		2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	DA		2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1

Notes:

(a) For Depth, S = near water surface, M = mid-depth, B = near seabed, DA = depth-averaged

(b) Ambient levels are determined based on the latest published EPD routine marine water monitoring data (1998-2005).

(c) “nr” denotes no record.

(d) “nd” denotes not determinable

The contour plots of the SS elevations during the dry and wet seasons are presented in *Figures 6.4* to *6.7* respectively. The mean contours over time for the surface layer and the bottom layer are shown on the top of the figures. The maximum contours over time for the surface and the bottom layer are shown in the middle of *Figure 6.4 to 6.7*. The surface layer represents the first tenth layer near to the water surface, whereas the bottom layer represents the last tenth layer near to the seabed.

The maximum SS plots for both seasons suggest that plumes over 10 mg L^{-1} (refers to the contour in green of <15 mg L^{-1}) are likely to be confined to the works area and will not reach the closest eastward WSR, ie SR16 – Tai Mei Tuk Water Sports Centre, and the nearby identified coral colonies. The estimated maximum extension of the sediment plume (maximum values over 10 mg L^{-1}) is summarised in *Table 6.11*.

Table 6.11: Predicted Maximum Extension of the Sediment Plume

Season	**Depth**	**Plume Size (m)**			
		Dredging		**Sandfilling**	
		NW-to-SE Direction	**NE-to-SW Direction**	**NW-to-SE Direction**	**NE-to-SW Direction**
Dry	Surface	154	385	146	354
	Bottom	169	570	162	554
Wet	Surface	146	454	146	423
	Bottom	192	500	177	562

Due to the relatively limited spread of SS and no exceedances of the WQOs or tolerance criterion at sensitive receivers, no unacceptable elevations of SS would be expected to occur.

Sediment Deposition due to Dredging and Sandfilling Operations

Contour plots, which were illustrated in *Figures 6.4* to *6.7*, of sediment deposition as a result of dredging operations indicate that the majority of sediment settles either within or within relatively close proximity to the Project Site. This is expected given the very low current velocities present at the site. *Table 6.12* summarises the predicted sediment deposition rate (less than 0.00001 g m^{-2} day^{-1}) at a coral site at Pak Sha Tau (SR7) due to the grab dredging and sandfilling operations. Based on the results, the predicted sedimentation rate will be compliant with the assessment criterion of 100 g m^{-2} day^{-1}. This indicates the marine works is unlikely to cause any unacceptable impacts to the WSRs, especially the coral site at Pak Sha Tau.

For the coral colonies identified in the dive survey, the sedimentation rate would be much less than the assessment criterion (refer to *Figures 6.4* to *6.7*). Therefore it is expected that the dredging and sandfilling works would not adversely affect those corals.

Table 6.12: Predicted Sediment Deposition Rate at WSRs due to Dredging or Sandfilling Operations

WSR	**Assessment Criterion** (g m^{-2} day^{-1})	**Sedimentation rate (g m^{-2} day^{-1})**			
		Dredging		**Sandfilling**	
		Dry season	**Wet season**	**Dry season**	**Wet season**
		Average over spring-neap	**Average over spring-neap**	**Average over spring-neap**	**Average over spring-neap**
SR7 (Pak Sha Tau)	100	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Dissolved Oxygen Depletion due to Dredging and Sandfilling Operations

The degree of oxygen depletion exerted by a sediment plume is a function of the sediment oxygen demand of the sediment, its concentration in the water column and the rate of oxygen replenishment.

The impact of the sediment oxygen demand (SOD) on dissolved oxygen concentrations has been calculated based on the following equation (1):

$$DO_{Dep} = C * SOD * K * 10^{-6}$$

where DO_{Dep} = Dissolved oxygen depletion (mg L^{-1})

C = Suspended solids concentration (mg L^{-1})

SOD = Sediment oxygen demand (mg kg^{-1})

K = Daily oxygen uptake factor (set as 1 (2))

K was set to be 1, which means instantaneous oxidation of the sediment oxygen demand. This was a more conservative prediction of DO depletion than this study since oxygen depletion is not instantaneous and will depend on tidally averaged SS concentrations.

It is worth noting that the above equation does not account for re-aeration which would tend to reduce impacts of the SS on the DO concentrations in the water column. The proposed analysis, which is on the conservative side, will not, therefore, underestimate the DO depletion.

SOD values of the sediment within the dredging area were obtained from the sediment testing for this Proposed Beach Development. These values range between <100 and 600 mg kg^{-1}. The maximum value 600 mg kg^{-1} is used for the calculation in order to investigate the worst case.

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(1) ERM (1997). EIA for Disposal of Contaminated Mud in the East Sha Chau Marine Borrow Pit. For Civil Engineering Department, Hong Kong SAR Government.

(2) Mouchel (2002). EIA for Permanent Aviation Fuel Facility. For Hong Kong Airport Authority.

Based on the above, the calculated DO depletion at the WSRs will be less than 0.01 mg L^{-1}. With respect to the ambient DO concentrations of approximately 6.5 mg L^{-1} (annual mean recorded at EPD monitoring station TM5), it is expected that the dredging and sandfilling works are unlikely to attribute to the non-compliance of DO at the WSRs.

As discussed in *Section 6.3.1*, there is no specific DO level established for FCZs for the Tolo Harbour and Channel WCZ. DO level of 5 mg L^{-1} is a WQO parameter generally applied for FCZs at other WCZs. Since the DO depletion is predicted to be less than 0.01 mg L^{-1} with the ambient DO concentrations of approximately 6.5 mg L^{-1}, the DO concentrations at SR1 (Yim Tin Tsai West FCZ) and SR2 (Yim Tin Tsai East FCZ) are predicted to be in compliance with the assessment criterion. It is hence no adverse impacts on the DO levels at two FCZs are expected.

Release of Contaminants due to Dredging and Sandfilling Operations

Elutriate tests were undertaken to investigate whether dredging would cause the release of contaminants contained in the sediment. Samples were taken from the sampling locations as shown in *Figure 7.2*.

The elutriate test results indicate that concentrations of PAHs, total PCBs, TBT and all chlorinated pesticides were found below the reporting limits for all sampling locations. This suggests that the leaching potential of these contaminants would be low.

The elutriate test results of the dissolved metals are presented in *Table 6.13*. The results show that the concentrations of dissolved metals in most of the samples are below the reporting limits and all of them are compliant with the assessment criteria. This indicates that dredging the sediments is unlikely to cause a detectable increase in contaminant levels in the surrounding water. Note that the values shown in the table include the background concentrations.

Therefore, it is expected that dredging at the proposed Project Site is unlikely to cause unacceptable levels of contaminant release from the dredged sediment to the surrounding water.

The potential source of sand will be imported from Mainland China (see details in Section 3.8). Consideration of the source will make reference to the past completed projects and concurrent projects, for example, Peng Chau Sand Replenishment Project which imported the sand from Shajiao, Zhujiang estuary. The imported sand shall comply with the requirements as promulgated in *WBTC No. 10/1995*. In addition, the sand quality will be based on similar requirements in respect to sand for a recreational beach as set out in *Section 3.6* of the *Port Works Design Manual: Part 5 – Guide to Design of Beaches* (1). It specifies that there should be no organic content and contaminated materials. It is hence anticipated that the sand used for filling will not impact surrounding water.

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(1) Civil Engineering Department (2003). Port Works Design Manual: Part 5 – Guide to Design of Beaches. First published, June 2003.

Table 6.13: Summary of Elutriate Test Results (Dissolved Metals)

Sample Reference		**Heavy Metals**								
Sampling Locations	**Depth**	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Mercury (Hg)	Arsenic (As)	Silver (Ag)
	From To	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Report Limit		0.2	1.0	1.0	1.0	1.0	10	0.1	1.0	1.0
Assessment Criterion		2.5	15	4.8	30	25	40	0.3	25	1.9
SS1	0.2-0.9m	<0.2	<1	<1	1.7	<1	<10	<0.1	<1	<1
SS1	0.9-1.2m	<0.2	<1	2.2	<1	<1	<10	<0.1	<1	<1
SS2	0.5-0.9m	<0.2	<1	<1	2.2	<1	<10	<0.1	<1	<1
SS2	0.9-1.9m	<0.2	<1	<1	2.3	<1	<10	<0.1	<1	<1
SS2	1.9-2.5m	<0.2	<1	<1	1.4	<1	<10	<0.1	<1	<1
SS3	0.0-0.9m	<0.2	<1	1.1	1.6	<1	<10	<0.1	4.5	<1
SS3	0.9-1.9m	<0.2	<1	1.3	1.8	<1	10	<0.1	<1	<1
SS3	1.9-2.8m	<0.2	<1	2.1	1.5	<1	<10	<0.1	<1	<1
SS4	0.0-0.9m	<0.2	<1	<1	1.1	<1	<10	<0.1	<1	<1
SS4	0.9-1.3m	<0.2	<1	<1	<1	<1	<10	<0.1	<1	<1
SS5	0.0-0.9m	<0.2	<1	<1	<1	1.4	<10	<0.1	<1	<1
SS6	0.0-0.9m	<0.2	<1	<1	<1	<1	<10	<0.1	1.9	<1
SS6	0.9-1.6m	0.3	<1	1.2	1.3	1.4	10	<0.1	5.2	<1
SS7	0.0-0.9m	<0.2	<1	<1	1.5	1.6	<10	<0.1	<1	<1
SS7	0.9-1.3m	<0.2	<1	<1	<1	<1	<10	<0.1	<1	<1
SS8	0.0-0.9m	<0.2	<1	<1	1.4	<1	<10	<0.1	<1	<1
SS8	0.9-1.7m	<0.2	<1	<1	<1	<1	<10	<0.1	1.8	<1
SS9	0.0-0.9m	<0.2	<1	<1	<1	<1	<10	<0.1	<1	<1
SS9	0.9-1.9m	0.3	<1	2.2	<1	<1	23	<0.1	<1	<1

Release of Nutrients due to Dredging Operations

By reviewing the sediment sampling results, the concentrations of nitrite and nitrate in the sampled sediments were below the reporting limits and the ammoniacal nitrogen levels were below 1.8 mg kg^{-1}. Total Kjeldahl Nitrogen (TKN) concentrations in the sediment ranged between <50 and 210 mg kg^{-1}. The maximum value of TKN in the sample sediment is about one-third of the ambient concentrations (annul mean recorded at EPD monitoring station TS4). This indicates that the nutrient level in the sediment within the dredging area is relatively low compared to other areas in the WCZ.

As discussed previously, the SS elevations at the WSRs would be less than 0.5 mg L^{-1} and the sediment plume is predicted to be confined to the dredging site. It is hence expected that the nutrient elevation in the water as a result of the sediment plume due to unmitigated dredging works would be minimal. As a consequence of this prediction it is not expected that algal blooms are likely to occur.

*Effect on Chlorophyll-*a *Level due to Dredging Operations*

During dredging operations, the suspension of sediment and subsequent release of nutrients may affect the chlorophyll-*a* level in the vicinity of the Project Area. Chlorophyll-*a* was hence modelled directly and the model results are presented in *Tables 6.14* and *6.15* as well as in *Figures 6.8* and *6.9*.

Model results show that during the dredging operations the relative change in chlorophyll-*a* levels (pre-development phase minus dredging phase) is very small and ranges between -0.092 µg L^{-1} (reduction) and 0.004 µg L^{-1} (increment) -2.786% to 0.046% (*Table 6.14*). The modeling also indicates that the relative percentage change (increase in chlorophyll-*a*) is less than 0.07%. This demonstrates that the dredging works are unlikely to significantly elevate chlorophyll-*a* levels at WSRs or to cause any adverse impacts. Chlorophyll-*a* concentrations may decrease as a result of the dredging activity during which the light availability will be reduced. In other words, less light will be available for primary production and hence chlorophyll-*a* concentrations will tend to decrease. It is anticipated that the very small change in chlorophyll-*a* concentrations will be transient and the chlorophyll-*a* level will return to pre-dredging conditions after the completion of dredging works.

The predicted chlorophyll-*a* levels at the WSRs within or in the vicinity of the Project Site area, are checked for compliance with the assessment criterion (the WQO of chlorophyll-*a* for the buffer subzone of Tolo Harbour and Channel WCZ) (1). The model results are determined in the same way as the WQO. *Table 6.15* presents the maximum 5-day arithmetic mean of chlorophyll-*a* concentrations at each water depth of the near-field WSRs.

Based on the model results, it is therefore concluded that the dredging works would not cause any WQO non-compliances for chlorophyll-*a*.

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(1) Note that the WQO of chlorophyll-*a* stated that the waste discharges shall not cause the level of chlorophyll-*a* in waters of the subzone to exceed 10 milligrams per cubic metre (equivalent to micrograms per litre), calculated as a running arithmetic mean of 5 daily measurements for any single location and depth.

Table 6.14: Predicted Absolute and Relative Change in Chlorophyll-*a* Concentrations at WSRs due to Dredging Operations

WSR	Depth	Absolute Difference (a) in Chlorophyll-*a* (ug L^{-1})				Relative Change (%)(b)			
		Dry Season		Wet Season		Dry Season		Wet Season	
		Avg (c)	Max (d)	Avg (c)	Max (d)	Avg (c)	Max (d)	Avg (c)	Max (d)
SR1 (Yim Tin Tsai West Fish Culture Zone)	S	0.000	0.000	0.000	0.000	0.000%	0.000%	0.000%	0.000%
	M	0.000	0.000	0.000	0.000	0.000%	0.000%	0.003%	0.003%
	B	0.000	0.000	0.000	0.000	0.000%	0.000%	0.001%	0.009%
	DA	0.000	0.000	0.000	0.000	0.000%	0.000%	0.000%	0.002%
SR2 (Yim Tin Tsai East Fish Culture Zone)	S	-0.002	-0.005	0.001	0.002	-0.059%	-0.046%	0.028%	0.035%
	M	-0.002	-0.005	0.001	0.003	-0.056%	-0.046%	0.028%	0.038%
	B	-0.002	-0.005	0.000	0.001	-0.057%	-0.047%	0.012%	0.015%
	DA	-0.002	-0.005	0.001	0.002	-0.059%	-0.046%	0.024%	0.032%
SR3 (Ting Kok SSSI, near Ting Kok) /SR5 (Ting Kok)	S	-0.013	-0.043	-0.013	-0.006	-0.324%	-0.380%	-0.257%	-0.063%
	M	-0.013	-0.043	-0.014	-0.007	-0.323%	-0.378%	-0.265%	-0.072%
	B	-0.013	-0.043	-0.015	-0.008	-0.323%	-0.377%	-0.283%	-0.079%
	DA	-0.012	-0.043	-0.014	-0.007	-0.323%	-0.378%	-0.268%	-0.071%
SR4 (Ting Kok SSSI, near Shuen Wan)	S	-0.003	-0.008	0.002	0.002	-0.075%	-0.060%	0.037%	0.031%
	M	-0.003	-0.008	0.002	0.003	-0.075%	-0.060%	0.037%	0.039%
	B	-0.003	-0.008	0.002	0.004	-0.075%	-0.060%	0.037%	0.061%
	DA	-0.004	-0.008	0.002	0.003	-0.077%	-0.060%	0.037%	0.045%
SR6 (Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone)	S	-0.001	-0.002	0.001	0.003	-0.026%	-0.019%	0.038%	0.044%
	M	-0.001	-0.002	0.001	0.003	-0.029%	-0.018%	0.035%	0.044%
	B	-0.001	-0.002	0.001	0.003	-0.026%	-0.018%	0.030%	0.041%
	DA	-0.001	-0.002	0.001	0.003	-0.026%	-0.018%	0.035%	0.043%
SR7 (Pak Sha Tau)	S	0.000	0.000	0.000	0.000	-0.007%	-0.003%	0.004%	0.009%
	M	0.000	0.000	0.000	0.000	-0.006%	-0.005%	0.000%	0.006%
	B	0.000	0.000	0.000	0.000	-0.006%	-0.005%	0.002%	0.000%
	DA	0.000	0.000	0.000	0.000	-0.006%	-0.006%	0.007%	0.006%
SR13 (Sha Lan)	S	-0.002	-0.006	0.002	0.004	-0.055%	-0.049%	0.036%	0.054%
	M	-0.002	-0.005	0.002	0.004	-0.055%	-0.040%	0.036%	0.057%
	B	-0.002	-0.006	0.002	0.004	-0.053%	-0.049%	0.037%	0.054%
	DA	-0.002	-0.006	0.002	0.004	-0.055%	-0.049%	0.039%	0.056%
SR14 (MSL of Chinese University)	S	0.000	0.000	0.000	0.000	0.001%	0.000%	0.000%	0.000%
	M	0.000	0.001	0.000	0.000	0.001%	0.005%	0.003%	0.002%
	B	0.000	0.000	0.000	0.000	0.000%	0.000%	0.002%	0.000%
	DA	0.000	0.000	0.000	0.000	0.002%	0.000%	0.000%	0.002%

WSR	**Depth**	**Absolute Difference [a] in Chlorophyll-*a* (ug L^{-1})**				**Relative Change (%)[b]**			
		Dry Season		**Wet Season**		**Dry Season**		**Wet Season**	
		Avg [c]	**Max [d]**	**Avg [c]**	**Max [d]**	**Avg [c]**	**Max [d]**	**Avg [c]**	**Max [d]**
SR15 (WSD at Tai Po Industrial Estate)	S	0.000	0.001	0.000	0.001	0.000%	0.003%	0.000%	0.004%
	M	0.000	0.000	0.000	0.000	0.001%	0.000%	0.002%	0.000%
	B	0.000	0.000	0.000	0.000	0.004%	0.000%	0.006%	0.004%
	DA	0.000	0.000	0.000	0.001	0.000%	0.000%	0.000%	0.008%
SR16 (Tai Mei Tuk Water Sports Centre)	S	-0.012	-0.034	-0.004	-0.023	-0.330%	-0.325%	-0.096%	-0.311%
	M	-0.015	-0.058	-0.028	-0.049	-0.441%	-0.588%	-0.608%	-0.648%
	B	-0.017	-0.092	-0.021	-0.058	-0.571%	-1.161%	-0.845%	-1.316%
	DA	-0.015	-0.065	-0.018	-0.047	-0.451%	-0.689%	-0.466%	-0.711%
TM3 (Tolo Harbour & Channel WCZ)	S	0.000	0.000	0.000	0.000	0.000%	0.000%	0.001%	0.000%
	M	0.000	0.000	0.000	0.000	0.000%	0.000%	0.003%	0.001%
	B	0.000	0.000	0.000	0.000	0.000%	0.005%	0.003%	0.003%
	DA	0.000	0.001	0.000	0.000	0.000%	0.009%	0.003%	0.003%
TM5 (Tolo Harbour & Channel WCZ)	S	-0.002	-0.005	0.001	0.003	-0.062%	-0.046%	0.028%	0.047%
	M	-0.002	-0.005	0.001	0.003	-0.062%	-0.046%	0.031%	0.049%
	B	-0.002	-0.005	0.000	0.000	-0.063%	-0.048%	0.000%	-0.002%
	DA	-0.002	-0.005	0.001	0.002	-0.062%	-0.047%	0.025%	0.036%
TM6 (Tolo Harbour & Channel WCZ)	S	0.000	0.001	0.000	0.001	-0.005%	0.007%	0.006%	0.006%
	M	0.000	0.000	0.000	0.000	-0.016%	-0.002%	0.000%	0.000%
	B	0.000	0.000	0.000	0.000	-0.013%	-0.011%	0.000%	0.000%
	DA	0.000	0.000	0.000	0.000	-0.010%	-0.003%	0.006%	0.006%

Notes:

(a) Absolute difference is calculated as values obtained from dredging scenario minus baseline scenario. The values were rounded up to 3 decimal places.

(b) Relative change is calculated as absolute difference divided by baseline scenario. The values were rounded up to 3 decimal places.

(c) Avg denotes the mean value over a spring-neap cycle.

Max denotes the maximum value over a spring-neap cycle.

Table 6.15: Predicted Chlorophyll-*a* Concentrations (μg L^{-1}) at WSRs during Pre-development and Dredging Operations

WSR	Layer	Predicted Chlorophyll-a Concentrations (in ug/L, calculated as maximum 5-day arithmetic average) [(a)]				
		WQO	Pre-development		Dredging Operations	
			Dry	Wet	Dry	Wet
SR2 (Yim Tin Tsai East Fish Culture Zone)	1 (surface)	10	6.10	5.69	6.09	5.70
	2	10	6.10	5.71	6.10	5.71
	3	10	6.11	5.72	6.10	5.72
	4	10	6.11	5.73	6.11	5.74
	5	10	6.11	5.70	6.10	5.70
	6	10	6.10	5.57	6.10	5.58
	7	10	6.09	5.30	6.09	5.30
	8	10	6.08	5.02	6.08	5.02
	9	10	6.07	4.82	6.06	4.82
	10 (bottom)	10	6.05	4.81	6.05	4.81
(Ting Kok SSSI, near Ting Kok) /SR5 (Ting Kok)	1 (surface)	10	6.64	7.13	6.62	7.12
	2	10	6.64	7.13	6.63	7.12
	3	10	6.65	7.14	6.63	7.12
	4	10	6.65	7.15	6.64	7.13
	5	10	6.65	7.15	6.64	7.14
	6	10	6.65	7.16	6.64	7.14
	7	10	6.65	7.16	6.64	7.15
	8	10	6.66	7.17	6.64	7.15
	9	10	6.66	7.16	6.64	7.15
	10 (bottom)	10	6.66	7.16	6.64	7.15
SR4 (Ting Kok SSSI, near Shuen Wan)	1 (surface)	10	7.56	6.27	7.55	6.28
	2	10	7.57	6.28	7.56	6.28
	3	10	7.58	6.28	7.57	6.28
	4	10	7.59	6.28	7.58	6.29
	5	10	7.59	6.28	7.59	6.28

WSR	Layer	Predicted Chlorophyll-a Concentrations (in ug/L, calculated as maximum 5-day arithmetic average) [(a)]				
		WQO	Pre-development		Dredging Operations	
			Dry	Wet	Dry	Wet
SR4 (Ting Kok SSSI, near Shuen Wan)	6	10	7.60	6.28	7.59	6.28
	7	10	7.60	6.28	7.60	6.28
	8	10	7.61	6.27	7.60	6.28
	9	10	7.61	6.27	7.60	6.27
	10 (bottom)	10	7.61	6.26	7.61	6.27
SR6 (Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone)	1 (surface)	10	6.15	5.34	6.15	5.34
	2	10	6.17	5.35	6.17	5.35
	3	10	6.19	5.35	6.18	5.35
	4	10	6.19	5.34	6.19	5.34
	5	10	6.20	5.34	6.20	5.34
	6	10	6.21	5.33	6.20	5.33
	7	10	6.21	5.31	6.21	5.32
	8	10	6.22	5.25	6.21	5.25
	9	10	6.22	5.15	6.22	5.15
	10 (bottom)	10	6.23	5.12	6.23	5.12
SR13 (Sha Lan)	1 (surface)	10	7.06	5.78	7.05	5.78
	2	10	7.07	5.79	7.07	5.79
	3	10	7.08	5.78	7.08	5.79
	4	10	7.09	5.78	7.08	5.78
	5	10	7.09	5.77	7.09	5.77
	6	10	7.10	5.76	7.09	5.76
	7	10	7.10	5.74	7.09	5.75
	8	10	7.10	5.72	7.10	5.73
	9	10	7.10	5.70	7.09	5.70
	10 (bottom)	10	7.10	5.67	7.09	5.68

WSR	**Layer**	**Predicted Chlorophyll-a Concentrations (in ug/L, calculated as maximum 5-day arithmetic average)** [(a)]				
		WQO	**Pre-development**		**Dredging Operations**	
			Dry	**Wet**	**Dry**	**Wet**
SR16 (Tai Mei Tuk Water Sports Centre)	1 (surface)	10	5.95	5.83	5.93	5.82
	2	10	5.97	6.05	5.95	6.04
	3	10	5.95	6.57	5.93	6.55
	4	10	5.90	6.86	5.88	6.83
	5	10	5.81	6.72	5.78	6.68
	6	10	5.70	6.03	5.67	5.99
	7	10	5.59	5.29	5.57	5.25
	8	10	5.50	4.57	5.48	4.54
	9	10	5.43	3.88	5.40	3.84
	10 (bottom)	10	5.41	3.72	5.38	3.68
TM5 (buffer subzone, Tolo Harbour & Channel WCZ)	1 (surface)	10	6.02	5.71	6.01	5.72
	2	10	6.03	5.73	6.02	5.73
	3	10	6.03	5.74	6.02	5.74
	4	10	6.03	5.74	6.02	5.75
	5	10	6.02	5.67	6.02	5.67
	6	10	6.01	5.48	6.01	5.48
	7	10	6.00	5.18	5.99	5.18
	8	10	5.97	4.83	5.97	4.83
	9	10	5.94	4.52	5.94	4.52
	10 (bottom)	10	5.91	4.49	5.90	4.49

Notes:

(a) Model results were calculated as a running arithmetic mean of 5 daily measurements for any single location and depth for the last 15 days of simulation and the maximum values of the 5-day mean over fifteen days were taken for the presentation. The values were corrected to 3 significant figures.

(b) Bolded values, if any, indicate non-compliance with the WQO and assessment criterion.

Construction Site Runoff

During land based construction activities for the Proposed Beach Development, impacts to water quality may occur from pollutants, mainly SS, in site runoff which may enter marine waters, if the runoff is not adequately controlled.

Design features and methods that will be used to control surface runoff, reduce the potential for erosion, and prevent offsite siltation to receiving waters will be adopted. Prior to construction of the drainage diversion at Lo Tsz River, the upstream river water will be diverted. This indicates no river water will pass through the works area and hence the construction works will not affect the water quality of Lo Tze River. Although no unacceptable water quality impacts are predicted due to the drainage diversion works, the excavation works will be carried out to minimize any seawater influx entering the works area and hence to keep the works area dry as much as possible. To avoid any adverse water quality impacts resulting from the site runoff due to heavy rainfall, it is recommended to deploy silt curtains at the inshore waters enclosing the works area before the commencement of the excavation works for two drainage diversions until the completion of the diversions. Details of the mitigation measures are shown in *Section 6.6*.

Site inspections will be undertaken to ensure the ongoing suitability and good repair of the adopted erosion control measures. In particular, inspections will be undertaken before and after heavy rainfall events. The site runoff will be treated, if required, and checked for compliance with the appropriate standards prior to being discharged.

As construction runoff is expected to be managed through good site practice, no unacceptable impacts to sensitive receivers are predicted.

Sewage Generated by Workforce

Sewage will arise from the construction workforce and site office's sanitary facilities. It is estimated that up to 100 construction workers will be on site at the peak of the construction programme. It is expected that portable toilets will be provided for the site workers. The maximum volume of the collected sewage is estimated to be 0.1 m^3 per day. Portable toilet wastewater should be disposed of by a licensed chemical waste collector.

As sewage discharges to the marine environment or neighboring streams are not expected to occur, no unacceptable water quality impacts to sensitive receivers are predicted.

6.5.2 Operation Phase

The potential impacts that may arise from the operation of the Proposed Beach Development include the following:

- Sewage generated from the visitors and employees, if uncontrolled, may deteriorate the surrounding water quality;

- Presence of the Proposed Beach Development, especially the diversion of box culvert may change the chlorophyll-*a* levels;

- Presence of the groynes, especially at the eastern part of the site, may affect the flushing circulation;

- Sediment/Sand loss due to the maintenance dredging and sandfilling;

- Surface runoff from the Project Site (car park) that may contain oil/petroleum chemicals, if uncontrolled may enter the nearby watercourses; and

- Unsewered sewage from the nearby villages that may deteriorate the beach water quality.

The above potential impacts are evaluated in the following sections.

In addition, it is also necessary to assess whether Lung Mei bathing beach is suitable to become a gazetted beach. The effect on the beach water quality arising from the discharges of the nearby drains and watercourses will be addressed.

Sewage Generated from the Visitors and Employees

It is estimated that there will be approximately 4,000 visitors per day during peak season. The peak design sewage and wastewater flow generated from the beach facilities (fast food kiosk and shower area included) is 30 L s^{-1}.

To avoid any possible future overloading of the existing sewerage system caused by the beach development, a holding tank is proposed with a capacity of around $10m^3$ (the estimated total volume of sewage per day generated from the Proposed Beach Development). Sewage will be stored in the sewage holding tank during the high flow hours and gradually released to the existing sewerage system by pumps in the low flow hours at night within the time between 12:00pm and 4:00am with approximate pump rate of 5 l/s. The proposed sewerage pipeline under the Project will be connected to the existing trunk sewer located along the existing cycle track and the collected sewage will be eventually treated at Tai Po Sewage Treatment Works. Since no sewage will be directly discharged into the beach from the beach facilities and the sewage discharge will be compliant with the standards stipulated in the *TM*, no unacceptable water quality impacts are expected.

Surface Runoff from the Project Site

The *Drainage Impact Assessment* (1) for this Proposed Beach Development indicated that the paving area for beach facilities would potentially increase the surface runoff. This surface runoff will be collected by the proposed western gabion.

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(1) Halcrow (2007). Development of a Bathing Beach at Lung Mei, Tai Po. Environmental, Drainage and Traffic Assessments - Investigation. Drainage Impact Assessment Report. For Civil Engineering and Development Department, HKSAR.

The surface runoff from the car park may contain some oil or petroleum chemicals. In this regard, a petrol interceptor will be put at the connection point of the proposed western gabion and the outlet of the drains inside the carpark area.

As aforementioned, the gabion embankments in the proposed western gabion would allow vegetation. This would also enhance screening and filtering of silts or other particulates in the discharge before entering the sea.

With good maintenance of the diversion systems and full implementation of recommended mitigation measures (see *Section 6.6*), no unacceptable water quality impacts are expected.

*Effect on Chlorophyll-*a *Level due to Operation of Bathing Beach*

The Proposed Beach Development which will involve drainage diversion that could potentially affect the chlorophyll-*a* levels in the surrounding area through a change in dispersion patterns of nutrients in the run-off from the diverted drainage channels. Hence, water quality modelling was carried out to investigate the situation with the diverted flows in place. The model results are shown in *Tables 6.16(a)-(c)* and *6.17* as well as in *Figures 6.10(a)-(c)* and *6.11(a)-(c)*.

Model results show that the chlorophyll-*a* levels during the operation phase, as compared with the pre-development phase, will change within a very narrow range for all three difference scenarios, as shown below (the values were corrected to 4 decimal places):

- **60% sewerage connection rate scenario**: absolute difference (operation phase minus pre-development phase) between -0.6574 µg L^{-1} (reduction) and 0.0128 µg L^{-1} (increment) (*Table 6.16(a)*);

- **40% sewerage connection rate scenario**: absolute difference (operation phase minus pre-development phase) between -0.4428 µg L^{-1} (reduction) and 0.0129 µg L^{-1} (increment) (*Table 6.16(b)*);

- **20% sewerage connection rate scenario**: absolute difference (operation phase minus pre-development phase) between -0.2230 µg L^{-1} (reduction) and 0.0132 µg L^{-1} (increment) (*Table 6.16(c)*);

Reduction in chlorophyll-*a* levels is predicted to occur mainly within the beach area or in close proximity of the beach (*Tables 6.16 (a) - (c)*). The reduction is likely due to the drainage diversion and the provision of two groynes at both sides of the beach which would change the hydrodynamic regime in the near-field area and induce a beneficial effect on the water quality in terms of chlorophyll-*a* concentrations.

The above results indicate that alteration of the two drainage channels' discharge locations would not cause a relative change with respect to the pre-development condition of more than 0.35% in either near-field or far-field areas for all three scenarios. It is hence not expected the Proposed Beach Development would cause a significant increase in chlorophyll-*a* levels at WSRs.

In order to investigate whether the chlorophyll-*a* levels within or in the vicinity of the beach area are in compliance with the assessment criterion, the predicted chlorophyll-*a* levels at the near-field WSRs were compared against the WQO of chlorophyll-*a* for the buffer subzone of Tolo Harbour and Channel WCZ (1). The model results were calculated in the same way as the WQO. *Table 6.17* presents the maximum 5-day arithmetic mean of chlorophyll-*a* concentrations at each water depth of the near-field WSRs.

Based on the model results, it is anticipated that WQO non-compliances of chlorophyll-*a* are not expected to occur during the operation phase of the Proposed Beach Development.

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(1) Note that the WQO of chlorophyll-*a* stated that the waste discharges shall not cause the level of chlorophyll-*a* in waters of the subzone to exceed 10 milligrams per cubic metre (equivalent to micrograms per litre), calculated as a running arithmetic mean of 5 daily measurements for any single location and depth.

Table 6.16(a): Predicted Absolute Difference and Relative Change in Chlorophyll-*a* Concentrations at WSRs during Operation Phase – 60% Sewerage Connection Rate

WSR	Depth (a)	Absolute Difference (a) in Chlorophyll-*a* (ug L^{-1})				Relative Change (%)(b)			
		Dry Season		Wet Season		Dry Season		Wet Season	
		Avg (b)	Max (c)	Avg (b)	Max (c)	Avg (b)	Max (c)	Avg (b)	Max (c)
SR1 (Yim Tin Tsai West Fish Culture Zone)	S	-0.0037	-0.0020	-0.0015	-0.0160	-0.056%	-0.012%	-0.023%	-0.135%
	M	-0.0019	-0.0020	-0.0016	0.0080	-0.036%	-0.015%	-0.049%	0.131%
	B	0.0002	0.0032	0.0000	0.0010	0.015%	0.119%	-0.006%	0.088%
	DA	-0.0016	0.0000	-0.0008	0.0007	-0.038%	0.000%	-0.024%	0.012%
SR2 (Yim Tin Tsai East Fish Culture Zone)	S	-0.0173	-0.0520	-0.0709	-0.1342	-0.464%	-0.481%	-1.811%	-1.964%
	M	-0.0171	-0.0510	-0.0703	-0.1354	-0.458%	-0.471%	-1.821%	-1.975%
	B	-0.0167	-0.0500	-0.0446	-0.1207	-0.450%	-0.469%	-1.380%	-2.021%
	DA	-0.0170	-0.0510	-0.0630	-0.1340	-0.456%	-0.473%	-1.713%	-2.029%
SR3 (Ting Kok SSSI, near Ting Kok) /SR5 (Ting Kok)	S	-0.0286	-0.1300	-0.1871	-0.3263	-0.741%	-1.148%	-3.616%	-3.330%
	M	-0.0286	-0.1300	-0.1875	-0.3146	-0.739%	-1.142%	-3.630%	-3.322%
	B	-0.0286	-0.1310	-0.1873	-0.3300	-0.738%	-1.147%	-3.650%	-3.356%
	DA	-0.0287	-0.1300	-0.1874	-0.3173	-0.742%	-1.142%	-3.634%	-3.326%
SR4 (Ting Kok SSSI, near Shuen Wan)	S	-0.0310	-0.1000	-0.1073	-0.2197	-0.666%	-0.752%	-2.344%	-3.049%
	M	-0.0310	-0.1000	-0.1072	-0.2188	-0.664%	-0.749%	-2.339%	-3.044%
	B	-0.0310	-0.1000	-0.1062	-0.2177	-0.663%	-0.747%	-2.325%	-3.036%
	DA	-0.0310	-0.1000	-0.1070	-0.2185	-0.664%	-0.749%	-2.337%	-3.041%
SR6 (Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone)	S	-0.0172	-0.0430	-0.0620	-0.1282	-0.453%	-0.398%	-1.665%	-2.022%
	M	-0.0174	-0.0440	-0.0621	-0.1285	-0.455%	-0.403%	-1.667%	-2.023%
	B	-0.0173	-0.0430	-0.0592	-0.1271	-0.451%	-0.393%	-1.631%	-2.013%
	DA	-0.0173	-0.0440	-0.0614	-0.1282	-0.453%	-0.404%	-1.658%	-2.022%
SR7 (Pak Sha Tau)	S	-0.0002	-0.0011	-0.0049	-0.0087	-0.007%	-0.012%	-0.213%	-0.200%
	M	-0.0023	0.0128	-0.0058	-0.0133	-0.134%	0.200%	-0.409%	-0.426%
	B	0.0000	-0.0008	-0.0021	-0.0057	0.003%	-0.097%	-0.356%	-0.424%
	DA	-0.0007	0.0010	-0.0044	-0.0081	-0.041%	0.019%	-0.314%	-0.259%

WSR	**Depth (a)**	**Absolute Difference (a) in Chlorophyll-*a* (ug L^{-1})**				**Relative Change (%)(b)**			
		Dry Season		**Wet Season**		**Dry Season**		**Wet Season**	
		Avg (b)	**Max (c)**	**Avg (b)**	**Max (c)**	**Avg (b)**	**Max (c)**	**Avg (b)**	**Max (c)**
SR8 (Proposed Land Requirement Boundary)	S	-0.0377	-0.1980	-0.2475	-0.5273	-1.030%	-1.820%	-5.282%	-6.831%
	M	-0.0361	-0.1930	-0.2818	-0.4958	-0.988%	-1.778%	-5.892%	-6.295%
	B	-0.0362	-0.1880	-0.2218	-0.3256	-1.006%	-1.789%	-5.927%	-5.273%
	DA	-0.0364	-0.1920	-0.2495	-0.4441	-1.000%	-1.782%	-5.653%	-6.078%
SR9 (Proposed Land Requirement Boundary)	S	-0.0424	-0.2140	-0.2979	-0.6308	-1.178%	-1.999%	-6.243%	-8.117%
	M	-0.0399	-0.2040	-0.3184	-0.5099	-1.115%	-1.918%	-6.628%	-6.525%
	B	-0.0354	-0.1665	-0.2389	-0.3860	-1.030%	-1.713%	-6.826%	-6.758%
	DA	-0.0390	-0.1950	-0.2840	-0.4994	-1.100%	-1.877%	-6.503%	-6.984%
SR10 (Proposed Land Requirement Boundary)	S	-0.0478	-0.2490	-0.3248	-0.5541	-1.316%	-2.303%	-6.821%	-7.271%
	M	-0.0472	-0.2480	-0.3338	-0.5465	-1.299%	-2.294%	-7.077%	-7.176%
	B	-0.0477	-0.2550	-0.3407	-0.4916	-1.317%	-2.381%	-7.904%	-6.967%
	DA	-0.0474	-0.2500	-0.3345	-0.5264	-1.305%	-2.318%	-7.247%	-7.066%
SR11 (Proposed Land Requirement Boundary)	S	-0.0498	-0.2680	-0.3285	-0.5257	-1.355%	-2.443%	-6.805%	-6.818%
	M	-0.0484	-0.2630	-0.3341	-0.5214	-1.312%	-2.387%	-6.953%	-6.787%
	B	-0.0498	-0.2720	-0.3527	-0.5100	-1.349%	-2.468%	-7.606%	-6.812%
	DA	-0.0490	-0.2670	-0.3393	-0.5202	-1.329%	-2.425%	-7.114%	-6.811%
SR12 (Proposed Land Requirement Boundary)	S	-0.0638	-0.3240	-0.3515	-0.5873	-1.760%	-2.994%	-7.103%	-7.542%
	M	-0.0577	-0.2930	-0.3465	-0.5852	-1.587%	-2.700%	-7.044%	-7.533%
	B	-0.0619	-0.3280	-0.3789	-0.4945	-1.702%	-3.028%	-8.036%	-6.615%
	DA	-0.0601	-0.3090	-0.3521	-0.5614	-1.654%	-2.850%	-7.223%	-7.298%
SR13 (Sha Lan)	S	-0.0250	-0.0720	-0.0948	-0.2025	-0.575%	-0.584%	-2.298%	-3.049%
	M	-0.0249	-0.0720	-0.0941	-0.2032	-0.570%	-0.581%	-2.288%	-3.053%
	B	-0.0247	-0.0710	-0.0917	-0.2019	-0.566%	-0.574%	-2.270%	-3.039%
	DA	-0.0248	-0.0720	-0.0936	-0.2028	-0.568%	-0.582%	-2.284%	-3.050%
SR14 (MSL of Chinese University)	S	-0.0011	-0.0020	-0.0050	-0.0150	-0.013%	-0.008%	-0.064%	-0.085%
	M	-0.0040	0.0020	-0.0050	-0.0033	-0.054%	0.010%	-0.134%	-0.034%

WSR	Depth (a)	Absolute Difference (a) in Chlorophyll-*a* (ug L^{-1})				Relative Change (%)(b)			
		Dry Season		Wet Season		Dry Season		Wet Season	
		Avg (b)	Max (c)	Avg (b)	Max (c)	Avg (b)	Max (c)	Avg (b)	Max (c)
SR14 (MSL of Chinese University)	B	0.0001	0.0007	-0.0006	-0.0069	0.006%	0.023%	-0.063%	-0.444%
	DA	-0.0012	0.0020	-0.0037	-0.0029	-0.021%	0.013%	-0.095%	-0.032%
SR15 (WSD at Tai Po Industrial Estate)	S	-0.0050	-0.0120	-0.0030	-0.0070	-0.040%	-0.035%	-0.022%	-0.029%
	M	-0.0042	-0.0040	-0.0019	-0.0060	-0.047%	-0.015%	-0.031%	-0.051%
	B	-0.0004	-0.0020	-0.0003	0.0000	-0.016%	-0.039%	-0.019%	0.000%
	DA	-0.0030	-0.0060	-0.0013	0.0000	-0.038%	-0.028%	-0.020%	0.000%
SR16 (Tai Mei Tuk Water Sports Centre)	S	-0.0306	-0.1230	-0.1913	-0.5913	-0.855%	-1.177%	-4.382%	-7.933%
	M	-0.0245	-0.1094	-0.2800	-0.6574	-0.715%	-1.109%	-6.163%	-8.690%
	B	-0.0182	-0.0807	-0.1286	-0.2251	-0.597%	-1.017%	-5.079%	-5.090%
	DA	-0.0242	-0.1043	-0.2130	-0.4369	-0.723%	-1.109%	-5.489%	-6.651%
TM3 (Tolo Harbour & Channel WCZ)	S	-0.0047	-0.0050	-0.0014	-0.0130	-0.057%	-0.025%	-0.018%	-0.077%
	M	-0.0008	0.0000	-0.0039	-0.0050	-0.015%	0.000%	-0.124%	-0.075%
	B	0.0008	0.0070	-0.0002	0.0003	0.062%	0.328%	-0.035%	0.031%
	DA	-0.0015	0.0000	-0.0018	-0.0001	-0.032%	0.000%	-0.053%	-0.002%
TM5 (Tolo Harbour & Channel WCZ)	S	-0.0174	-0.0510	-0.0799	-0.1583	-0.469%	-0.473%	-2.004%	-2.341%
	M	-0.0172	-0.0510	-0.0780	-0.1603	-0.463%	-0.473%	-2.014%	-2.364%
	B	-0.0165	-0.0460	-0.0451	-0.1140	-0.450%	-0.444%	-1.494%	-2.030%
	DA	-0.0170	-0.0490	-0.0690	-0.1490	-0.459%	-0.458%	-1.897%	-2.308%
TM6 (Tolo Harbour & Channel WCZ)	S	-0.0010	0.0040	-0.0117	-0.0148	-0.023%	0.027%	-0.249%	-0.164%
	M	-0.0014	0.0024	-0.0095	-0.0171	-0.075%	0.047%	-0.617%	-0.537%
	B	0.0000	-0.0012	-0.0025	-0.0050	-0.001%	-0.130%	-0.458%	-0.511%
	DA	-0.0010	-0.0010	-0.0093	-0.0143	-0.048%	-0.016%	-0.525%	-0.414%

Notes:

(a) Absolute difference is calculated as values obtained from dredging scenario minus baseline scenario. The values were rounded up to 4 decimal places.

(b) Relative change is calculated as absolute difference divided by baseline scenario. The values were rounded up to 3 decimal places.

(c) Avg denotes the mean value over a spring-neap cycle.

(d) Max denotes the maximum value over a spring-neap cycle.

Table 6.16(b): Predicted Absolute Difference and Relative Change in Chlorophyll-*a* Concentrations at WSRs during Operation Phase – 40% Sewerage Connection Rate

WSR	**Depth** [a]	**Absolute Difference** [a] **in Chlorophyll-*a* (ug L^{-1})**				**Relative Change (%)**[b]			
		Dry Season		**Wet Season**		**Dry Season**		**Wet Season**	
		Avg [b]	**Max** [c]	**Avg** [b]	**Max** [c]	**Avg** [b]	**Max** [c]	**Avg** [b]	**Max** [c]
SR1 (Yim Tin Tsai West Fish Culture Zone)	S	-0.0041	-0.0030	-0.0019	-0.0160	-0.062%	-0.019%	-0.029%	-0.135%
	M	-0.0022	-0.0030	-0.0016	0.0083	-0.042%	-0.022%	-0.049%	0.136%
	B	0.0002	0.0028	0.0000	0.0011	0.015%	0.104%	-0.007%	0.097%
	DA	-0.0018	-0.0010	-0.0009	0.0008	-0.043%	-0.010%	-0.027%	0.013%
SR2 (Yim Tin Tsai East Fish Culture Zone)	S	-0.0130	-0.0400	-0.0474	-0.0882	-0.349%	-0.370%	-1.211%	-1.291%
	M	-0.0128	-0.0400	-0.0470	-0.0890	-0.343%	-0.369%	-1.217%	-1.298%
	B	-0.0126	-0.0390	-0.0301	-0.0819	-0.340%	-0.366%	-0.931%	-1.371%
	DA	-0.0128	-0.0400	-0.0422	-0.0884	-0.344%	-0.371%	-1.148%	-1.338%
SR3 (Ting Kok SSSI, near Ting Kok) /SR5 (Ting Kok)	S	-0.0203	-0.0900	-0.1240	-0.2145	-0.526%	-0.795%	-2.397%	-2.189%
	M	-0.0203	-0.0910	-0.1242	-0.2070	-0.525%	-0.799%	-2.404%	-2.186%
	B	-0.0204	-0.0910	-0.1242	-0.2173	-0.527%	-0.797%	-2.421%	-2.210%
	DA	-0.0204	-0.0900	-0.1242	-0.2088	-0.527%	-0.791%	-2.408%	-2.189%
SR4 (Ting Kok SSSI, near Shuen Wan)	S	-0.0229	-0.0760	-0.0726	-0.1482	-0.492%	-0.572%	-1.586%	-2.057%
	M	-0.0230	-0.0760	-0.0725	-0.1475	-0.493%	-0.569%	-1.582%	-2.052%
	B	-0.0230	-0.0760	-0.0719	-0.1465	-0.492%	-0.568%	-1.574%	-2.043%
	DA	-0.0230	-0.0760	-0.0725	-0.1472	-0.493%	-0.569%	-1.583%	-2.049%
SR6 (Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone)	S	-0.0129	-0.0350	-0.0416	-0.0849	-0.340%	-0.324%	-1.117%	-1.339%
	M	-0.0131	-0.0350	-0.0417	-0.0851	-0.343%	-0.321%	-1.120%	-1.340%
	B	-0.0131	-0.0350	-0.0398	-0.0843	-0.342%	-0.320%	-1.097%	-1.335%
	DA	-0.0130	-0.0350	-0.0412	-0.0849	-0.340%	-0.321%	-1.113%	-1.339%
SR7 (Pak Sha Tau)	S	0.0001	-0.0003	-0.0029	-0.0014	0.003%	-0.003%	-0.126%	-0.032%
	M	-0.0021	0.0129	-0.0041	-0.0082	-0.123%	0.202%	-0.289%	-0.263%
	B	0.0001	-0.0006	-0.0016	-0.0039	0.014%	-0.070%	-0.270%	-0.290%
	DA	-0.0005	0.0013	-0.0029	-0.0032	-0.029%	0.025%	-0.207%	-0.102%

WSR	**Depth (a)**	**Absolute Difference (a) in Chlorophyll-*a* (ug L^{-1})**				**Relative Change (%)(b)**			
		Dry Season		**Wet Season**		**Dry Season**		**Wet Season**	
		Avg (b)	**Max (c)**	**Avg (b)**	**Max (c)**	**Avg (b)**	**Max (c)**	**Avg (b)**	**Max (c)**
SR8 (Proposed Land Requirement Boundary)	S	-0.0250	-0.1330	-0.1635	-0.3438	-0.683%	-1.223%	-3.489%	-4.454%
	M	-0.0238	-0.1290	-0.1894	-0.3256	-0.651%	-1.189%	-3.960%	-4.134%
	B	-0.0247	-0.1280	-0.1543	-0.2180	-0.686%	-1.218%	-4.124%	-3.531%
	DA	-0.0243	-0.1290	-0.1687	-0.2934	-0.667%	-1.197%	-3.822%	-4.016%
SR9 (Proposed Land Requirement Boundary)	S	-0.0276	-0.1380	-0.1946	-0.4087	-0.767%	-1.289%	-4.078%	-5.259%
	M	-0.0259	-0.1320	-0.2079	-0.3313	-0.723%	-1.241%	-4.327%	-4.240%
	B	-0.0233	-0.1051	-0.1661	-0.2518	-0.678%	-1.081%	-4.746%	-4.408%
	DA	-0.0254	-0.1250	-0.1885	-0.3276	-0.716%	-1.203%	-4.316%	-4.581%
SR10 (Proposed Land Requirement Boundary)	S	-0.0329	-0.1710	-0.2246	-0.3657	-0.906%	-1.581%	-4.717%	-4.799%
	M	-0.0325	-0.1710	-0.2347	-0.3667	-0.894%	-1.582%	-4.976%	-4.815%
	B	-0.0335	-0.1820	-0.2526	-0.3372	-0.925%	-1.699%	-5.860%	-4.779%
	DA	-0.0327	-0.1730	-0.2383	-0.3535	-0.901%	-1.604%	-5.162%	-4.745%
SR11 (Proposed Land Requirement Boundary)	S	-0.0351	-0.1910	-0.2322	-0.3498	-0.955%	-1.741%	-4.810%	-4.537%
	M	-0.0338	-0.1860	-0.2384	-0.3518	-0.916%	-1.688%	-4.961%	-4.580%
	B	-0.0354	-0.1960	-0.2612	-0.3526	-0.959%	-1.779%	-5.633%	-4.709%
	DA	-0.0344	-0.1890	-0.2446	-0.3526	-0.933%	-1.717%	-5.129%	-4.617%
SR12 (Proposed Land Requirement Boundary)	S	-0.0452	-0.2270	-0.2296	-0.3801	-1.247%	-2.098%	-4.640%	-4.881%
	M	-0.0391	-0.1960	-0.2246	-0.3823	-1.075%	-1.806%	-4.566%	-4.921%
	B	-0.0431	-0.2300	-0.2606	-0.3024	-1.185%	-2.123%	-5.527%	-4.045%
	DA	-0.0415	-0.2110	-0.2308	-0.3604	-1.142%	-1.946%	-4.735%	-4.685%
SR13 (Sha Lan)	S	-0.0189	-0.0570	-0.0642	-0.1366	-0.434%	-0.462%	-1.557%	-2.057%
	M	-0.0188	-0.0560	-0.0638	-0.1370	-0.430%	-0.452%	-1.552%	-2.058%
	B	-0.0187	-0.0560	-0.0622	-0.1361	-0.428%	-0.453%	-1.540%	-2.049%
	DA	-0.0188	-0.0560	-0.0634	-0.1367	-0.431%	-0.453%	-1.547%	-2.056%
SR14 (MSL of Chinese University)	S	-0.0014	-0.0030	-0.0038	-0.0120	-0.016%	-0.012%	-0.049%	-0.068%
	M	-0.0044	0.0010	-0.0042	0.0002	-0.060%	0.005%	-0.112%	0.002%

WSR	**Depth (a)**	**Absolute Difference (a) in Chlorophyll-*a* (ug L^{-1})**				**Relative Change (%)(b)**			
		Dry Season		**Wet Season**		**Dry Season**		**Wet Season**	
		Avg (b)	**Max (c)**	**Avg (b)**	**Max (c)**	**Avg (b)**	**Max (c)**	**Avg (b)**	**Max (c)**
SR14 (MSL of Chinese University)	B	0.0000	0.0002	-0.0005	-0.0067	0.000%	0.007%	-0.058%	-0.431%
	DA	-0.0014	0.0010	-0.0031	-0.0007	-0.024%	0.006%	-0.079%	-0.008%
SR15 (WSD at Tai Po Industrial Estate)	S	-0.0050	-0.0130	-0.0020	-0.0050	-0.040%	-0.038%	-0.015%	-0.021%
	M	-0.0045	-0.0050	-0.0017	-0.0050	-0.050%	-0.019%	-0.028%	-0.042%
	B	-0.0006	-0.0025	-0.0003	0.0002	-0.024%	-0.049%	-0.019%	0.007%
	DA	-0.0032	-0.0060	-0.0010	0.0010	-0.040%	-0.028%	-0.015%	0.008%
SR16 (Tai Mei Tuk Water Sports Centre)	S	-0.0202	-0.0800	-0.1270	-0.4428	-0.565%	-0.766%	-2.909%	-5.941%
	M	-0.0157	-0.0679	-0.1805	-0.3252	-0.458%	-0.688%	-3.973%	-4.299%
	B	-0.0116	-0.0490	-0.0871	-0.1472	-0.381%	-0.618%	-3.440%	-3.329%
	DA	-0.0156	-0.0649	-0.1398	-0.2855	-0.466%	-0.690%	-3.602%	-4.346%
TM3 (Tolo Harbour & Channel WCZ)	S	-0.0051	-0.0060	-0.0011	-0.0120	-0.062%	-0.030%	-0.014%	-0.071%
	M	-0.0011	-0.0010	-0.0034	-0.0032	-0.021%	-0.008%	-0.108%	-0.048%
	B	0.0008	0.0066	-0.0002	0.0004	0.062%	0.309%	-0.031%	0.042%
	DA	-0.0018	-0.0010	-0.0015	0.0009	-0.038%	-0.009%	-0.044%	0.014%
TM5 (Tolo Harbour & Channel WCZ)	S	-0.0132	-0.0400	-0.0534	-0.1045	-0.356%	-0.371%	-1.339%	-1.545%
	M	-0.0130	-0.0400	-0.0523	-0.1060	-0.350%	-0.371%	-1.350%	-1.563%
	B	-0.0125	-0.0370	-0.0305	-0.0764	-0.341%	-0.357%	-1.010%	-1.361%
	DA	-0.0129	-0.0390	-0.0463	-0.0987	-0.348%	-0.365%	-1.273%	-1.529%
TM6 (Tolo Harbour & Channel WCZ)	S	-0.0008	0.0030	-0.0076	-0.0051	-0.018%	0.021%	-0.161%	-0.057%
	M	-0.0013	0.0035	-0.0065	-0.0105	-0.070%	0.068%	-0.422%	-0.330%
	B	0.0001	-0.0008	-0.0018	-0.0037	0.013%	-0.085%	-0.327%	-0.378%
	DA	-0.0009	-0.0012	-0.0063	-0.0083	-0.043%	-0.019%	-0.356%	-0.240%

Notes:

(a) Absolute difference is calculated as values obtained from dredging scenario minus baseline scenario. The values were rounded up to 4 decimal places.
(b) Relative change is calculated as absolute difference divided by baseline scenario. The values were rounded up to 3 decimal places.
(c) Avg denotes the mean value over a spring-neap cycle.
(d) Max denotes the maximum value over a spring-neap cycle.

Table 6.16(c): Predicted Absolute Difference and Relative Change in Chlorophyll-*a* Concentrations at WSRs during Operation Phase – 20% Sewerage Connection Rate

WSR	**Depth** [(a)]	**Absolute Difference** [(a)] **in Chlorophyll-*a* (ug L^{-1})**				**Relative Change (%)**[(b)]			
		Dry Season		**Wet Season**		**Dry Season**		**Wet Season**	
		Avg [(b)]	**Max** [(c)]	**Avg** [(b)]	**Max** [(c)]	**Avg** [(b)]	**Max** [(c)]	**Avg** [(b)]	**Max** [(c)]
SR1 (Yim Tin Tsai West Fish Culture Zone)	S	-0.0044	-0.0040	-0.0023	-0.0160	-0.067%	-0.025%	-0.035%	-0.135%
	M	-0.0025	-0.0040	-0.0017	0.0087	-0.048%	-0.029%	-0.052%	0.142%
	B	0.0001	0.0023	-0.0001	0.0011	0.007%	0.085%	-0.010%	0.097%
	DA	-0.0020	-0.0020	-0.0011	0.0010	-0.048%	-0.020%	-0.034%	0.017%
SR2 (Yim Tin Tsai East Fish Culture Zone)	S	-0.0082	-0.0260	-0.0238	-0.0425	-0.220%	-0.241%	-0.608%	-0.622%
	M	-0.0081	-0.0260	-0.0237	-0.0431	-0.217%	-0.240%	-0.614%	-0.629%
	B	-0.0080	-0.0270	-0.0157	-0.0429	-0.216%	-0.253%	-0.486%	-0.718%
	DA	-0.0081	-0.0260	-0.0214	-0.0432	-0.217%	-0.241%	-0.582%	-0.654%
SR3 (Ting Kok SSSI, near Ting Kok) /SR5 (Ting Kok)	S	-0.0117	-0.0480	-0.0619	-0.1039	-0.303%	-0.424%	-1.196%	-1.060%
	M	-0.0117	-0.0490	-0.0621	-0.1005	-0.302%	-0.430%	-1.202%	-1.061%
	B	-0.0118	-0.0490	-0.0622	-0.1057	-0.305%	-0.429%	-1.212%	-1.075%
	DA	-0.0118	-0.0480	-0.0621	-0.1014	-0.305%	-0.422%	-1.204%	-1.063%
SR4 (Ting Kok SSSI, near Shuen Wan)	S	-0.0141	-0.0490	-0.0378	-0.0767	-0.303%	-0.369%	-0.826%	-1.065%
	M	-0.0141	-0.0490	-0.0378	-0.0760	-0.302%	-0.367%	-0.825%	-1.057%
	B	-0.0141	-0.0490	-0.0375	-0.0747	-0.301%	-0.366%	-0.821%	-1.042%
	DA	-0.0141	-0.0490	-0.0377	-0.0756	-0.302%	-0.367%	-0.823%	-1.052%
SR6 (Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone)	S	-0.0081	-0.0230	-0.0211	-0.0418	-0.213%	-0.213%	-0.567%	-0.659%
	M	-0.0082	-0.0240	-0.0212	-0.0420	-0.215%	-0.220%	-0.569%	-0.661%
	B	-0.0082	-0.0230	-0.0204	-0.0417	-0.214%	-0.210%	-0.562%	-0.660%
	DA	-0.0081	-0.0240	-0.0210	-0.0419	-0.212%	-0.220%	-0.567%	-0.661%
SR7 (Pak Sha Tau)	S	0.0006	0.0010	-0.0009	0.0058	0.020%	0.011%	-0.039%	0.134%
	M	-0.0018	0.0132	-0.0023	-0.0032	-0.105%	0.207%	-0.162%	-0.103%
	B	0.0001	-0.0003	-0.0011	-0.0021	0.024%	-0.042%	-0.182%	-0.156%
	DA	-0.0002	0.0018	-0.0015	0.0017	-0.012%	0.035%	-0.107%	0.054%

WSR	Depth [(a)]	Absolute Difference [(a)] in Chlorophyll-*a* (ug L^{-1})				Relative Change (%)[(b)]			
		Dry Season		**Wet Season**		**Dry Season**		**Wet Season**	
		Avg [(b)]	**Max** [(c)]	**Avg** [(b)]	**Max** [(c)]	**Avg** [(b)]	**Max** [(c)]	**Avg** [(b)]	**Max** [(c)]
SR8 (Proposed Land Requirement Boundary)	S	-0.0123	-0.0650	-0.0821	-0.1726	-0.336%	-0.598%	-1.752%	-2.236%
	M	-0.0116	-0.0630	-0.1008	-0.1656	-0.317%	-0.580%	-2.108%	-2.103%
	B	-0.0132	-0.0660	-0.0892	-0.1154	-0.367%	-0.628%	-2.384%	-1.869%
	DA	-0.0121	-0.0640	-0.0908	-0.1515	-0.332%	-0.594%	-2.057%	-2.074%
SR9 (Proposed Land Requirement Boundary)	S	-0.0129	-0.0600	-0.0949	-0.2023	-0.358%	-0.560%	-1.989%	-2.603%
	M	-0.0121	-0.0580	-0.1027	-0.1639	-0.338%	-0.545%	-2.138%	-2.097%
	B	-0.0114	-0.0426	-0.0959	-0.1237	-0.332%	-0.438%	-2.740%	-2.166%
	DA	-0.0119	-0.0530	-0.0966	-0.1663	-0.336%	-0.510%	-2.212%	-2.326%
SR10 (Proposed Land Requirement Boundary)	S	-0.0180	-0.0910	-0.1284	-0.1886	-0.496%	-0.842%	-2.697%	-2.475%
	M	-0.0179	-0.0920	-0.1395	-0.1974	-0.493%	-0.851%	-2.957%	-2.592%
	B	-0.0194	-0.1060	-0.1677	-0.1910	-0.536%	-0.990%	-3.890%	-2.707%
	DA	-0.0182	-0.0950	-0.1459	-0.1905	-0.501%	-0.881%	-3.161%	-2.557%
SR11 (Proposed Land Requirement Boundary)	S	-0.0204	-0.1120	-0.1394	-0.1835	-0.555%	-1.021%	-2.888%	-2.380%
	M	-0.0191	-0.1070	-0.1463	-0.1908	-0.518%	-0.971%	-3.044%	-2.484%
	B	-0.0210	-0.1180	-0.1730	-0.2033	-0.569%	-1.071%	-3.731%	-2.715%
	DA	-0.0198	-0.1110	-0.1533	-0.1938	-0.537%	-1.008%	-3.214%	-2.537%
SR12 (Proposed Land Requirement Boundary)	S	-0.0269	-0.1300	-0.1121	-0.1836	-0.742%	-1.201%	-2.265%	-2.358%
	M	-0.0208	-0.0980	-0.1071	-0.1901	-0.572%	-0.903%	-2.177%	-2.447%
	B	-0.0246	-0.1310	-0.1465	-0.1205	-0.677%	-1.209%	-3.107%	-1.612%
	DA	-0.0231	-0.1120	-0.1138	-0.1701	-0.636%	-1.033%	-2.335%	-2.211%
SR13 (Sha Lan)	S	-0.0121	-0.0380	-0.0335	-0.0703	-0.278%	-0.308%	-0.812%	-1.058%
	M	-0.0120	-0.0380	-0.0333	-0.0703	-0.275%	-0.307%	-0.810%	-1.056%
	B	-0.0119	-0.0380	-0.0326	-0.0699	-0.273%	-0.307%	-0.807%	-1.052%
	DA	-0.0120	-0.0380	-0.0331	-0.0702	-0.275%	-0.307%	-0.808%	-1.056%
SR14 (MSL of Chinese University)	S	-0.0018	-0.0040	-0.0026	-0.0080	-0.021%	-0.016%	-0.034%	-0.045%
	M	-0.0047	0.0000	-0.0034	0.0037	-0.064%	0.000%	-0.091%	0.038%

WSR	**Depth (a)**	**Absolute Difference (a) in Chlorophyll-*a* (ug L^{-1})**				**Relative Change (%)(b)**			
		Dry Season		**Wet Season**		**Dry Season**		**Wet Season**	
		Avg (b)	**Max (c)**	**Avg (b)**	**Max (c)**	**Avg (b)**	**Max (c)**	**Avg (b)**	**Max (c)**
SR14 (MSL of Chinese University)	B	-0.0001	-0.0002	-0.0005	-0.0066	-0.006%	-0.007%	-0.052%	-0.425%
	DA	-0.0017	0.0000	-0.0024	0.0016	-0.030%	0.000%	-0.061%	0.018%
SR15 (WSD at Tai Po Industrial Estate)	S	-0.0050	-0.0140	-0.0010	-0.0030	-0.040%	-0.041%	-0.007%	-0.012%
	M	-0.0048	-0.0060	-0.0016	-0.0040	-0.054%	-0.022%	-0.026%	-0.034%
	B	-0.0007	-0.0030	-0.0003	0.0004	-0.027%	-0.059%	-0.019%	0.015%
	DA	-0.0034	-0.0070	-0.0007	0.0020	-0.043%	-0.032%	-0.011%	0.016%
SR16 (Tai Mei Tuk Water Sports Centre)	S	-0.0097	-0.0340	-0.0642	-0.2230	-0.271%	-0.325%	-1.471%	-2.992%
	M	-0.0068	-0.0250	-0.0865	-0.1489	-0.198%	-0.253%	-1.904%	-1.968%
	B	-0.0051	-0.0164	-0.0469	-0.0728	-0.167%	-0.207%	-1.852%	-1.646%
	DA	-0.0070	-0.0241	-0.0694	-0.1377	-0.209%	-0.256%	-1.788%	-2.096%
TM3 (Tolo Harbour & Channel WCZ)	S	-0.0054	-0.0070	-0.0009	-0.0100	-0.066%	-0.035%	-0.011%	-0.059%
	M	-0.0014	-0.0020	-0.0028	-0.0015	-0.027%	-0.015%	-0.089%	-0.022%
	B	0.0007	0.0062	-0.0002	0.0005	0.054%	0.290%	-0.025%	0.053%
	DA	-0.0020	-0.0020	-0.0012	0.0019	-0.043%	-0.018%	-0.035%	0.029%
TM5 (Tolo Harbour & Channel WCZ)	S	-0.0084	-0.0260	-0.0269	-0.0507	-0.226%	-0.241%	-0.675%	-0.750%
	M	-0.0083	-0.0260	-0.0264	-0.0513	-0.223%	-0.241%	-0.682%	-0.757%
	B	-0.0081	-0.0260	-0.0159	-0.0390	-0.221%	-0.251%	-0.527%	-0.695%
	DA	-0.0083	-0.0260	-0.0234	-0.0483	-0.224%	-0.243%	-0.643%	-0.748%
TM6 (Tolo Harbour & Channel WCZ)	S	-0.0005	0.0030	-0.0032	0.0046	-0.011%	0.021%	-0.068%	0.051%
	M	-0.0011	0.0045	-0.0034	-0.0039	-0.059%	0.088%	-0.221%	-0.123%
	B	0.0002	-0.0004	-0.0011	-0.0024	0.027%	-0.039%	-0.197%	-0.246%
	DA	-0.0007	-0.0012	-0.0032	-0.0023	-0.033%	-0.019%	-0.181%	-0.067%

Notes:

(a) Absolute difference is calculated as values obtained from dredging scenario minus baseline scenario. The values were rounded up to 4 decimal places.

(b) Relative change is calculated as absolute difference divided by baseline scenario. The values were rounded up to 3 decimal places.

(c) Avg denotes the mean value over a spring-neap cycle.
Max denotes the maximum value over a spring-neap cycle.

Table 6.17: Predicted Chlorophyll-*a* Concentrations at Near-field WSRs during Operation Phase

WSR	Vertical Layer of Water Column	Predicted Chlorophyll-a Concentrations (in µg/L, calculated as maximum 5-day arithmetic average) [(a)]								
		WQO	Pre-development		Operation Phase 60% Sewerage Connection		Operation Phase 40% Sewerage Connection		Operation Phase 20% Sewerage Connection	
			Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
SR2 (Yim Tin Tsai East Fish Culture Zone)	1 (surface)	10	6.10	5.69	6.07	5.59	6.08	5.63	6.08	5.66
	2	10	6.10	5.71	6.08	5.60	6.09	5.64	6.09	5.67
	3	10	6.11	5.72	6.08	5.61	6.09	5.65	6.10	5.68
	4	10	6.11	5.73	6.09	5.63	6.09	5.66	6.10	5.70
	5	10	6.11	5.70	6.08	5.59	6.09	5.63	6.09	5.66
	6	10	6.10	5.57	6.08	5.47	6.08	5.51	6.09	5.54
	7	10	6.09	5.30	6.07	5.20	6.08	5.23	6.08	5.27
	8	10	6.08	5.02	6.06	4.94	6.06	4.96	6.07	4.99
	9	10	6.07	4.82	6.04	4.74	6.05	4.77	6.05	4.79
	10 (bottom)	10	6.05	4.81	6.03	4.73	6.03	4.76	6.04	4.79
SR3 (Ting Kok SSSI, near Ting Kok) /SR5 (Ting Kok)	1 (surface)	10	6.64	7.13	6.52	6.81	6.56	6.92	6.60	7.03
	2	10	6.64	7.13	6.53	6.81	6.57	6.92	6.60	7.03
	3	10	6.65	7.14	6.53	6.82	6.57	6.93	6.61	7.04
	4	10	6.65	7.15	6.54	6.82	6.57	6.93	6.61	7.04
	5	10	6.65	7.15	6.54	6.83	6.58	6.94	6.61	7.05
	6	10	6.65	7.16	6.54	6.83	6.58	6.95	6.62	7.06
	7	10	6.65	7.16	6.54	6.84	6.58	6.95	6.62	7.06
	8	10	6.66	7.17	6.54	6.84	6.58	6.95	6.62	7.06
	9	10	6.66	7.16	6.54	6.84	6.58	6.95	6.62	7.06
	10 (bottom)	10	6.66	7.16	6.54	6.84	6.58	6.95	6.62	7.06
SR4 (Ting Kok SSSI, near Shuen Wan)	1 (surface)	10	7.56	6.27	7.51	6.11	7.52	6.16	7.54	6.22
	2	10	7.57	6.28	7.52	6.11	7.53	6.17	7.55	6.22
	3	10	7.58	6.28	7.53	6.11	7.54	6.17	7.56	6.22
	4	10	7.59	6.28	7.54	6.11	7.55	6.17	7.56	6.23
	5	10	7.59	6.28	7.55	6.11	7.56	6.17	7.57	6.22

WSR	Vertical Layer of Water Column	Predicted Chlorophyll-a Concentrations (in µg/L, calculated as maximum 5-day arithmetic average) [(a)]								
		WQO	Pre-development		Operation Phase 60% Sewerage Connection		Operation Phase 40% Sewerage Connection		Operation Phase 20% Sewerage Connection	
			Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
SR4 (Ting Kok SSSI, near Shuen Wan)	6	10	7.60	6.28	7.55	6.11	7.56	6.17	7.58	6.22
	7	10	7.60	6.28	7.55	6.11	7.57	6.16	7.58	6.22
	8	10	7.61	6.27	7.56	6.11	7.57	6.16	7.58	6.22
	9	10	7.61	6.27	7.56	6.10	7.57	6.16	7.59	6.21
	10 (bottom)	10	7.61	6.26	7.57	6.10	7.58	6.15	7.59	6.21
SR6 (Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone)	1 (surface)	10	6.15	5.34	6.13	5.24	6.14	5.27	6.14	5.31
	2	10	6.17	5.35	6.15	5.24	6.15	5.28	6.16	5.31
	3	10	6.19	5.35	6.16	5.24	6.17	5.28	6.17	5.31
	4	10	6.19	5.34	6.17	5.24	6.18	5.27	6.18	5.31
	5	10	6.20	5.34	6.18	5.23	6.18	5.27	6.19	5.30
	6	10	6.21	5.33	6.19	5.23	6.19	5.26	6.19	5.29
	7	10	6.21	5.31	6.19	5.21	6.19	5.25	6.20	5.28
	8	10	6.22	5.25	6.19	5.15	6.20	5.18	6.20	5.21
	9	10	6.22	5.15	6.20	5.05	6.20	5.08	6.21	5.12
	10 (bottom)	10	6.23	5.12	6.21	5.02	6.21	5.06	6.22	5.09
SR8 (Proposed Land Requirement Boundary)	1 (surface)	10	6.22	6.26	6.07	5.95	6.13	6.06	6.17	6.16
	2	10	6.22	6.29	6.08	5.97	6.13	6.08	6.18	6.19
	3	10	6.22	6.35	6.08	6.02	6.13	6.14	6.18	6.25
	4	10	6.22	6.49	6.08	6.14	6.13	6.26	6.18	6.38
	5	10	6.21	6.56	6.07	6.16	6.12	6.28	6.17	6.39
	6	10	6.21	6.48	6.06	5.99	6.11	6.16	6.16	6.31
	7	10	6.20	6.17	6.06	5.73	6.11	5.88	6.16	6.02
	8	10	6.19	5.83	6.05	5.42	6.10	5.56	6.15	5.69
	9	10	6.18	5.45	6.04	5.06	6.09	5.19	6.14	5.31
	10 (bottom)	10	6.18	5.39	6.03	5.00	6.08	5.13	6.13	5.25

WSR	Vertical Layer of Water Column	Predicted Chlorophyll-a Concentrations (in µg/L, calculated as maximum 5-day arithmetic average) [(a)]								
		WQO	Pre-development		Operation Phase 60% Sewerage Connection		Operation Phase 40% Sewerage Connection		Operation Phase 20% Sewerage Connection	
			Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
SR9 (Proposed Land Requirement Boundary)	1 (surface)	10	6.12	6.41	5.96	6.02	6.02	6.15	6.07	6.28
	2	10	6.12	6.45	5.96	6.05	6.02	6.19	6.07	6.32
	3	10	6.11	6.60	5.96	6.17	6.01	6.32	6.07	6.46
	4	10	6.10	6.74	5.95	6.29	6.00	6.45	6.06	6.59
	5	10	6.09	6.82	5.94	6.21	5.99	6.43	6.05	6.63
	6	10	6.07	6.52	5.92	5.99	5.98	6.18	6.03	6.36
	7	10	6.05	6.09	5.90	5.63	5.95	5.79	6.01	5.95
	8	10	6.02	5.64	5.87	5.21	5.93	5.36	5.98	5.50
	9	10	5.99	5.17	5.84	4.78	5.90	4.91	5.95	5.04
	10 (bottom)	10	5.97	5.11	5.82	4.72	5.87	4.85	5.93	4.98
SR10 (Proposed Land Requirement Boundary)	1 (surface)	10	6.20	6.38	6.03	5.97	6.09	6.10	6.14	6.22
	2	10	6.21	6.38	6.04	5.97	6.09	6.10	6.15	6.23
	3	10	6.21	6.38	6.04	5.97	6.10	6.10	6.15	6.22
	4	10	6.21	6.40	6.04	5.95	6.10	6.08	6.15	6.20
	5	10	6.21	6.42	6.04	5.92	6.10	6.05	6.15	6.18
	6	10	6.21	6.41	6.04	5.86	6.09	6.00	6.15	6.18
	7	10	6.21	6.37	6.03	5.78	6.09	5.96	6.15	6.13
	8	10	6.21	6.28	6.03	5.69	6.09	5.86	6.15	6.03
	9	10	6.20	6.13	6.03	5.55	6.09	5.72	6.14	5.88
	10 (bottom)	10	6.20	6.08	6.03	5.50	6.08	5.67	6.14	5.83
SR11 (Proposed Land Requirement Boundary)	1 (surface)	10	6.29	6.50	6.12	6.05	6.17	6.17	6.23	6.29
	2	10	6.30	6.52	6.13	6.05	6.18	6.18	6.24	6.29
	3	10	6.31	6.53	6.13	6.05	6.19	6.17	6.25	6.29
	4	10	6.31	6.54	6.14	6.04	6.19	6.16	6.25	6.30
	5	10	6.31	6.55	6.14	6.02	6.20	6.14	6.25	6.30

WSR	Vertical Layer of Water Column	Predicted Chlorophyll-a Concentrations (in µg/L, calculated as maximum 5-day arithmetic average) (a)								
		WQO	Pre-development		Operation Phase 60% Sewerage Connection		Operation Phase 40% Sewerage Connection		Operation Phase 20% Sewerage Connection	
			Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
SR11 (Proposed Land Requirement Boundary)	6	10	6.32	6.55	6.14	5.98	6.20	6.13	6.25	6.30
	7	10	6.32	6.54	6.14	5.94	6.20	6.12	6.25	6.29
	8	10	6.32	6.53	6.14	5.92	6.20	6.10	6.25	6.27
	9	10	6.32	6.50	6.14	5.89	6.19	6.07	6.25	6.23
	10 (bottom)	10	6.32	6.47	6.14	5.86	6.19	6.04	6.25	6.20
SR12 (Proposed Land Requirement Boundary)	1 (surface)	10	6.23	6.78	6.02	6.20	6.09	6.35	6.16	6.56
	2	10	6.24	6.80	6.03	6.20	6.10	6.36	6.17	6.58
	3	10	6.24	6.80	6.04	6.20	6.11	6.38	6.18	6.60
	4	10	6.24	6.81	6.05	6.18	6.11	6.39	6.18	6.61
	5	10	6.24	6.81	6.05	6.17	6.12	6.40	6.18	6.62
	6	10	6.24	6.80	6.05	6.19	6.12	6.42	6.18	6.64
	7	10	6.24	6.78	6.05	6.19	6.11	6.42	6.18	6.64
	8	10	6.24	6.75	6.04	6.17	6.11	6.40	6.18	6.62
	9	10	6.24	6.69	6.04	6.11	6.11	6.34	6.18	6.55
	10 (bottom)	10	6.24	6.66	6.04	6.07	6.11	6.29	6.17	6.50
SR13 (Sha Lan)	1 (surface)	10	7.06	5.78	7.02	5.63	7.03	5.68	7.04	5.73
	2	10	7.07	5.79	7.04	5.64	7.04	5.69	7.05	5.74
	3	10	7.08	5.78	7.05	5.64	7.05	5.68	7.06	5.73
	4	10	7.09	5.78	7.05	5.63	7.06	5.68	7.07	5.73
	5	10	7.09	5.77	7.06	5.62	7.07	5.67	7.07	5.72
	6	10	7.10	5.76	7.06	5.61	7.07	5.66	7.08	5.71
	7	10	7.10	5.74	7.06	5.60	7.07	5.65	7.08	5.69
	8	10	7.10	5.72	7.07	5.58	7.07	5.63	7.08	5.67
	9	10	7.10	5.70	7.06	5.56	7.07	5.60	7.08	5.65
	10 (bottom)	10	7.10	5.67	7.06	5.53	7.07	5.58	7.08	5.62

WSR	**Vertical Layer of Water Column**	**Predicted Chlorophyll-a Concentrations (in µg/L, calculated as maximum 5-day arithmetic average) [a]**								
		WQO	**Pre-development**		**Operation Phase 60% Sewerage Connection**		**Operation Phase 40% Sewerage Connection**		**Operation Phase 20% Sewerage Connection**	
			Dry	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**
SR16 (Tai Mei Tuk Water Sports Centre)	1 (surface)	10	5.95	5.83	5.83	5.54	5.88	5.64	5.92	5.73
	2	10	5.97	6.05	5.86	5.72	5.89	5.83	5.93	5.94
	3	10	5.95	6.57	5.86	6.14	5.88	6.29	5.92	6.43
	4	10	5.90	6.86	5.78	6.27	5.82	6.45	5.87	6.67
	5	10	5.81	6.72	5.69	6.15	5.73	6.35	5.78	6.55
	6	10	5.70	6.03	5.58	5.62	5.63	5.77	5.67	5.91
	7	10	5.59	5.29	5.48	4.97	5.52	5.08	5.56	5.20
	8	10	5.50	4.57	5.39	4.32	5.43	4.41	5.47	4.50
	9	10	5.43	3.88	5.32	3.68	5.36	3.75	5.40	3.82
	10 (bottom)	10	5.41	3.72	5.30	3.52	5.34	3.59	5.38	3.66
TM5 (buffer subzone, Tolo Harbour & Channel WCZ)	1 (surface)	10	6.02	5.71	5.99	5.59	6.00	5.63	6.00	5.68
	2	10	6.03	5.73	6.00	5.61	6.01	5.65	6.01	5.69
	3	10	6.03	5.74	6.01	5.62	6.01	5.66	6.02	5.70
	4	10	6.03	5.74	6.00	5.62	6.01	5.66	6.01	5.70
	5	10	6.02	5.67	6.00	5.55	6.00	5.59	6.01	5.63
	6	10	6.01	5.48	5.99	5.36	5.99	5.40	6.00	5.44
	7	10	6.00	5.18	5.97	5.07	5.98	5.11	5.98	5.15
	8	10	5.97	4.83	5.95	4.74	5.95	4.77	5.96	4.80
	9	10	5.94	4.52	5.92	4.44	5.93	4.47	5.93	4.50
	10 (bottom)	10	5.91	4.49	5.89	4.41	5.89	4.44	5.90	4.47

Notes:

(a) Model results were calculated as a running arithmetic mean of 5 daily measurements for any single location and depth for the last 15 days of simulation and the maximum values of the 5-day mean over fifteen days were taken for the presentation. The values were corrected to 3 significant figures.

(b) Bolded values, if any, indicate non-compliance with the WQO and assessment criterion.

Effect on Flushing Circulation

Presence of two groynes may potentially affect the circulation of the water inside the bay, especially at the area in-between the eastern groyne and the drainage division.

As mentioned above, the chlorophyll-*a* concentrations would not significantly increase in the surrounding area during the operation phase. *Figures 6.10 (a)-(c)* and *6.11(a)-(c)* show the chlorophyll-*a* concentrations during the pre-development phase and the operation phase and the chlorophyll-*a* level is unlikely to be built up at the area of concern. Contour plots, as shown in *Figures 6.12(a)-(c)* and *6.13(a)-(c)* show negligible differences of DO levels between pre-development and operation phases and hence this further reveals that the water quality would not be deteriorated by the presence of the project-related structures and no significant adverse effect on flushing circulation is expected.

Maintenance Dredging and Sandfilling

Maintenance dredging is not anticipated during the operation of the beach. Maintenance sandfilling will be carried out, if necessary, during the operation of the beach. The sandfilling works will only be carried out on the beach above the high water mark (HWM). As a result, impacts to water quality are not anticipated.

Suitability of the Site for a Gazetted Bathing Beach Development

Through communication with the Drainage Services Department (DSD), there is a plan to establish a new sewerage system (under The Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94)) which allows the residents in Lung Mei to connect their sewers to the public sewer. This public sewer will deliver the sewage to the Tai Po STW for further treatment. It is anticipated that the sewerage system will be completed prior to the operation of the Proposed Beach Development and approximately 60% of the private sewers would be connected to the public sewer.

Sewerage improvement works are in progress in the Ting Kok area and existing residents have been encouraged to connect their sewerage system to the public sewers. For any new development, a connection to the public sewer is compulsory. As connections for existing households to the public sewer are voluntary, it is unlikely that a 100% connection rate will be achieved. However, according to DSD's information provided, although the connection rate varies from village to village, high percentages have been achieved in many villages. A 60% connection rate that would be more likely to be implemented is considered representable to be used in the water quality impact assessment.

Nevertheless, reasonable conservative assumptions of 20% and 40% connection rates are also used as the pollution inventories for this study to assess the *E. coli* concentrations to further verify the suitability of Lung Mei for use as a bathing beach. *Tables 6.18-6.20* present the pollution inventories for the connection rate of 60%, 40% and 20% respectively.

The water quality in the nearby existing watercourses has been characterised in *Section 6.4.5*. As discussed in *Section 6.4.5*, these watercourses, may contribute to elevated *E. coli* counts at the existing Lung Mei Beach. It is expected that the new sewerage system combining with the diversion of the western gabion and eastern box culvert would be beneficial to the proposed beach. In order to investigate how these would improve the water quality at the proposed beach, a quantitative assessment has been conducted to compare the *E. coli* concentrations in the beach area during pre-development stage and operation phase. The water quality sampling results, as presented in *Table 6.7*, have been input in the water quality model as the pollution loads. Model inputs for the two stages are the same except the sewage flows from the nearby villages are reduced by 60%, 40% and 20% for the operation phase under three scenarios, as shown in *Tables 6.18-6.20*.

Table 6.18: Pollution Inventories during the Operation Phase, assuming 60% Sewerage Connection Rates

Location	**Flow Rate ($m^3 s^{-1}$) [(a)]**				**Geometric Mean of *E.coli* (cfu $100mL^{-1}$) [(c)]**
	Pre-Development		**Operation (60% Sewerage Connection)**		
	Dry	**Wet**	**Dry**	**Wet [(b)]**	**Pre- and Post- [(d)]**
W3 [(e)]	0.056	0.105	0.0224	0.0714	9.1E+02
W4 [(f)]	0.056	0.105	0.0224	0.0714	2.3E+04
W5 [(g)]	0.056	0.105	0.0224	0.0714	5.9E+03
W6 [(g)]	0.056	0.105	0.0224	0.0714	6.0E+01

Notes:

(a) The flow rate was small and could not be measured during the survey. The mean value of on the EPD River Monitoring Data of TR4 (Shan Liu River) between 1998-2005 is used for the assessment purpose.
(b) Flow rate for wet season during operation phase calculated as “Reduced Dry Flow + (0.105-0.056)”
(c) Data obtained from the water sampling surveys in Dec 2006 - Jan 2007.
(d) “Pre-“ denotes pre-development phase; “Post-“ denotes operation phase.
(e) Diverted to western side by a gabion after development.
(f) Diverted to eastern side by a box culvert after development.
(g) Discharge location is the same before and after development.

Table 6.19: Pollution Inventories during the Operational Phase, assuming 40% Sewerage Connection Rates

Location	**Flow Rate ($m^3 s^{-1}$) [(a)]**				**Geometric Mean of *E. coli* (cfu $100mL^{-1}$) (c)**
	Pre-Development		**Post-development (40% Sewerage Connection)**		
	Dry	**Wet**	**Dry**	**Wet (b)**	**Pre- and Post- (d)**
W3 (e)	0.056	0.105	0.0336	0.0826	9.1E+02
W4 (f)	0.056	0.105	0.0336	0.0826	2.3E+04
W5 (g)	0.056	0.105	0.0336	0.0826	5.9E+03
W6 (g)	0.056	0.105	0.0336	0.0826	6.0E+01

Notes:

(a) The flow rate was small and could not be measured during the survey. The mean value of on the EPD River Monitoring Data of TR4 (Shan Liu River) between 1998-2005 is used for the assessment purpose.

(b) Flow rate for wet season during post-development calculated as "Reduced Dry Flow + (0.105-0.056)"

(c) Data obtained from the water sampling surveys in Dec 2006 - Jan 2007.

(d) "Pre-" denotes pre-development phase; "Post-" denotes post-development phase.

(e) Diverted to western side by a gabion after development.

(f) Diverted to eastern side by a box culvert after development.

(g) Discharge location is the same before and after development.

Table 6.20: Pollution Inventories during the Operational Phase, assuming 20% Sewerage Connection Rates

Location	**Flow Rate ($m^3 s^{-1}$) (a)**				**Geometric Mean of *E. coli* (cfu $100mL^{-1}$) (c)**
	Pre-Development		**Post-development (20% Sewerage Connection)**		
	Dry	**Wet**	**Dry**	**Wet (b)**	**Pre- and Post- (d)**
W3 (e)	0.056	0.105	0.0448	0.0938	9.1E+02
W4 (f)	0.056	0.105	0.0448	0.0938	2.3E+04
W5 (g)	0.056	0.105	0.0448	0.0938	5.9E+03
W6 (g)	0.056	0.105	0.0448	0.0938	6.0E+01

Notes:

(a) The flow rate was small and could not be measured during the survey. The mean value of on the EPD River Monitoring Data of TR4 (Shan Liu River) between 1998-2005 is used for the assessment purpose.
(b) Flow rate for wet season during post-development calculated as “Reduced Dry Flow + (0.105-0.056)”
(c) Data obtained from the water sampling surveys in Dec 2006 - Jan 2007.
(d) “Pre-“ denotes pre-development phase; “Post-“ denotes post-development phase.
(e) Diverted to western side by gabion after development.
(f) Diverted to eastern side by a box culvert after development.
(g) Discharge location is the same before and after development.

Note that the data were taken from December 2006 and January 2007 and did not cover peak flow season and the bathing season during which *E. coli* concentrations may differ. The data were hence used for comparison purpose only but not for predicting the absolute *E. coli* counts at the proposed beach during the bathing season at its operation phase. The most appropriate method is to find out the relative change in *E. coli* concentrations between the pre-development stage and the operation phase and then apply this relative change to EPD's long-term monitoring for the bathing season to determine whether the predicted value would exceed the WQO for bathing beach.

The modelling results (the change of absolute *E. coli* concentrations as well as the calculation of the relative percentage change) are shown in *Tables 6.21-6.23* and *Figures 6.14 - 6.19*. Note that the *E.coli* concentrations presented in *Tables 6.21-6.23* are the geometric mean over a spring-neap cycle but not the geometric mean over a whole bathing season. Therefore it should not be directly compared to the EPD monitoring data as shown in *Table 6.6*.

SR8 to SR12 are the four corners and the middle point of the Project Site and hence are representative points to evaluate the beach's operation performance. Note that the proposed area of the Proposed Bathing Beach Development, ie the Permanent Government Land Allocation under LCSD's control during operation phase, is depicted in *Figure 6.22*.

Table 6.21: Comparison of Relative Change in *E. coli* Concentrations between Pre-development and Operation Phase – 60% Sewerage Connection Rate (Note that the *E.coli* concentrations presented in this table are the geometric mean over a spring-neap cycle but not the geometric mean over a whole bathing season. Therefore it should not be directly compared to the EPD monitoring data as shown in *Table 6.6* and beach WQO, ie 180 cfu per 100mL)

Modelling Assessment Points	Depth	Predicted *E. coli* Concentrations (no./100mL) Geometric Mean over a Spring-Neap Cycle				Percentage of Relative Change	
		Pre-development		Operation Phase			
		Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season
SR8 (Proposed Land Requirement Boundary)	S	9	3	2	<d.l.	-81%	<n.d.
	M	9	5	2	1	-81%	-76%
	B	10	7	2	2	-82%	-72%
	DA	9	5	2	1	-81%	-75%
SR9 (Proposed Land Requirement Boundary)	S	15	7	7	5	-53%	-29%
	M	17	16	8	11	-55%	-34%
	B	21	21	9	15	-57%	-27%
	DA	18	15	8	11	-55%	-30%
SR10 (Proposed Land Requirement Boundary)	S	40	32	7	7	-82%	-79%
	M	41	36	7	7	-83%	-79%
	B	42	43	7	9	-84%	-80%
	DA	41	37	7	8	-83%	-79%
SR11 (Proposed Land Requirement Boundary)	S	30	22	3	3	-89%	-87%
	M	30	23	3	3	-89%	-87%
	B	30	25	3	3	-89%	-87%
	DA	30	23	3	3	-89%	-87%

Modelling Assessment Points	**Depth**	**Predicted *E. coli* Concentrations (no./100mL) Geometric Mean over a Spring-Neap Cycle**				**Percentage of Relative Change**	
		Pre-development		**Operation Phase**			
		Dry Season	**Wet Season**	**Dry Season**	**Wet Season**	**Dry Season**	**Wet Season**
SR12 (Proposed Land Requirement Boundary)	S	135	179	41	72	-70%	-60%
	M	141	**195**	43	84	-69%	-57%
	B	146	**216**	54	120	-63%	-44%
	DA	141	**197**	46	92	-67%	-53%

Notes:
1. S = near to the water surface; M = mid-depth; B = near to the seabed; DA = depth averaged
2. The relative change is calculated as 100% * (Operation Phase - Pre-development) / Pre-development
3. “<d.l.” denotes less than detection limit.
4. “n.d.” denotes not determinable.
5. Note that the *E.coli* concentrations presented in this table are the geometric mean over a spring-neap cycle but not the geometric mean over a whole bathing season. Therefore it should not be directly compared to the EPD monitoring data as shown in *Table 6.6* and beach WQO, ie 180 cfu per 100mL.

Table 6.22: Comparison of Relative Change in *E. coli* Concentrations between Pre-development and Operation Phase – 40% Sewerage Connection Rate (Note that the *E.coli* concentrations presented in this table are the geometric mean over a spring-neap cycle but not the geometric mean over a whole bathing season. Therefore it should not be directly compared to the EPD monitoring data as shown in *Table 6.6* and beach WQO, ie 180 cfu per 100mL)

Modelling Assessment Points	Depth	Predicted *E. coli* Concentrations (no./100mL) Geometric Mean over a Spring-Neap Cycle				Percentage of Relative Change	
		Pre-development		Operation Phase			
		Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season
SR8 (Proposed Land Requirement Boundary)	S	9	3	2	<d.l.	-71%	<n.d.
	M	9	5	3	1	-72%	-73%
	B	10	7	3	2	-72%	-68%
	DA	9	5	3	2	-72%	-71%
SR9 (Proposed Land Requirement Boundary)	S	15	7	10	6	-29%	-18%
	M	17	16	12	13	-32%	-24%
	B	21	21	13	18	-35%	-15%
	DA	18	15	12	12	-33%	-19%
SR10 (Proposed Land Requirement Boundary)	S	40	32	11	8	-73%	-76%
	M	41	36	11	9	-74%	-76%
	B	42	43	10	10	-76%	-77%
	DA	41	37	11	9	-74%	-76%
SR11 (Proposed Land Requirement Boundary)	S	30	22	5	3	-83%	-85%
	M	30	23	5	3	-83%	-85%
	B	30	25	5	4	-83%	-85%
	DA	30	23	5	3	-83%	-85%

Modelling Assessment Points	**Depth**	**Predicted *E. coli* Concentrations (no./100mL) Geometric Mean over a Spring-Neap Cycle**				**Percentage of Relative Change**	
		Pre-development		**Operation Phase**			
		Dry Season	**Wet Season**	**Dry Season**	**Wet Season**	**Dry Season**	**Wet Season**
SR12 (Proposed Land Requirement Boundary)	S	135	179	61	83	-55%	-54%
	M	141	**195**	65	97	-54%	-50%
	B	146	**216**	82	139	-44%	-35%
	DA	141	**197**	70	106	-51%	-46%

Notes:

1. S = near to the water surface; M = mid-depth; B = near to the seabed; DA = depth averaged
2. The relative change is calculated as 100% * (Operation Phase - Pre-development) / Pre-development
3. "<d.l." denotes less than detection limit.
4. "n.d." denotes not determinable.
5. Note that the *E.coli* concentrations presented in this table are the geometric mean over a spring-neap cycle but not the geometric mean over a whole bathing season. Therefore it should not be directly compared to the EPD monitoring data as shown in *Table 6.6* and beach WQO, ie 180 cfu per 100mL.

Table 6.23: Comparison of Relative Change in *E. coli* Concentrations between Pre-development and Operation Phase – 20% Sewerage Connection Rate (Note that the *E.coli* concentrations presented in this table are the geometric mean over a spring-neap cycle but not the geometric mean over a whole bathing season. Therefore it should not be directly compared to the EPD monitoring data as shown in *Table 6.6* and beach WQO, ie 180 cfu per 100mL)

Modelling Assessment Points	Depth	Predicted *E. coli* Concentrations (no./100mL) Geometric Mean over a Spring-Neap Cycle				Percentage of Relative Change	
		Pre-development		Operation Phase			
		Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season
SR8 (Proposed Land Requirement Boundary)	S	9	3	3	<d.l.	-62%	<n.d.
	M	9	5	3	2	-63%	-69%
	B	10	7	4	3	-63%	-63%
	DA	9	5	3	2	-63%	-67%
SR9 (Proposed Land Requirement Boundary)	S	15	7	14	7	-6%	-7%
	M	17	16	15	14	-10%	-13%
	B	21	21	18	20	-14%	-4%
	DA	18	15	16	14	-10%	-8%
SR10 (Proposed Land Requirement Boundary)	S	40	32	14	9	-64%	-73%
	M	41	36	14	10	-66%	-73%
	B	42	43	14	11	-67%	-73%
	DA	41	37	14	10	-66%	-73%
SR11 (Proposed Land Requirement Boundary)	S	30	22	7	4	-77%	-84%
	M	30	23	7	4	-77%	-83%
	B	30	25	7	4	-77%	-83%
	DA	30	23	7	4	-77%	-83%

Modelling Assessment Points	**Depth**	**Predicted *E. coli* Concentrations (no./100mL) Geometric Mean over a Spring-Neap Cycle**				**Percentage of Relative Change**	
		Pre-development		**Operation Phase**			
		Dry Season	**Wet Season**	**Dry Season**	**Wet Season**	**Dry Season**	**Wet Season**
SR12 (Proposed Land Requirement Boundary)	S	135	179	81	94	-40%	-47%
	M	141	**195**	87	110	-38%	-44%
	B	146	**216**	109	158	-25%	-27%
	DA	141	**197**	93	121	-34%	-39%

Notes:

1. S = near to the water surface; M = mid-depth; B = near to the seabed; DA = depth averaged
2. The relative change is calculated as 100% * (Operation Phase - Pre-development) / Pre-development
3. “<d.l.” denotes less than detection limit.
4. “n.d.” denotes not determinable.
5. Note that the *E.coli* concentrations presented in this table are the geometric mean over a spring-neap cycle but not the geometric mean over a whole bathing season. Therefore it should not be directly compared to the EPD monitoring data as shown in *Table 6.6* and beach WQO, ie 180 cfu per 100mL.

Figures 6.14 – 6.19 show that the *E. coli* plume of 180 counts per 100mL (WQO criterion) would be outside the groynes and the beach area in general. It is predicted that the *E. coli* plume of 180 counts per 100mL would not be formed to the west of the western groyne whereas the plume would be formed to the east of the eastern groyne but would be outside the groyne. To get an insight whether that *E. coli* plume will flow over the inclined groynes, the results are compared with the historical tidal data collected at Tai Po Kau at where the tidal gauge for the whole Tai Po District is located.

Table 6.24 presents the sea level data at Tai Po Kau under normal conditions whilst *Table 6.25* depicts the sea level under five extreme conditions, ie return periods of 2, 5, 10, 20 and 50 years. The maximum horizontal extent of *E. coli* plume of 180 counts per 100mL near the water surface was predicted from *Figures 6.14 – 6.19.* Based on this, the corresponding elevation of groyne was estimated. The corresponding elevation of groyne in addition to the height of the planter (at least 1.5 m high, on the top of the groyne) was then compared to the sea level under both normal and extreme conditions. As seen from *Table 6.26*, the overflow of the *E. coli* would be unlikely to occur since the groyne as well as the planter will effectively prevent the plume from entering the beach area.

Table 6.24: Sea Level at Tai Po Kau under Normal Conditions

Sea Levels at Tai Po Kau under Normal Conditions (1)	
	Elevation (mPD)
Mean Sea Level	+1.2
Mean Higher High Water (MHHW) (2)	+2.0
Mean Lower Low Water (MLLW)	+0.4

Note:
(1) Civil Engineering Department, HKSAR (2002). Ports Works Manual Part 1 - General Design Considerations for Marine Works. Table 2. Period of data: 1981-1999
(2) Higher High Water (HHW): The higher of the two high waters of any tidal day. The single high water occurring daily during periods when the tide is diurnal is considered to be Higher High Water.

Table 6.25: Sea Level at Tai Po Kau under Extreme Conditions

Sea Levels at Tai Po Kau under Extreme Conditions (1)	
Return Period	**Elevation (mPD)**
1 in 2 years	+2.90
1 in 5 years	+3.30
1 in 10 years	+3.60
1 in 20 years	+3.80
1 in 50 years	+4.10

Note:
(1) Civil Engineering Department, HKSAR (2002). Ports Works Manual Part 1 - General Design Considerations for Marine Works. Table 5. Period of data: 1962-1999

Table 6.26: Possibility of Overflow of *E. coli* plume under both Normal Conditions and Extreme Conditions

Scenarios	**Predicted *E.coli* Plume of 180 cfu/100mL (1)**		**Top Level of Groyne with Planter (planter height = at least 1.5 m)**	**Possibility of Overflow under Normal Conditions**	**Possibility of Overflow under Extreme Conditions (1 in 2 years return period)**	**Possibility of Overflow under Extreme Conditions (1 in 5 years return period)**	**Possibility of Overflow under Extreme Conditions (1 in 10 years return period)**	**Possibility of Overflow under Extreme Conditions (1 in 20 years return period)**	**Possibility of Overflow under Extreme Conditions (1 in 50 years return period)**
(Sewerage Connection Rate)	**Max. Horiz. Distance from the Vert. Seawall (m)**	**Corres. Elevation of Groyne (mPD)**	**(mPD)**	Overflow occurs if the top level of the groyne with planter is lower than the MHHW of +2.0 mPD	Overflow occurs if the top level of the groyne with planter is lower than the Sea Level of +2.9mPD	Overflow occurs if the top level of the groyne with planter is lower than the Sea Level of +3.3mPD	Overflow occurs if the top level of the groyne with planter is lower than the Sea Level of +3.6mPD	Overflow occurs if the top level of the groyne with planter is lower than the Sea Level of +3.8mPD	Overflow occurs if the top level of the groyne with planter is lower than the Sea Level of +4.1mPD
60%	36	+3.36	+4.86	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
40%	45	+3.00	+4.50	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
20%	50	+2.80	+4.30	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely

Notes:

(1) Refers to *E.coli* plume near water surface during the wet season predicted by water quality modelling for this Study.

To assess whether Lung Mei Beach would be environmentally suitable for swimming and other recreational uses, the following has been considered:

- Water Quality Objective (WQO) for bathing beaches has been set under the *Water Pollution Control Ordinance* (*WPCO*). The WQO states that the level of *E. coli* should not exceed 180 per 100mL, calculated as the geometric mean for all samples collected from March to October inclusive. During bathing seasons, all gazetted beaches are monitored at least three times per month, while the non-gazetted beaches are monitored at least twice per month. This WQO applies to all bathing beaches in Hong Kong waters.

- The current government's policy of opening a gazetted beach was referenced. Leisure and Cultural Services Department (LCSD) confirmed that the decision to open or close a beach depends on a dual system, namely beach annual ranking system and beach weekly grading system.

    - **Beach annual ranking system** - Annual geometric mean *E.coli* concentration, calculated as the geometric mean for all samples collected from March to October inclusive. There are totally four ranks, which are Good (=24 counts per 100 mL), Fair (25-180 counts per 100 mL), Poor (181-610 counts per 100 mL) and Very Poor (>610 counts per 100 mL). LCSD will consider closing the "Very Poor" gazetted beaches in the next bathing season. EPD will assist to continue monitoring of the beach water quality and provide LCSD the monitoring results. LCSD will consider re-opening these gazetted beaches when the water quality becomes suitable for swimming.

    - **Beach weekly grading system** - Geometric mean *E.coli* concentration of the 5 most recent sampling occasions. There are totally four grades, which are Grade 1 (=24 counts per 100 mL), Grade 2 (25-180 counts per 100 mL), Grade 3 (181-610 counts per 100 mL) and Grade 4 (>610 counts per 100 mL or last reading exceeds 1,600 counts). LCSD will consider closing the gazetted beach when the weekly grading reaches Grade 4. EPD will assist to continue monitoring of the beach water quality and provide LCSD the monitoring results. LCSD will consider re-opening its gazetted beaches when the water quality becomes suitable for swimming.

Assessment based on WQO (Beach) and Beach Annual Ranking System

- In regard with the beach annual ranking system, the beach water at Lung Mei was all ranked as "Fair" throughout year 2000 to 2006. Annual rank has not been assigned to 2007 at the completion of the EIA Report since the monitoring data for October 2007 is pending.

- With the combination of DSD's new sewerage system, it is mandatory for new developments to connect to the public sewer whereas connections to the sewer for existing households are subject to various factors such as technical feasibility. From information provided by DSD, overall the connection rate is relatively high for the villages which have installed with new sewers. It is anticipated that over 60% connection rate can be achieved. Thus, over 60% of the effluents from the village will be sewered to the system and thus it is expected that this would improve the water quality at Lung Mei.

- The predicted *E. coli* concentrations in the beach water during the operation phase are calculated by multiplying the relative percentage change with the annual geometric mean (bathing season only):

  - <u>Relative Percentage Change</u>: Relative change will give an indication of how much better (or worse) after the implementation of sewerage improvement at various locations of the beach during the operational phase. The predicted values in both dry and wet season under three scenarios are shown in *Table 6.27*. It shows that the overall reduction (mean relative change) in *E. coli* concentrations within the beach area is over 50%.

  - <u>Annual Geometric Mean</u>: The EPD routine beach water quality monitoring *E. coli* data (up to September 2007) was reviewed. The data for 2007 were used for the assessment since it is the latest available information and the most conservative case as compared with the other years. The *E. coli* level at Lung Mei beach is 345 cfu per 100 mL, calculated as the geometric mean for all samples collected from March 2007 to September 2007 inclusive.

  - <u>Predicted *E. coli* Concentrations</u>: It indicates that the water quality of the proposed beach is expected to be significantly improved and the mean *E. coli* concentrations to be compliant with the WQO, ie 180 counts per 100 mL.

Table 6.27: Predicted Mean *E.coli* Concentrations in Beach Water during Operation Phase

Proposed Improvement Works		**Dry Season**		**Wet Season**	
Proposed Bathing Beach Development	**DSD's Sewerage System Connection Rate**	**Relative Percentage Change [(a)]**	**Predicted *E.coli* Concentration (counts/100mL) [(b)]**	**Relative Percentage Change [(a)]**	**Predicted *E.coli* Concentration (counts/100mL) [(b)]**
Drainage diversions and groynes in place	60%	-75%	86	-65%	121
Drainage diversions and groynes in place	40%	-63%	128	-59%	141
Drainage diversions and groynes in place	20%	-50%	173	-54%	159

Notes:

(a) Mean was calculated as the average of the modelling results at the model output points, SR8 to SR12.

(b) 345 counts per 100mL multiplied by relative percentage change.

Assessment based on Beach Weekly Grading System

- The existing condition was reviewed and the weekly grading of Lung Mei Beach between March and September 2007 is summarised in *Table 6.28*. It shows that with 62% of time throughout March and September 2007 Lung Mei Beach was graded as Grade 2 or Grade 3.

- Prediction of percentage of weekly gradings for the operation phase was made based on the modelling results. By applying the mean relative percentage changes, as shown in *Table 6.27* to EPD monitoring beach water quality data (year 2007), the percentages of weekly grading for three operational scenarios are calculated and presented in *Table 6.28*. A conservative assumption of a 60% sewerage connection rate was assumed in this assessment. In long term, a higher sewerage connection rate may be achievable. Since the modelling results show that a higher sewerage connection rate is likely to increase the frequency of occurrence of Grade 2 at Lung Mei Beach, it is anticipated that the frequency of Grade 1 or Grade 2 would be increased in case a higher sewerage connection rate of >60% could be achieved.

Table 6.28: Lung Mei Beach – Percentage of Weekly Gradings in 2007 and Predicted Percentage of Weekly Gradings during Operation Phase

Beach Grade	% of Time throughout Bathing Season			
	Pre-development (Year 2007)*	Operation Phase		
		60% Sewerage Connection**	40% Sewerage Connection**	20% Sewerage Connection**
Grade 1	0	0	0	0
Grade 2	19	62	53	53
Grade 3	43	24	33	33
Grade 4	38	14	14	14
Beach Open or Close	*62% of time Open*	*86% of time Open*	*86% of time Open*	*86% of time Open*

Source: EPD Routine Beach Water Quality Monitoring data (March 2007 to September 2007)

- The findings summarized in *Table 6.28* depicts that with most of the time (over 86%) bathing beach in operation phase, the weekly beach gradings of Lung Mei Beach will be of Grade 2 or Grade 3 which LCSD considers to be acceptable. This suggests that the water quality at Lung Mei Beach during the operation phase will be significantly improved, provided that both the Proposed Bathing Beach Development (especially the drainage diversions and groynes are completed) and DSD's new sewerage system will be in place.

Further Discussion on Assessment the Suitability for Gazetted Beach Development

The above assessment has predicted that the beach water quality during the operation phase of the beach will be in compliance with standards including WQO (beach). The following continuous effort to be paid by the operator should also be taken into account whilst assessing the suitability of Lung Mei being a gazetted bathing beach.

- DSD's new sewerage system will form part of the proposed improvement works for the Proposed Beach Development. It is hence recommended that the project proponent and the operator should closely liaise with DSD to monitor the implementation programme of the village sewerage projects to achieve the target sewerage connection rate to communal sewers before the beach is put into operation.

- EPD has well established a comprehensive water quality monitoring programme for all gazetted beaches to detect any deterioration of beach water quality, which will also be implemented for this Lung Mei bathing beach. In case the beach water quality at Lung Mei tends to be deterioriated and becomes not desirable for swimming, LCSD will close the beach temporarily until the beach water quality becomes suitable for swimming. EPD will continue monitoring the beach water quality and provide LCSD the monitoring results.

- Under the abnormal conditions, for example accidental leakage from unsewered septic tanks, sewage may flow via the drains and eventually enter the sea. This domestic sewage may contain SS, nutrients and BOD and as a result the beach water quality may have deterioration. However, it is anticipated that the leakage will be of small amount and deterioration of water quality will be transient. In this special case, similar to the practice adopted for other gazetted beaches by LCSD, Lung Mei Beach may be closed to swimmers in accordance with the above-mentioned relevant procedures until the beach water quality resumes normal. Bathers are usually advised to avoid swimming at the beach during the closure.

In view that the improvement works, including the diversion of drains, the provision of groynes and DSD's new sewerage system to be in place, the beach water quality is expected to be significantly improved. The proposed site is suitable to operate as a bathing beach with regard to the compliance with the WQO for *E. coli* and high likelihood of achieving Beach Grade 2 (Fair) standard during its operation phase. Apart from the improvement works, the operator LCSD will pay best effort to provide the greatest protection for the bathers. It is also noted that the the Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94) including Lung Mei area, as part of the Sewerage Master Plan (SMP) Works, is expected to be gazetted prior to the operation of the Proposed Beach Development. This will further improve the water quality in the Lung Mei region since it is mandatory for new developments to connect to the public sewer. CEDD and LCSD will closely monitor the implementation programme of the village sewerage projects to achieve the target sewerage connection rate to communal sewers before the beach is put into operation.

In addition to the compliance with water quality standards, Lung Mei is considered to be the best location for the proposed beach development in view of the community demand and accessibility:

- Community Demand: There is no beach facility in the east region of the New Territories, except in the Sai Kung District, which is very far from Tai Po District. Moreover, the existing and future swimming facilities in the Tai Po areas could not satisfy the demand for a bathing beach. Therefore, the public has been requesting repeatedly to the LCSD for a beach development in the Tai Po District. Consequently, the Feasibility Study was carried out and identified in 2001 that the current project site as a feasible location for developing a bathing beach. In light of the above, the Tai Po District Council (TPDC) strongly requested the development of a bathing beach at Lung Mei and members of the TPDC urged for early implementation of the Project. In a Legislative Council case conference on 20 April 2004, Members requested the Government to accord priority to this Assignment. This project was one of the 25 projects identified for priority implementation in the Chief Executive's 2005 Policy Address and has the support of Home Affairs Bureau. It is considered that this Proposed Beach Development at Lung Mei will meet the increasing demand for swimming facilities. Moreover, the beach can serve a recreational function even during non-bathing season, ie playing in the sand, sunbathing and other beach activities.

- Accessibility: Lung Mei is located next to the existing road (Ting Kok Road) and at the sea front. The proposed Lung Mei beach facilities and carpark area will be highly accessible.

6.6 Mitigation Measures and Residual Impacts

6.6.1 Mitigation Measures for Construction Phase

Dredging and Sandfilling Operations

The impacts arising from the dredging and sandfilling works to the surrounding water quality have been assessed in *Section 6.5.1*. It is predicted that the sediment plume and the sediment deposition will not be large in extent and no unacceptable water impacts including DO depletion, release of contaminants and nutrients are expected. Although no unacceptable water quality impacts would result, the following good construction site practice and proactive precautionary measures are recommended to ensure dredging and sandfilling operations would be undertaken in such a manner as to avoid any uncontrolled or unexpected incidents during the marine works:

- Sandfilling works should be carried out after the completion of groyne construction.

- A movable cage type / metal frame type silt curtain, as shown in *Figure 6.20* will be deployed around the dredging area next to the grab dredger prior to commencement of dredging works;

- Standing type silt curtains, as shown in *Figure 6.21*, will be deployed around the proposed sandfilling extent prior to commencement of sandfilling works;

- A hourly dredging rate of a closed grab dredger (with a minimum grab size of 3 m^3) should be less than 31 m^3 hr^{-1}, with reference to the maximum rate for dredging, which was derived in the EIA;

- A daily filling rate should be less than 1,000 m^3 day^{-1}, which was defined in the EIA;

- Mechanical grabs should be designed and maintained to avoid spillage and should seal tightly while being lifted;

- Barges or hoppers should have tight fitting seals to their bottom openings to prevent leakage of material;

- Loading of barges or hoppers shall be controlled to prevent splashing of dredged material to the surrounding water;

- Barges or hoppers should not be filled to a level which will cause overflow of materials or pollution of water during loading or transportation;

- Excess material should be cleaned from the decks and exposed fittings of barges or hoppers before the vessel is moved;

- Adequate freeboard should be maintained on barges to reduce the likelihood of decks being washed by wave action;

- All vessels should be sized such that adequate clearance is maintained between vessels and the seabed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash; and

- The works should not cause foam, oil, grease, litter or other objectionable matter to be present in the water within and adjacent to the Project Site.

Construction Site Runoff

- The excavation works for the drainage diversions should be carried out to minimize any seawater influx entering the works area and hence to keep the works area dry as much as possible.

- Silt curtains at the inshore waters should be deployed to enclose the works area before the commencement of the excavation works for two drainage diversions until the completion of the diversions. The indicative locations of silt curtains are shown in *Figure 6.21*.

- At the start of Proposed Beach Development establishment, perimeter cut-off drains to direct off-site water around the site should be constructed and internal drainage works and erosion and sedimentation control facilities implemented. Channels, earth bunds or sand bag barriers should be provided on site to direct stormwater to silt removal facilities. The design of efficient silt removal facilities should be based on the guidelines in *Appendix A1* of *ProPECC PN 1/94*.

- All the surface runoff should be collected by the on-site drainage system and diverted through the silt traps prior to discharge into storm drain.

- All exposed earth areas should be completed as soon as possible after earthworks have been completed, or alternatively, within 14 days of the cessation of earthworks, where practicable. If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by tarpaulin or by other means.

- All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms. Deposited silt and grit should be removed regularly and disposed of by spreading evenly over stable, vegetated areas.

- Measures should be taken to reduce the ingress of site drainage into excavations. If the excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.

- Open stockpiles of construction materials (for example, aggregates, sand and fill material) of more than 50 m^3 should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.

- Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system.

- Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecasted, and actions to be taken during or after rainstorms are summarised in *Appendix A2* of *ProPECC PN 1/94*. Particular attention should be paid to the control of silty surface runoff during storm events, especially for areas located near steep slopes.

- Oil interceptors should be provided in the drainage system and regularly emptied to prevent the release of oil and grease into the storm water drainage system after accidental spillages. The interceptor should have a bypass to prevent flushing during periods of heavy rain. Typical design of the oil interceptors could make reference to *Appendix D* of *ProPECC PN 1/94*.

- All temporary and permanent drainage pipes and culverts provided to facilitate runoff discharge should be adequately designed for the controlled release of storm flows. All sediment traps should be regularly cleaned and maintained. The temporary diverted drainage should be reinstated to the original condition when the construction work has finished or the temporary diversion is no longer required.

Sewage Generated by Workforce

- Sewage from toilets should be collected by a licensed waste collector.

Storage and Handling of Oil, Other Petroleum Products and Chemicals

- Waste streams classifiable as chemical wastes should be properly stored, collected and treated for compliance with *Waste Disposal Ordinance or Disposal (Chemical Waste) (General) Regulation* requirements.

- All fuel tanks and chemical storage areas should be provided with locks and be sited on paved areas.

- The storage areas should be surrounded by bunds with a capacity equal to 110% of the storage capacity of the largest tank to prevent spilled oil, fuel and chemicals from reaching the receiving waters.

- Oil leakage or spillage should be contained and cleaned up immediately. Waste oil should be collected and stored for recycling or disposal, in accordance with the *Waste Disposal Ordinance*. The Contractors should prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals.

- Vehicle and plant servicing areas, vehicle wash bays and lubrication bays should, as far as possible, be located within roofed areas. The drainage in these covered areas should be connected to foul sewers via a petrol interceptor.

6.6.2 Mitigation Measures for Operation Phase

Although no unacceptable water quality impact is anticipated during the operation phase, the following measures are recommended:

Surface Runoff from Project Site

- A petrol interceptor should be provided in the drainage system and regularly emptied to prevent the release of oil and grease into the storm water drainage system after accidental spillages. The interceptor should have a bypass to prevent flushing during periods of heavy rain.

- Oil leakage or spillage should be contained and cleaned up immediately. Waste oil should be collected and stored for recycling or disposal in accordance with the *Waste Disposal Ordinance.*

6.7 Residual Impacts

It has been predicted in the previous section that there would not be any unacceptable environmental impacts, provided the mitigation measures are properly and fully implemented. Hence no residual water quality impacts were predicted to occur due to construction of the Proposed Beach Development provided the above described mitigation measures are implemented. Similarly, no residual water quality impacts were predicted to occur during the operation of the Proposed Beach Development.

6.8 Cumulative Impacts

The Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94) will carry out works connecting the unsewered areas from Ting Kok village to Lung Mei village, which are in the vicinity of the bathing beach development. The current programme for the sewerage construction works is November 2008 to November 2010, which coincidently will be concurrent with the anticipated construction period for this Proposed Bathing Beach Development project. Apart from the tentative timeline, details of the construction works of this sewerage project are not available.

In general, the construction works of similar kind of sewerage projects include the trenching works, lying of pipes and backfilling of trenches. The potential water quality impact of key concern is the site runoff although it is not anticipated that these minor land based works would general substantial site runoff.

Normally, the contractor will have a good practice on controlling the site runoff, for example, by deploying the sandbags besides the trenches in order to avoid overflowing and divert the natural runoff to the rainstorm drains. The site runoff will be minimal if good practices are applied during its construction phase.

It has been discussed in *Section 6.5.1* that the site runoff from the Proposed Beach Development will not cause unacceptable water quality impacts, with the full implementation of site practices and mitigation measures. Therefore, no adverse cumulative impacts are predicted.

6.9 Environmental Monitoring Audit Requirements

6.9.1 Construction Phase

Although no unacceptable impacts have been predicted to occur during the operation of dredging and sandfilling, monitoring of marine water quality during the construction phase is considered necessary to evaluate whether any impacts would be posed by these marine works on the surrounding waters during the operation of dredging and filling works. The details of the EM&A programme are presented in *Section 11*.

6.9.2 Post-Construction Phase

The Post-Construction Phase is defined as after completion of construction works but before operation of the beach. Within six weeks after the completion of the construction of the Proposed Beach Development, *E. coli* monitoring will be carried out twice per week at two diverted drains and EPD routine monitoring stations to examine the correlation of the pollution loading and the beach water quality (details refer to *Section 11.6* and the *EM&A Manual*). This information will be reviewed by LCSD to ensure the beach water quality is suitable for recreational purpose before the beach is put into operation.

6.9.3 Operation Phase

As no unacceptable impacts have been predicted to occur during the operation of the Proposed Beach Development, monitoring of marine water quality during the operation phase is not considered necessary.

EPD has well established a comprehensive water quality monitoring programme for all gazetted beaches to detect any deterioration of beach water quality, which will also be implemented for this Lung Mei bathing beach. In case the beach water quality at Lung Mei tends to be deterioriated and becomes not desirable for swimming, LCSD will close the beach temporarily in consultation with EPD according to established procedures until the beach water quality becomes suitable for swimming whilst EPD will continue monitoring the beach water quality and explore further measure to improve the water quality in the locality.

6.10 Conclusions

This Section has dealt with the assessment of the impacts on water quality of the construction and operation of Lung Mei bathing beach.

Construction Phase

The water quality modelling works have indicated that for both the dry and wet seasons, no exceedances of the WQO and the evaluation criterion are predicted to occur during the dredging and sandfilling operations. The impact assessment has also shown that other land-based construction works, if properly controlled, are not expected to cause any adverse impacts to the surrounding waters and the sensitive receivers. Mitigation measures were described, which would provide a series of good site management options to minimise the impacts.

Operation Phase

No operational impacts to water quality are expected to occur if mitigation measures are fully implemented. Considering that the improvement works, including the diversion of drains, the provision of groynes and with DSD's new sewerage system to be in place, the beach water quality is expected to be significantly improved. The proposed site is suitable to operate as a bathing beach with regard to the compliance with the WQO for *E. coli* and high likelihood of achieving Beach Grade 2 (Fair) standard during its operation phase. In addition to the improvement works, the operator will pay best effort to provide the greatest protection for the bathers.

7 WASTE MANAGEMENT IMPLICATIONS

7.1 Introduction

This section identifies the potential wastes arising from the construction and operation of the Proposed Beach Developing at Lung Mei and assesses the potential environmental impacts associated with waste handling and disposal. The main issues are:

- Management of dredged materials;
- Handling and disposal of contaminated soil/sediments;
- Handling and disposal of construction and demolition (C&D) materials arising from the demolition, excavation and construction works; and
- Management of chemical waste, sewage, and general refuse.

Waste avoidance, minimisation, reuse and recycling, storage, collection, transport and disposal schemes have been examined and appropriate measures for waste reduction and management have been proposed.

7.2 Relevant Legislation and Guidelines

The following discussion on legislative requirements and evaluation criteria applies to both the construction and operational phases of the Proposed Beach Development. The criteria and guidelines for evaluating potential waste management implications are laid out in Annexes 7 and 15 of the EIAO-TM under the *EIAO (Cap 499)*. The following legislation covers, or has some bearing upon the handling, treatment and disposal of the wastes generated from the construction and operation of the Proposed Beach Development.

- Waste Disposal Ordinance (Cap 354);
- Waste Disposal (Chemical Waste) (General) Regulation (Cap 354C);
- Land (Miscellaneous Provisions) Ordinance (Cap 28)
- Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances Regulation; and
- Dumping at Sea Ordinance (Cap 466).

7.2.1 Waste Disposal Ordinance (Cap 354)

The *Waste Disposal Ordinance (WDO)* prohibits the unauthorised disposal of wastes, with waste defined as any substance or article, which is abandoned. Construction waste is not directly defined in the *WDO* but is considered to fall within the category of 'trade waste'. Trade waste is defined as waste from any trade, manufacturer or business or any wasted building, or civil engineering materials, but does not include animal waste.

Under the *WDO*, wastes can only be disposed of at a licensed site. The *WDO* provides for the issuing of licences for the collection and transport of wastes. Licences are not, however, currently issued for the collection and transport of construction waste or trade waste.

The *Waste Disposal (Charges for Disposal of Construction Waste) Regulation* defined construction waste as any substance, matters or things that is generated from construction work and abandoned, whether or not it has been processed or stockpiled before being abandoned.

The Construction Waste Disposal Charging Scheme entered into operation on 1 December 2005. Starting from 1 December 2005, the main contractor who undertakes construction work under a contract with value of HK$1 million or above is required to open a billing account solely for the contract for waste disposal. Application shall be made within 21 days after the contract is awarded. Under the Scheme, charging for disposal of construction waste started on 20 January 2006 and therefore will apply to this Project.

Depending on the percentage of inert materials in the construction waste, inert construction waste can be disposed of at public fill reception facilities. However mixed construction waste can be disposed of at construction waste sorting facilities and landfills which have different disposal costs. The scheme encourages reducing, reusing and sorting of construction waste such that the waste producer can reduce their disposal fee. *Table 7.1* summarises the government construction waste disposal facilities, types of waste accepted and disposal cost.

Table 7.1: Government Facilities for Disposal of C&D Materials

Government Waste Disposal Facilities	**Type of Construction Waste Accepted**	**Charge (HK$/Tonne)**
Public fill reception facilities	Consisting entirely of inert construction waste	$27
Sorting facilities	Containing more than 50% by weight of inert construction waste	$100
Landfills	Containing not more than 50% by weight of inert construction waste	$125
Outlying Islands Transfer Facilities	Containing any percentage of inert construction waste	$125

7.2.2 *Waste Disposal (Chemical Waste) (General) Regulation (Cap 354C)*

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*, if the specified substance or chemical occurs in such a form, quantity or concentration so as to cause pollution or constitute a danger to health or risk of pollution to the environment.

A person should not produce, or cause to be produced, chemical wastes without registration with the EPD. Chemical wastes must either be treated using on-site facility licensed by EPD or be collected by a licensed collector for off-site treatment at a licensed facility. Under EPD *Regulation*, the waste producer, collector and disposal facility must sign all relevant parts of a computerised trip ticket for each consignment of waste. The computerized system is designed to allow the transfer of wastes to be traced from cradle-to-grave.

The EPD *Regulation* prescribes storage facilities to be provided on-site which include labelling and warning signs. To reduce the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written emergency procedures for spillage, leakage or accidents arising from the storage of chemical wastes. They must also provide their employees with training on such procedures.

7.2.3 *Land (Miscellaneous Provisions) Ordinance (Cap 28)*

The inert portion of C&D materials (also called public fill) may be taken to public fill reception facilities. Public filling areas usually form part of land reclamation schemes and are operated by the Civil Engineering and Development Department (CEDD) and others. The *Land (Miscellaneous Provisions) Ordinance* requires that individuals or companies who deliver public fill to the public fill reception facilities to obtain a Dumping Licence from the CEDD.

Under the licence conditions, public fill reception facilities will only accept earth, soil, sand, rubble, brick, tile, rock, boulder, concrete, asphalt, masonry or used bentonite. In addition, in accordance with paragraph 11 of the ETWB TC(W) No.31.2004, Public Fill Committee will advise on the acceptance criteria (e.g. no mixing of construction waste, nominal size of the materials less than 250mm, etc). The material should, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical wastes, animal and vegetable matter and any other materials considered unsuitable by the public fill reception facility supervisor.

7.2.4 *Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances Regulation*

This *Regulation* provides a further control on the illegal dumping of wastes on unauthorised (unlicensed) sites.

7.2.5 Dumping at Sea Ordinance (Cap 466)

This *Ordinance* came into operation in April 1995 and empowers the Director of Environmental Protection (DEP) to control the disposal and incineration of substances and articles at sea for the protection of the marine environment. Under the *Ordinance*, a permit from the DEP is required for the disposal of regulated substances within and outside the waters of the Hong Kong SAR. The permit contains terms and conditions that includes the following specifications:

- Type and quantity of substances permitted to be dumped;
- Location of the disposal grounds;
- Requirement of equipment for monitoring the disposal operations; and
- Environmental monitoring requirements.

Management of Dredged/Excavated Sediments for Marine Disposal

Marine disposal of any dredged/excavated sediment is subject to control under the *Dumping at Sea Ordinance* 1995. Dredged/excavated sediment destined for marine disposal is classified based on its contaminant levels with reference to the Chemical Exceedance Levels (CEL), as stipulated in ETWBTC No. 34/2002: Management of Dredged/Excavated Sediment. This Technical Circular includes a set of sediment quality criteria, as presented in *Table 7.2*, which includes heavy metals and metalloids, organic pollutants and a class of contamination level for highly contaminated sediment not suitable for marine disposal.

Table 7.2: Dredged/Excavated Sediment Quality Criteria for the Classification under the ETWBTC No 34/2002

Contaminants	**Lower Chemical Exceedance Level (LCEL)**	**Upper Chemical Exceedance Level (UCEL)**
Metals (mg kg^{-1} dry weight)		
Cd	1.5	4
Cr	80	160
Cu	65	110
Hg	0.5	1
Ni$^{(a)}$	40	40
Pb	75	110
Silver (Ag)	1	2
Zinc (Zn)	200	270
Metalloid (mg kg^{-1} dry weight)		
Arsenic (As)	12	42
Organic-PAHs (mg kg^{-1} dry weight)		
Low Molecular Weight (LMW) PAHs	550	3,160
High Molecular Weight (HMW) PAHs	1,700	9,600
Organic-non-PAHs (mg kg^{-1} dry weight)		
Total PCBs	23	180
Organometallics (mgTBT l^{-1} in interstitial water)		
Tributyl-tin $^{(a)}$	0.15	0.15

Note:
(a) The contaminant level is considered to have exceeded the UCEL if it is greater than the value shown.

In accordance with ETWBTC 34/2002, the sediment is classified into three categories based on its contamination levels:

Category L: Sediment with all contaminant levels not exceeding the LCEL. The material must be dredged, transported and disposed of in a manner which reduces the loss of contaminants either into solution or by re-suspension.

Category M: Any one or more contaminants in the sediment exceeding the LCEL with none exceeding the UCEL. The material must be dredged and transported with care, and must be effectively isolated from the environment upon final disposal unless appropriate biological tests demonstrate that the material will not adversely affect the marine environment.

Category H: Any one or more contaminants in the sediment exceeding the UCEL. The material must be dredged and transported with great care, and must be effectively isolated from the environment upon final disposal.

Figure 7.2 summarises the sediment classification and disposal arrangements. EPD will use the sediment and biological test results to determine the most appropriate disposal site (e.g. open sea or confined marine disposal site).

In accordance with ETWB TC 34/2002, the allocation of sediment disposal space at sea will be considered only if the need for removal of the sediment has been satisfactorily demonstrated. Therefore it is desirable to demonstrate that any proposed mud dredging has been reduced as far as reasonably and safely practicable and to obtain, in-principle, an agreement from the Secretary of the Marine Fill Committee (MFC) of the CEDD at an early stage. Procedures as stipulated under ETWB TCW No. 34/2002 should be followed if marine disposal of dredged/ excavated sediments is involved.

7.2.6 Other Relevant Guidelines

Other guideline documents which detail how the Contractor will comply with the *WDO* and its associated regulations include:

- Waste Disposal Plan for Hong Kong (December 1989), Planning, Environment and Lands Branch Government Secretariat, Hong Kong Government;
- Chapter 9 - Environment (1999), Hong Kong Planning Standards and Guidelines, Hong Kong Government;
- New Disposal Arrangements for Construction Waste (1992), EPD & CED, Hong Kong Government;
- Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992), EPD, Hong Kong Government;
- Works Branch Technical Circular (WBTC) No. 32/92, The Use of Tropical Hard Wood on Construction Site; Works Branch, Hong Kong Government;
- WBTC No. 2/93, Public Dumps. Works Branch, Hong Kong Government;
- WBTC No. 2/93B, Public Filling Facilities, Works Branch, Hong Kong Government;
- WBTC No. 16/96, Wet Soil in Public Dumps; Works Branch, Hong Kong Government;
- WBTC Nos. 4/98 and 4/98A, Use of Public Fill in Reclamation and Earth Filling Projects; Works Bureau, Hong Kong SAR Government;

- Waste Reduction Framework Plan, 1998 to 2007, Planning, Environment and Lands Bureau, Government Secretariat, 5 November 1998;
- WBTC Nos. 25/99, 25/99A and 25/99C, Incorporation of Information on Construction and Demolition Material Management in Public Works Sub-committee Papers; Works Bureau, Hong Kong SAR Government;
- WBTC No. 12/2000, Fill Management; Works Bureau, Hong Kong SAR Government;
- WBTC No. 19/2001, Metallic Site Hoardings and Signboards; Works Bureau, Hong Kong SAR Government;
- WBTC Nos. 6/2002 and 6/2002A, Enhanced Specification for Site Cleanliness and Tidiness. Works Bureau, Hong Kong SAR Government;
- WBTC No. 11/2002, Control of Site Crusher. Works Bureau, Hong Kong SAR Government;
- WBTC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates. Works Bureau, Hong Kong SAR Government;
- ETWBTC No. 33/2002, Management of Construction and Demolition Material Including Rock; Environment, Transport and Works Bureau, Hong Kong SAR Government;
- EWBTC No. 34/2002, Management of Dredged/Excavated Sediment; Environment, Transport and Works Bureau, Hong Kong SAR Government;
- ETWBTC No. 31/2004, Trip Ticket System for Disposal of Construction & Demolition Materials, Environment, Transport and Works Bureau, Hong Kong SAR Government; and
- ETWBTC No. 19/2005, Environmental Management of Construction Site, Environment, Transport and Works Bureau, Hong Kong SAR Government.

7.3 Expected Waste Sources

7.3.1 Construction Phase

During the construction phase, the main activities, which will result in generation of waste, include dredging and excavation, road widening, culvert diversion and construction and building works. The Proposed Beach Development was designed to minimize waste generation and promote reuse and recycling of any waste generated from the construction. Waste avoidance and minimisation will be considered during the planning and design stages and in the selection of options for construction methods and programme.

The typical waste types associated with these activities include:

- Dredged marine sediment;
- C&D materials;
- Chemical waste;
- Sewage; and
- General refuse.

7.3.2 Operational Phase

The following wastes will be generated from the operation of the Proposed Beach Development:

- Sewage; and
- General refuse.

7.4 Assessment Methodology

The potential environmental impacts associated with the handling and disposal of waste arising from the construction and operation of the Proposed Beach Development were assessed in accordance with the criteria presented in Annexes 7 and 15 of the EIAO-TM and summarised as follows:

- Estimation of the types and quantities of the wastes to be generated based on information provided by the engineering design team and the relevant research and studies on waste arisings;

- 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.

7.5 Evaluation of Impacts

7.5.1 Construction Phase

Dredged Marine Sediments

The beach development works will involve dredging and filling. Various beach layouts and construction methods have been examined with respect to the practicality of constructing the Proposed Beach Development without dredging. It is concluded that dredging is unavoidable, however the proposed dredging works have been kept to minimum. Dredging will be required for foundation formation of the proposed groynes and removal of 500mm thick granular soil from the existing beach areas.

Dredging activities will be conducted within the Project Site as shown in *Figure 1.1*. *Table 7.3* summarize the quantity of dredged materials to be generated.

Dredging in the offshore area will be conducted by Closed Grab Dredger. The formation of the 200m long beach with a groyne at end of the beach will generate a total of approximately 10,500 m³ of dredged sediment. The dredging activities will take about 2 months (i.e. tentatively from February 2009 to March 2009).

Table 7.3: Quantity of Dredging Marine Sediment

Description	**Dredged Marine Sediment (m^3)**
Seabed reformation/ Groyne Construction	10,500

A preliminary marine sediment sampling programme has been undertaken as part of the EIA Study to provide an indication of the quality of the sediment and the volumes of different types of sediment to be dredged. The sediment sampling programme (including the sampling stations, the chemical analysis suite and the biological testing programmes) was developed based on the guidelines described in ETWBTC 34/2002. The sampling and testing programmes are summarised in *Table 7.4* and the sampling locations are presented in *Figure 7.2*.

Table 7.4: Marine Sediment Sampling Locations

Sampling Location	**Coordinates**		**Vibrocore Sampling**	**Interstitial Water (for TBT)**	**Elutriation and Marine Water Test**
	Northing (m)	**Easting (m)**			
SS1	841401.05	836818.49	✓	✓	✓
SS2	841421.86	836773.17	✓	✓	✓
SS3	841459.93	836680.53	✓	✓	✓
SS4	841493.11	836857.52	✓	✓	✓
SS5	841512.75	836811.54	✓	✓	✓
SS6	841551.91	836719.80	✓	✓	✓
SS7	841585.07	836896.75	✓	✓	✓
SS8	841604.72	836850.78	✓	✓	✓
SS9	841628.28	836795.60	✓	✓	✓

Samples from the vertical profile of sediments to be dredged were collected using a vibrocore device to the required dredging depth of 3 m or until further drilling was not possible, whichever was the shallowest. The vibrocore samples were cut on site at the proposed sampling depths from the existing seabed surface at -0.9m, -1.9m and -2.9m. The sediment samples for further biological testing were also concurrently collected. All vibrocores collected were of depth less than 3m due to thin layer of marine deposit in the area. It should be noted that the sample taken at depths of 0.0-0.2m and 0.0-0.5m for virbocores SS1 and SS2, respectively, were not tested due to its sandy material content. In addition, a reference sediment sample was collected at the EPD routine sediment monitoring station PS6 (Hong Kong Metric coordinates: 850234E, 820057N) in the Port Shelter.

The contaminants tested include all the contaminants stated in Table 1 - Analytical Methodology in *Appendix B* of ETWBTC No 34/2002 plus PCBs and 12 Chlorinated Pesticides.

Tier III biological screening was also performed on samples where one or more contaminant level exceeded the LCEL. The ecotoxicological-testing programme featured a suite of tests that include three phylogenetically distinct species (amphipod, polychaete and bivalve larvae) which interact with marine sediments in different ways. The objective of the bioassays was to determine if the potential toxicological impacts of marine disposal of the dredged sediment on the marine biota, and whether there is any difference in the toxicity of the sediments samples taking from the Project Site and the reference station (collected from a clean area in Port Shelter, New Territories). The chemical and biological analysis results of the marine sediment are presented in *Table 7.5*.

According to the sediment classification results shown in *Table 7.5*, sediment samples from drill holes SS1, SS2, SS4, SS7 and SS8 required biological testing in order to determine the disposal arrangements. Biological testing has been carried out for these samples and analysis results are shown in *Table 7.5*.

Table 7.5: Marine Sediment Testing Result

Sample Reference		Heavy Metals (mg kg^{-1})									Sediment Category	Biological Sample No.	Failed Biological Tests			Final Disposal
Drill hole No.	Depth (m) From – To	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Mercury (Hg)	Arsenic (As)	Silver (Ag)			Amphipod	Bivalve	Polychaete	
Reporting Limits		**0.2**	**8**	**7**	**4**	**8**	**20**	**0.05**	**1**	**0.1**						
LCEL		**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**12**	**1**						
UCEL		**4**	**160**	**110**	**40**	**110**	**270**	**1**	**42**	**2**						
SS1	0.2-0.9m	<0.2	<8	<7	<4	13	<20	<0.05	**17**	<0.1	M	CS1	x			Type 2 Confined
SS1	0.9-1.2m	<0.2	<8	<7	<4	31	26	<0.05	**24**	<0.1	M	CS1	x			Type 2 Confined
SS2	0.5-.0.9m	<0.2	<8	<7	<4	17	20	<0.05	**17**	<0.1	M	CS2				Type 1 Dedicated
SS2	0.9-1.9m	<0.2	<8	<7	<4	18	23	<0.05	**28**	<0.1	M	CS2				Type 1 Dedicated
SS2	1.9-2.5m	<0.2	<8	<7	<4	25	<20	<0.05	**42**	<0.1	M	CS2				Type 1 Dedicated
SS3	0.0-0.9m	<0.2	<8	<7	<4	13	<20	0.07	5.8	<0.1	L					Type 1
SS3	0.9-1.9m	<0.2	<8	<7	<4	11	<20	0.05	5	<0.1	L					Type 1
SS3	1.9-2.8m	<0.2	<8	<7	<4	20	<20	0.06	12	<0.1	L					Type 1
SS4	0.0-0.9m	<0.2	<8	<7	<4	12	20	<0.05	6.9	<0.1	L					Type 1
SS4	0.9-1.3m	<0.2	<8	<7	<4	12	<20	<0.05	**27**	<0.1	M	CS3				Type 1 Dedicated
SS5	0.0-0.9m	<0.2	<8	<7	7.8	19	<20	<0.05	2.5	0.12	L					Type 1
SS6	0.0-0.9m	<0.2	<8	<7	<4	8.5	<20	0.10	3.3	<0.1	L					Type 1
SS6	0.9-1.6m	<0.2	<8	<7	<4	<8	<20	0.06	4.2	<0.1	L					Type 1
SS7	0.0-0.9m	<0.2	<8	<7	<4	13	<20	<0.05	6.1	<0.1	L					Type 1
SS7	0.9-1.3m	<0.2	<8	<7	<4	13	<20	<0.05	**14**	<0.1	M	CS3				Type 1 Dedicated
SS8	0.0-0.9m	<0.2	<8	<7	<4	12	<20	0.08	10	<0.1	L					Type 1
SS8	0.9-1.7m	<0.2	<8	<7	<4	8.8	<20	0.07	**16**	<0.1	M	CS3				Type 1 Dedicated

Sample Reference		Heavy Metals (mg kg^{-1})									Sediment Category	Biological Sample No.	Failed Biological Tests			Final Disposal
Drill hole No.	**Depth (m) From – To**	**Cadmium (Cd)**	**Chromium (Cr)**	**Copper (Cu)**	**Nickel (Ni)**	**Lead (Pb)**	**Zinc (Zn)**	**Mercury (Hg)**	**Arsenic (As)**	**Silver (Ag)**			**Amphipod**	**Bivalve**	**Polychaete**	
Reporting Limits		**0.2**	**8**	**7**	**4**	**8**	**20**	**0.05**	**1**	**0.1**						
LCEL		**1.5**	**80**	**65**	**40**	**75**	**200**	**0.5**	**12**	**1**						
UCEL		**4**	**160**	**110**	**40**	**110**	**270**	**1**	**42**	**2**						
SS9	0.0-0.9m	<0.2	<8	<7	<4	10	<20	0.07	4.0	<0.1	L					Type 1
SS9	0.9-1.9m	<0.2	<8	<7	<4	<8	<20	<0.05	2.5	<0.1	L					Type 1
SS9	1.9-2.1m	<0.2	<8	<7	<4	<8	<20	<0.05	8.5	<0.1	L					Type 1

Notes:

(a) Bold and unlined = Exceeding LCEL, classified as Category M, which requires biological screening to determine the types of disposal site (ie Type 1 or Type 2 Disposal).
(b) x = Failed biological testing.
(c) Type 1 Disposal = disposal at an open sea disposal.
(d) Type 1 Dedicated Site = disposal at a dedicated open sea disposal site.
(e) Type 2 Disposal = disposal at confined marine disposal site

Sample Reference		**Total PCBs**	**Total PAHs (Low MW)**	**Total PAHs (High MW)**	**TBT (in interstitial water)**	**Chlorinated Pesticides (mg kg^{-1})**											
Drillhole No.	**Depth (m) From-To**					**Alpha BHC**	**Beta BHC**	**Gamma BHC**	**Delta-BHC**	**Hepta-chlor**	**Aldrin**	**Hepta-chlor epoxide**	**Endo-sulfan**	**p,p' DDT**	**p,p' DDD**	**p,p' DDE**	**Endosulfan sulfate**
Reporting Limits		3	550	1700	0.015	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
LCEL		23	1700	550	23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
UCEL		180	9600	3160	180	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SS1	0.2-0.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS1	0.9-1.2m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS2	0.5-.0.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS2	0.9-1.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS2	1.9-2.5m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS3	0.0-0.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS3	0.9-1.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS3	1.9-2.8m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS4	0.0-0.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS4	0.9-1.3m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS5	0.0-0.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS6	0.0-0.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS6	0.9-1.6m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS7	0.0-0.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS7	0.9-1.3m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS8	0.0-0.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS8	0.9-1.7m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS9	0.0-0.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS9	0.9-1.9m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SS9	1.9-2.1m	<3	<550	<1700	<0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Note:
NA = Not Available

According to the ETWB TC(W) No. 34/2002, sediment is deemed to have failed the biological test if it fails in any one of the three toxicity tests. Due to the failure on the 20-Day Polychaete Test, the sediment to be dredged represented by sample collected at location SS1 must be dredged with great care and transported to the confined mud pits at East Sha Chau for disposal (ie Type 2 – Confined Marine Disposal).

The latest engineering review suggested that dredging depth will generally be limited to 0.5 - 1m below seabed level, and will not be greater than 3m. The estimated in-situ quantities of contaminated and uncontaminated sediment to be dredged for different work activities are summarized in *Table 7.6* and the Sediment Disposal Requirement Plan is shown in *Figure 7.3 and 7.4*.

Table 7.6: Estimated Quantity of Different Types of Marine Sediment to be Dredged (m^3)

Disposal Options	**Seabed**	**%**
Type 1 Open Sea Disposal	6,380	60.76%
Type 1 Dedicated Open Sea Disposal Site	2,620	24.95%
Type 2 Confined Marine Disposal Site	1,500	14.28%
Total	**10,500**	**100%**

Note:
(a) The quantity of contaminated sediment was estimated based on locations where sediment samples were classified as Category L and Category M within the proposed dredged areas. The estimated dredging depth would generally in the range of 0.5m to 1m and not greater than 3m.

It is estimated that a total of 17 barge trips will be required to transport the dredged sediments during the dredging period (1). The dredged marine sediments will be loaded onto barges using closed grabs and transported to the appropriate disposal sites depending on their level of contamination. In accordance with the requirements of ETWBTC No 34/2002, the Category M sediments will be dredged and transported with great care in order to avoid leakage of contaminated sediment into the sea. With the implementation of the mitigation measures recommended in Section 7.6, sediment disposal at the designated disposal sites will not cause adverse environmental impacts. The *Sediment Quality Report* (SQR) has been prepared in accordance with the requirements of ETWBTC 34/2002 for approval as required under the Dumping at Sea Ordinance and attached in *Appendix F*.

The final disposal site will be determined by the MFC and a dumping licence will be obtained from the DEP prior to the commencement of the dredging works. The potential water quality impacts due to the dredging and disposal of these sediments have been assessed and are presented in Section 6, Water Quality Impact Assessment. The assessment concluded that the dredging works and proper disposal of the sediment will meet the relevant water quality impact assessment criteria in the EIAO-TM with the implementation of the recommended mitigation measures.

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(1) Number of trips required for transportation of dredged sediment from dredging area(s) to disposal site(s) was calculated using a rate of 700m^3 per barge – 4 barge trip for Type 1 open sea disposal, 10 barge trip for Type 1 dedicated disposal and 3 barge trips for Type 2 confined disposal.

Demolition Waste

Demolition for existing structures and site clearance (450 m^3) and for building & landscaping works and western drainage channel (20 m^3) will produce approximately 470 m^3 of demolition waste consist of a mixture of vegetable matter and inert materials. The demolition works will be completed within 7 months (i.e. tentatively from December 2008 to July 2009). Sequential demolition method will be used to facilitate the separation of inert and non-inert materials as far as possible to enable the beneficial use of the inert materials and to minimise waste disposal costs. Assuming a bulking factor of 1.4, it is estimated that about 1 truck trips will be required each day to dispose of the demolition waste (1). Construction and demolition (C&D) materials generated will be separated/ sorted into inert and non-inert portions on site. Inert C&D materials will be reused on site (e.g. as filing materials) as far as possible. The surplus inert C&D materials should be delivered to public fill for re-use purpose. The delivery of the C&D materials to public fill reception facilities and landfills will be monitored using trip ticket system in accordance with ETWB TCW No. 31/2004.

Excavated Materials

Excavation and backfilling will be required to form a small piece of land to accommodate the future beach facilities/buildings, road and footpath, car park, drainage and sewerage facilities. The site formation works will last for 7 months, tentatively from December 2008 to June 2009.

A review of old and recent aerial photographs has indicated that changes of the Project Site in the past 2 decades are due to natural changes or by village development (see *Figure 7.5*). The area was used as agriculture land in 1940's to 1970's and left naturally in early 1980's. The existing hard standing area at the western side of the site was formed in late 1980's, but no structure was built on top of that area. No industrial development has ever been established near to the area. All connections to the existing box culverts are road drains and stream courses and the discharge is mainly surface run-off. It is unlikely that the effluent from box culverts contains high level of contaminations. Therefore no contamination issue is expected on the Project Site and the excavated soil/material would be free of contaminants and can be re-used on site or disposed of at public fill.

The excavation works will mainly be carried out in the first 5 months and will generate approximately 13,800 m^3 of excavated materials (mainly soil). The estimated quantities of excavated materials are presented in *Table 7.7*. Excavated soil will be reused as fill material within the Project Site as far as is practicable. It is estimated that 60% (i.e. 8,280 m^3) of excavated soil can be reused for backfilling and the remaining 5,520 m^3 will require off-site disposal. The location of the temporary stockpiling area for the construction of the Proposed Beach Development is shown in *Figure 4.2* and *Figure 7.6* shows the locations of soil excavation and backfilling. Assuming a bulking factor of 1.1 for soil and a truck capacity of 6 m^3, about 9 truck

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(1) Trucks per day = 470 m3 of excavated soil to be disposed offsite x bulk factor 1.4 / 7 months / 24 days per month / 6 m3 per truck = 1

trips (1) will be required each day to dispose the surplus excavated soil off-site. The excavated soil could be used as fill for reclamation and land formation projects. However, if the soil could not be accepted by other projects, it will be delivered to the public fill reception facilities.

Table 7.7: Summary of Quantity of Excavated Materials

Construction Works	**Excavation Materials (m^3)**
Building & Landscaping	800
Roadworks (road & footpath)	600
Car Park	4,000
Vertical Seawall / Retaining Wall	2,000
Western Drainage Channel	4,500
Eastern Box Culvert	1,900
Total	*13,800*
Quantity to be reused on-site	8,280
Quantity for off-site disposal	**5,520**

Construction Waste

C&D materials (consisting of waste concrete, packing materials, plastics, metal, concrete, wood, etc) will be generated from the new building construction. The total gross floor area (GFA) to be constructed at the Project Site is approximately 2,245 m^2. Based on a generation rate of 0.1 m^3 per m^2 of GFA constructed (2), it is estimated that a total of about 225 m^3 of C&D materials will be generated. These materials will be sorted on-site for public fill (inert portion) (about 180 m^3) and construction waste (about 45 m^3) in order to reduce the amount of construction waste to be disposed of at landfills. The public fill will be reused on-site as much as practical and the surplus will be reused at other concurrent reclamation/land formation projects or disposed of at Government public filling reception facilities.

With the proper implementation of good construction site practice and the mitigation measures, the handling and disposal of a small amount of C&D materials to be generated from the new building construction works will not cause adverse dust, noise or water quality impacts.

Chemical Wastes

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. A complete list of such substances is provided under the Regulation; however, substances likely to be generated from the construction of the Proposed Beach Development will, for the most part, arise from

(1) Trucks per day = 5,520 m^3 of excavated soil to be disposed offsite x bulk factor 1.1 / 5 months / 24 days per month / 6 m^3 per truck = 9

(2) Reduction of Construction Waste Final Report (March 1993), Hong Kong Polytechnics.

the maintenance of construction plant and equipment. These may include, but not limited to the following:

- Scrap batteries or spent acid/alkali from their maintenance;
- Used paint, engine oils, hydraulic fluids and waste fuel;
- Spent mineral oils/cleaning fluids from mechanical machinery; and
- Spent solvents/solutions from equipment cleaning activities.

Chemical wastes may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the Waste Disposal (Chemical Waste) (General) Regulation and the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. These hazards may include:

- Toxic effects to workers;
- Adverse effects on air, water and land from spills; and
- Fire hazards.

The amount of chemical waste that will arise from the construction activities will be highly dependent on the Contractor's on-site maintenance activities and the quantity of plant and equipment utilized. All barges and marine vessel will comply with the standard operational procedure and design for prevention of oil pollution. With respect to the nature of construction works and the number of construction plant and equipment to be used on site, it is estimated that the quantity of chemical waste to be generated will be small (in the order of few hundreds litre for the whole construction phase).

With the incorporation of suitable arrangements for the storage, handling, transportation and disposal of chemical wastes under the requirements stated in the Code of Practice on the Packaging, Labelling and Storage of Chemical Waste, no adverse environmental and health impacts, and hazards will result from the handling, transportation and disposal of chemical waste arising from the Proposed Beach Development.

Sewage

Sewage will be generated from the construction workforce, site office's sanitary facilities and from portable toilets. If not properly managed, these wastes could cause adverse water quality impacts, odour and potential health risks to the workforce by attracting pests and other disease vectors.

It is estimated that a maximum of 100 workers will be working on site at any one time during the construction period and maximum 0.1 m^3 of sewage will be generated per day (1). An adequate number of portable toilets will be provided at the Project Site to

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(1) Information from Architectural Service Department.

ensure that sewage from site staff is properly collected. No adverse environmental impacts are envisaged provided that the portable toilets are properly maintained by a licensed contractor and the collected sewage is disposed at the designated Sewage Treatment Works (eg Tai Po Sewage Treatment Works).

General Refuse

The presence of a construction site with workers and associated site office will result in the generation of general refuse (mainly consist of food waste, aluminium cans and waste paper) which requires off-site disposal. The storage of general refuse has the potential to give rise to adverse environmental impacts. These include odour if the waste is not collected frequently (for example, daily), windblown litter, water quality impacts if waste enters water bodies, and visual impact.

Assuming up to 100 construction workers will be working on site at any one time, with a general refuse generation rate of 0.65 kg per worker per day (1), the amount of general refuse to be generated will be about 65 kg per day.

Recyclable materials such as paper and aluminium cans will be separated and delivered to the local recyclers. An adequate number of waste containers will be provided to avoid spillage of waste. The non-recyclable waste will be collected and disposed of at the North East New Territories Landfill (NENT) on a daily basis. With respect to the small quantity of general refuse to be transferred, it is not anticipated that it will cause adverse operational impact to these facilities.

Provided that the mitigation measures recommended in *Section* 7.6 are adopted, no adverse environmental impacts are expected to arise from the storage, handling, transport and disposal of general refuse.

7.5.2 *Operational Phase*

Dredged Materials & Chemical Waste

The Project has been designed with a view to reduce disposal arising. No maintenance dredging is required and no dredged materials will be produced during operational phase.

In case oil dispersants will be use, approval from EPD will be sought and will comply with all requirements to minimize potential water quality impacts.

Sewage

Sewage will mainly arise from the visitors to the Proposed Beach Development. It is estimated that the peak numbers of visit during summer time would be approximate 4,000 visitors per day. Taking into account the estimated time spent on the beach and the associated activities, the average daily sewage generation rate from beach visitor is estimated to be 10 m^3 per day with a peak flow rate of 30 litres per second (2). The

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(1) This is considered as a conservative estimate based on the number reported in a number of EIA reports approved under the EIAO.

(2) Information from Architectural Service Department. .

sewer system for the Proposed Beach Development will be designed with an adequate capacity and connected to public sewerage conveying to the Tai Po Sewage Treatment Works for treatment. Therefore, no adverse water quality impacts are envisaged.

General Refuse

General refuse will arise from the visitors to the Proposed Beach Development. General refuse may consist of food waste, plastic, aluminium can and waste paper. A general refuse generation rate of 0.38 kg per visitor per day was assumed (1) and it is estimated that the amount of general refuse to be generated will be about 1,520 kg per day.

A waste recycling and collection system using 3-coloured waste separation bins will be provided at the Proposed Beach Development. Recyclable materials (i.e. paper, plastic bottle and aluminium can) will be separated and delivered to recyclers in order to reduce the amount of general refuse to be disposed of at landfill. The non-recyclable general refuse will be disposed of by refuse collecting vehicles transporting the wastes directly to landfill on a daily basis. With respect to the small quantity of general refuse to be disposed of, no adverse environmental impact associated with the handling and disposal of the refuse is anticipated.

7.6 Mitigation Measures and Residual Impacts

This section recommends the mitigation measures and good site practices to avoid or reduce potential adverse environmental impacts associated with handling, collection and disposal of waste arising from the construction and operation of the Proposed Beach Development.

The Contractor should incorporate these recommendations into a Waste Management Plan for the construction works. The Contractor should submit the plan to Project Proponent’s Engineer Representative for endorsement prior to the commencement of the construction works. The plan should incorporate site-specific factors, such as the designation of areas for the segregation and temporary storage of reusable and recyclable materials.

It will be the Contractor’s responsibility to ensure that only reputable licensed waste collectors are used and that appropriate measures to reduce adverse impacts, including windblown litter and dust from the transportation of these wastes, are employed. In addition, the Contractor must ensure that all the necessary permits or licences required under the Waste Disposal Ordinance are obtained for the construction phase.

Waste Management Hierarchy

The various waste management options are categorised in terms of preference from an environmental viewpoint. The options considered to be most preferable have the least environmental impacts and are more sustainable in the long term. The hierarchy is as follows:

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(1) This is considered as a conservative estimate based on the number reported on two theme park EIA study approved under the EIAO.

- Avoidance and reduction;
- Reuse of materials;
- Recovery and recycling; and
- Treatment and disposal.

The above hierarchy has been used to evaluate and select waste management options. The aim has been to reduce waste generation and reduce waste handling and disposal costs.

The Contractor should consult the EPD for the final disposal of wastes and implement the following good site practices and mitigation measures:

- Nomination of approved personnel to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility of all wastes generated at the site;

- Training of site personnel in proper waste management and chemical handling procedures;

- Provision of sufficient waste disposal points and regular collection for disposal;

- Appropriate measures to reduce windblown litter and dust transportation of waste by either covering trucks or by transporting wastes in enclosed containers;

- Separation of chemical wastes for special handling and appropriate treatment at the Chemical Waste Treatment Centre;

- Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors; and

- A recording system for the amount of wastes generated/recycled and disposal sites.

Waste Reduction Measures

Good management and control can prevent generation of significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:

- Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of material and their proper disposal;

- Encourage collection of aluminium cans and waste paper by individual collectors during construction with separate labelled bins being provided to allow the segregation of these wastes from other general refuse generated by the workforce;

- Any unused chemicals and those with remaining functional capacity be recycled as far as possible;

- Use of reusable non-timber formwork to reduce the amount of C&D materials;
- Prior to disposal of construction waste, wood, steel and other metals should be separated, to the extent practical for re-use and/or recycling to reduce the quantity of waste to be disposed at landfills;
- Proper storage and site practices to reduce the potential for damage or contamination of construction materials; and
- Plan and stock construction materials carefully to reduce amount of waste generated and avoid unnecessary generation of waste.

7.6.1 Dredging Materials

The final disposal site for the dredged sediments should be determined by the MFC and a dumping licence should be obtained from EPD prior to the commencement of the dredging works. Uncontaminated sediments should be disposed of at open sea disposal sites designated by the MFC. For contaminated sediments requiring Type 2 confined marine disposal, relevant contract documents should specify the allocation conditions of the MFC and EPD.

7.6.2 Excavated Materials and C&D Waste

Management of Waste Disposal

The contractor should open a billing account with EPD in accordance with the Waste Disposal (Charges for Disposal of Construction Waste) Regulation for the payment of disposal charges. Every waste load transferred to Government waste disposal facilities such as public fill, sorting facilities, or landfills should require a valid "chit" which contains the information of the account holder to facilitate waste transaction recording and billing to the waste producer. A trip-ticket system should be established in accordance with ETWBTC No. 31/2004 to monitor the reuse of surplus excavated materials off-site and disposal of construction waste and general refuse at transfer stations/landfills, and to control fly-tipping. The billing "chit" and trip-ticket system should be included as one of the contractual requirements and implemented by the contractor. Regular audits of the waste management measures implemented on-site as described in the Waste Management Plan should be conducted.

A recording system (similar to summary table as shown in Annex 5 and Annex 6 of *Appendix G* of ETWBTC No. 19/2005) for the amount of waste generated, recycled and disposed of (including the disposal sites) will be established during the construction phase.

Measures for the Reduction of C&D Materials Generation

Public fill and construction waste should be segregated and stored in different containers or skips to facilitate reuse or recycling of the public fill and proper disposal of the construction waste. Specific areas of the work site should be designated for such segregation and storage if immediate use is not practicable.

To reduce the potential dust and water quality impacts of site formation works, C&D materials should be wetted as quickly as possible to the extent practicable after excavation/filling.

7.6.3 Chemical Waste

The Contractor should register as a chemical waste producer with the EPD. Chemical waste, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes. 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 L unless the specifications 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 will:

- 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 of as chemical waste, if necessary); and
- Be arranged so that incompatible materials are appropriately separated.

Chemical waste should be collected by a licensed chemical waste collector to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility.

7.6.4 Sewage

An adequate number of portable toilets should be provided for the on-site construction workforce during construction phase. All portable toilets should be maintained in a state that will not deter the users from using them. Night soil should be regularly collected by a licensed collector for disposal. The sewage generated from the visitors during operation of the Proposed Beach Development should be discharged to the adjacent foul sewer conveying to Tai Po Sewage Treatment Works for treatment.

7.6.5 General Refuse

General refuse should be stored in enclosed bins or compaction units separately from construction and chemical wastes. A reputable waste collector should be employed to remove general refuse from the site, separately from construction and chemical wastes, on a daily basis to reduce odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

Recycling bins should be provided at strategic locations to facilitate recovery of aluminium cans and waste paper from the Project Site. Materials recovered should be sold for recycling.

7.6.6 Staff Training

Training should be provided to workers on the concept of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling at the beginning of the construction works.

7.6.7 Residual Impacts

There will be no residual impact due to the Proposed Beach Development if the recommended mitigation measures are properly implemented.

7.7 Environmental Monitoring and Audit Requirements

7.7.1 Construction Phase

To facilitate monitoring and control over the contractors' performance on waste management, a waste monitoring and audit programme should be implemented throughout the construction phase. The aims of the monitoring and audit programme are:

- To review the Contractor's WMP including the quantities and types of C&D materials generated, reused and disposed of off-site; the amount of fill materials exported from/imported to the site and the quantity of timber used in temporary works construction for each process/activity;
- To monitor the implementation and achievement of the WMP on site to assess its effectiveness; and
- To monitor the follow-up action on deficiencies identified.

Joint site audits by the Environmental Team and the Contractor should be undertaken on a weekly basis. Particular attention should be given to the Contractor's provision of sufficient spaces, adequacy of resources and facilities for on-site sorting and temporary storage of C&D materials. The C&D materials to be disposed of from the Project Site should be visually inspected. The public fill for delivery to the off-site stockpiling area should contain no observable non-inert materials (e.g., general refuse, timber, etc). Furthermore, the waste to be disposed of at refuse transfer stations or landfills should as far as possible contains no observable inert or reusable/recyclable C&D materials (e.g., soil, broken rock, metal, and paper/cardboard packaging, etc). Any irregularities observed during the weekly site audits should be raised promptly to the Contractor for rectification.

To facilitate assessment of the effectiveness of the waste management measures, the WMP should state the performance targets to be achieved in reducing generation of C&D materials taking account the site constraints. The performance targets should cover the following items and should be agreed with the Project Proponent at the beginning of the contract.

- The percentage of excavated materials to be sorted to recover the soil and broken rock for reuse on site or deliver to the off-site stockpiling area;
- The percentage of metal to be recovered for collection by recycling contractors; and
- The percentage of cardboard and paper packaging (for plant, equipment and materials) to be recovered. The recovered materials will be properly stockpiled in dry and covered condition to prevent cross contamination by other wastes.

The findings of the waste audits should be reported in the Environmental Monitoring and Audit Reports.

7.7.2 Operation Phase

As it is not expected that large quantities of waste will be generated from the operation of the bathing beach and no adverse environmental impacts will arise with the implementation of good waste management practices. Waste monitoring and audit programme for the operational phase of the Proposed Beach Development will not be required.

7.8 Conclusions

The key potential impacts during the construction phase are related to wastes generated from dredging, demolition works, seawall and groyne construction, culvert diversion and construction and new building construction.

It is estimated that a total of approximate10,500 m^3 of marine sediment will be dredged. About 6,380 m^3 of the sediments are uncontaminated and can be disposed of at the open sea disposal sites and about 2,620 m^3 of the Category M sediment (which passed the biological screening) will be disposed of at dedicated open sea disposal sites. The remaining 1,500 m^3 of the Category M (which failed the biological screening) will have to be disposed of at the confined marine disposal site at East Sha Chau. The final disposal site for the dredging sediments will be determined by the MFC and a dumping licence will be obtained from EPD prior to the commencement of the dredging works.

About 13,800 m^3 of excavated materials will be generated during construction phase and 8,280 m^3 (about 60%) of which will be reuse on-site. The surplus excavated soil will be reused in other concurrent construction projects in Hong Kong or disposed of at public fill reception facilities.

About 470 m^3 of demolition waste consist of inert and non-inert port (e.g. vegetable matters) will be generated during construction phase. Approximately 225 m^3 of C&D materials will be generated from new building construction. A maximum of 0.1m^3 of sewage and 65kg of general refuse will be generated by workers each day. A small quantity of chemical waste (mainly used lube oil from maintenance of heavy machinery) will be generated. In view of the small quantity of various wastes to be generated, the handling and disposal of these wastes at the licensed waste disposal facilities will not cause adverse environmental impacts.

During the operational phase, it is estimated that of 10 m^3 of sewage and 1,520 kg of general refuse will be produced each day by visitors during peak season. In view of the small quantity of sewage and general refuse to be generated and their proper disposal to foul sewer or transfer station/landfill, no adverse environmental impact associated with the management of these wastes is anticipated during the operation of the Proposed Beach Development.

With the implementation of the recommendations in *Section 7.6*, the potential environmental impacts arising from storage, handling, collection, transport and disposal of wastes will meet the criteria specified in the *EIAO-TM*. No adverse waste management impact is anticipated. No residual and cumulative environmental impacts and hazards associated with handling and disposal of wastes arising from the construction of Proposed Beach Development are anticipated.

A Waste Management Plan should be prepared by the Contractor and should be audited through the environmental monitoring and auditing (EM&A) programme recommended in *Section 7.7* to minimize the potential environmental impacts arising from waste management.

8 ECOLOGICAL IMPACT ASSESSMENT

8.1 Introduction

This *Section* presents the baseline conditions of ecological resources within the Study Area, and the results of an assessment of the potential ecological impacts arising from the construction and operation of the Proposed Beach Development.

Baseline conditions for ecological components of the terrestrial and marine environment were evaluated based on information from available literature and focussed field surveys conducted for the purposes of this EIA. Measures required to mitigate any identified adverse impacts are recommended, where appropriate.

8.2 Relevant Legislation and Guidelines

The following international conventions and local legislation and guidelines provide the framework for the protection of species and habitats of ecological importance:

- *Forests and Countryside Ordinance* (Cap 96);
- *Wild Animals Protection Ordinance* (Cap 170);
- *Protection of Endangered Species of Animals and Plants Ordinance* (Cap 586);
- *Town Planning Ordinance* (Cap 131);
- *Hong Kong Planning Standards and Guidelines Chapter 10* (HKPSG);
- *The Technical Memorandum on Environmental Impact Assessment Process under the Environmental Impact Assessment Ordinance (EIAO-TM)*;
- *United Nations Convention on Biodiversity* (1992); and
- *PRC Regulations and Guidelines*.

The *Forests and Countryside Ordinance* prohibits felling, cutting, burning or destroying of trees and growing plants in forests and plantations on Government land. The subsidiary *Forestry Regulations* prohibit the picking, felling or possession of listed rare and protected plant species. The list of protected species in Hong Kong which comes under the *Forestry Regulations* was last amended on 11 June 1993 under the *Forestry (Amendment) Regulation 1993* made under Section 3 of the *Forests and Countryside Ordinance*.

Under the *Wild Animals Protection Ordinance*, designated wild animals are protected from being hunted, whilst their nests and eggs are protected from destruction and removal. All birds and most mammals including all cetaceans are protected under this Ordinance, as well as certain reptiles, amphibians and invertebrates. The Second Schedule of the Ordinance that lists all the animals protected was last revised in June 1997.

The *Protection of Endangered Species of Animals and Plants Ordinance* (Cap 586) was enacted to align Hong Kong to control regime with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). With effect from 1 July 2006, it replaces the *Animals and Plants (Protection of Endangered Species) Ordinance* (Cap 187). The purpose of the *Protection of Endangered Species of Animals and Plants Ordinance* is to restrict the import and export of species listed in CITES Appendices so as to protect wildlife from overexploitation or extinction. The Ordinance is primarily related to controlling trade in threatened and endangered species and restricting the local possession of them. Certain types of corals are CITES listed, including Blue coral (*Heliopora coerulea*), Organ pipe corals (family Tubiporidae), Black corals (order Antipatharia), Stony coral (order Scleractinia), Fire corals (family Milleporidae) and Lace corals (family Stylasteridae). The import, export and possession of listed species, no matter dead or living, is restricted.

The recently amended *Town Planning Ordinance* provides for the designation of areas such as “Coastal Protection Areas”, “Sites of Special Scientific Interest (SSSIs)”, “Green Belt” and "Conservation Area” to promote conservation or protection or protect significant habitat. Chapter 10 of the *HKPSG* covers planning considerations relevant to conservation. This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong, and Government departments involved in conservation.

Annex 16 of the *EIAO-TM* sets out the general approach and methodology for assessment of ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts. *Annex 8* recommends the criteria that can be used for evaluating ecological impacts.

The Peoples’ Republic of China (PRC) is a Contracting Party to the *United Nations Convention on Biological Diversity* of 1992. The Convention requires signatories to make active efforts to protect and manage their biodiversity resources. The Government of the Hong Kong SAR has stated that it will be “committed to meeting the environmental objectives” of the Convention (PELB 1996).

In 1988 the PRC ratified the *Wild Animal Protection Law*, which lays down basic principles for protecting wild animals. The Law prohibits killing of protected animals, controls hunting, and protects the habitats of wild animals, both protected and non-protected. The Law also provides for the creation of lists of animals protected at the state level, under Class I and Class II. There are 96 animal species in Class I and 156 in Class II. Class I provides a higher level of protection for animals considered to be more threatened.

Literature Review of Ecological Characteristics of Lung Mei and Identification of Information Gap.

8.3 Study Area of the Assignment

The Study Area for the purpose of ecological assessment included all areas within 500m from the proposed land requirement boundary for the Proposed Beach Development including the Plover Cove Country Park, the Pat Sin Leng Country Park Lung Mei area, Conservation Area at Ting Kok, east of Ting Kok SSSI, Coastal Protection Area and part of the Tai Mei Tuk Water Sport Centre. For marine ecology, the survey sites covered the Study Area (intertidal and mangrove), Ting Kok SSSI (intertidal and mangrove), east Yeung Chau (coral) and north Ma Shi Chau (coral).

8.4 Literature Review of Ecological Characteristics of the Study Area

Methodology

A literature review was conducted to determine the existing ecological conditions within the Study Area to identify habitat resources and species of potential importance. The local literature reviewed included:

- *Porcupine!* (Newsletter of Department of Ecology & Biodiversity, University of Hong Kong) (1);
- AFCD Biodiversity Newsletters (2);
- A Field Guide to the Terrestrial Mammals of Hong Kong (3).
- Annual Reports of Hong Kong Bird Watching Society (4);
- Hong Kong Amphibians and Reptiles (5) ;
- A Field Guide to the Amphibians of Hong Kong (6);
- A Field Guide to the Dragonflies of Hong Kong (7);
- A Field Guide to Butterfly Watching in Hong Kong (8) ;

(1) *Newsletter of Department of Ecology & Biodiversity*, University of Hong Kong Issues 1 to 33.

(2) *AFCD Biodiversity Newsletters*. Issues 1-13.

(3) Chen S K., Cheung K.S., Ho C. Y, Lam F. N., Tang W, S (2006). *A Field Guide to the Terrestrial Mammals of Hong Kong*. AFCD.

(4) Hong Kong Bird Watching Society (1990-2000). Annual Reports.

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

(6) AFCD (2005). A Field Guide to the Amphibians of Hong Kong. Friends of Country Park.

(7) Wilson, K.D.P. (2004). *Field Guide to the Dragonflies of Hong Kong*. Friends of Country Park.

(8) Yiu V (2004). *Field Guide to the butterflies of Hong Kong.* Friends of Country Park.

- The Avifauna of Hong Kong (1);
- Gymnosperms and Angiosperms of Hong Kong (2);
- Orchidaceae of Hong Kong (3);
- A Field Guide to the Venomous Land Snakes of Hong Kong (4);
- Field Guide to Hard Corals of Hong Kong (5),
- Hong Kong Mangroves (6),
- EIA Study for the Proposed Submarine Gas Pipelines from Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal, Shenzhen to Tai Po Gas Production Plant, Hong Kong (7) ;
- Final Report for Consultancy Study on Marine Benthic Communities in Hong Kong (8);.and
- Feasibility Study on the Proposed Beach Improvement Work at Lung Mei Beach (9).

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

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

(3) Siu L P (2000). Orchidaceae of Hong Kong. *Memoirs of the Hong Kong Natural History Society*. 23: 137-147.

(4) Simon Chan Kin-fung, Cheung Ka-shing, Ho Ching-yee, Lam Fung-ngai, Tang Wing-sze. Herpetofauna Working Group (AFCD). *A Field Guide to the Venomous Land Snakes of Hong Kong*.

(5) Alan Chan, Choyce Choi, Denise McCorry, Khaki Chan, M W Lee and Ang Put Jr. (2005). *Field Guide to Hard Coral of Hong Kong*. Friends of the Country Parks.

(6) Tam, N. F. Y. and Wong, Y. S. (2000). Hong Kong Mangroves. The City University of Hong Kong and Agriculture, Fisheries and Conservation Department

(7) ERM (2003), EIA Study for the Proposed Submarine Gas Pipelines from Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal, Shenzhen to Tai Po Gas Production Plant, Hong Kong. EIA Report submitted for The Hong Kong and China Gas Company Limited.

(8) City U Professional Services Limited (2002). Final Report for Consultancy Study on Marine Benthic Communities in Hong Kong. Report for AFCD.

(9) Maunsell Consultants Asia Ltd (2001). Feasibility Study for Proposed Beach Improvement Work at Lung Mei Beach , Final Report. Volume I.

Results

Habitat and Vegetation

The Project Site and areas in the vicinity consisted of a mixed variety of woodlands, grassland, shrublands, abandoned fields, farmlands, roadside plantation, coastal vegetation, intertidal soft shore (muddy sand coast), mangroves, coastal waters, streams and human habitation (1). Human habitation included villages, recreation areas, graveyard, construction areas, roads and car parks and open storage. The habitats close to the Proposed Beach Development area were mainly abandoned fields with certain degree of human disturbance, ie soil dumping (2).

Terrestrial Mammals

There is limited information available from the literature**.**

Birds

There is no formal record of avifauna surveys within the present Study Area and the published bird records, in addition to the Chinese Pond Heron, Little Grebes and other readies reported in the Feasibility Study (3), as well as White eyes, Little Egrets and Greater Councils recorded in the Ting Kok mangrove (4) (5), were only reported in the location of Tai Mei Tuk and Sheen Wan. The bird data are summarized in *Table 1* of *Appendix G*.

There were 125 species of birds, in which sixteen species were species of conservation interest, recorded in Tai Mei Tuk and Shuen Wan. Some of the bird species were expected to be recorded in the Study Area.

The bird species of conservation interest recorded from the literature in Tai Mei Tuk and Shuen Wan are summarized in *Table 8.1*.

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(1) Maunsell Consultants Asia Ltd (2001). Feasibility Study for Proposed Beach Improvement Work at Lung Mei Beach , Final Report. Volume I.

(2) Maunsell Consultants Asia Ltd (2001). Feasibility Study for Proposed Beach Improvement Work at Lung Mei Beach , Final Report. Volume I.

(3) Maunsell Consultants Asia Ltd (2001). Feasibility Study for Proposed Beach Improvement Work at Lung Mei Beach , Final Report. Volume I.

(4) Tam, N. F. Y. and Y. S. Wong. 1997. *Ecological study on mangrove stands in Hong Kong*. The City University of Hong Kong. Unpublished report to the Agricultural and Fisheries Department.

(5) Tam, N. F. Y. and Wong, Y. S. (2000). Hong Kong Mangroves. The City University of Hong Kong and Agriculture, Fisheries and Conservation Department

Table 8.1: Evaluation of Bird Species of Conservation Concern Reported in the Vicinity of the Present Study Area

Species	**Protection status**	**Distribution**	**Rarity**
Falcated Teal *Anas falcata*	Listed as Near Threaten by IUCN. Not protected	Mostly found in ponds; Siberia, Mongolia and Japan	A rare wintering bird in Hong Kong
Black Baza *Aviceda leuphotes*	Class 2 Protected Animal of PRC	Breed in south China; Oriental	Very rare summer visitor and passage migrant in Hong Kong
White-bellied Sea Eagle *Haliaeetus leucogaster*	Class 2 Protected Animal of PRC	Found along coastal area and off shore islands in Hong Kong; Oriental and Australian	Uncommon resident bird in Hong Kong, rare in mainland China
Crested Serpent Eagle *Spilornis cheela*	Class 2 Protected Animal of PRC	Found in forest area; Oriental	Rare resident bird utilizing woodland as breeding site
Bonell's Eagle *Hieraaetus fasciatus*	Class 2 Protected Animal of PRC	Found in forest area; North African, Eurasia and Oriental	Rare resident
Osprey *Pandion haliaetus*	Class 2 Protected Animal of PRC	Found in coastal area; Cosmopolitan	Locally common winter visitor
Crested Goshawk *Accipiter trivirgatus*	Class 2 Protected Animal of PRC	Mainly utilize woodland, widespread in China	Uncommon in Hong Kong
Chinese Goshawk *Accipiter soloensis*	Class 2 Protected Animal of PRC	Utilize woodland; Oriental	Rare passage migrant to Hong Kong.
Bersa *Accipiter virgatus*	Class 2 Protected Animal of PRC	Utilize woodland as foraging and breeding sites; Oriental	Rare resident to Hong Kong
Grey-faced Buzzard *Butastur indicus*	Class 2 Protected Animal of PRC	Found in open areas; Oriental	Uncommon passage migrants in Hong Kong
Eurasian Hobby *Falco subbuteo*	Class 2 Protected Animal of PRC	Found in open areas, hunting aerial prey; Eurasia	Rare summer visitor and passage migrants
Peregrine Falcon *Falco peregrinus*	Class 2 Protected Animal of PRC; *Appendix 1* of CITES	Found in wide range of habitats; Eurasia and Oriental	Rare winter visitor to Hong Kong, population threatened by bird trade
Black Kite *Milvus migrans*	Class 2 Protected Animal of PRC	Found in wide range of habitats, Palaearctic, Ethiopian, Oriental and Australasian	Common resident and winter visitor in Hong Kong
Common Buzzard *Buteo buteo*	Class 2 Protected Animal of PRC	Found in wide range of habitats; Palaearctic and Himalayas	Common winter visitor in Hong Kong
Lesser Coucal *Centropus bangalensis*	Class 2 Protected Animal of PRC	Mainly found in shrubby habitats in Hong Kong; Oriental	Uncommon resident in Hong Kong
Collared Scops Owl *Otus bakkamoena*	Class 2 Protected Animal of PRC	Found in woodland habitat in Hong Kong	Uncommon resident in Hong Kong, the most widespread owl species locally
Asian Barred Owlet *Glaucidium cuculoides*	Class 2 Protected Animal of PRC	Found in many habitats in Hong Kong; Oriental	Rare resident in Hong Kong
Yellow-breasted Bunting *Emberiza aureola*	Listed as Near Threaten by IUCN. Not protected	Found in open areas, particularly rice fields and reedbed; Eurasia, Oriental	Uncommon passage migrant in Hong Kong. Number threatened by hunting

Herpetofauna

Garnot's Gecko has been recorded in the vicinity of the present Study Area (1). Garnot's Gecko is uncommon in Hong Kong but widely distributed on Hong Kong Island and Lantau Island (2).

Butterflies and Dragonflies

There is limited information on dragonfly and butterfly within the Study Area.

Stream Fauna

There is limited information on aquatic fauna within the Study Area.

Mangrove and Intertidal Fauna

Literature review shows that information on intertidal and benthic assemblages within the Study Area of Lung Mei was limited. The only source of available information identified during the literature review is on the intertidal assemblage of the adjacent Ting Kok SSSI (discuss in the following section) which is partly located within the Study Area.

Plover Cove Country Park and Pat Sing Leng Country Park

Plover Cove Country Park (PCCP) was designated in 1978, with an overall area of 4,594 hectares. Wild animals including Chinese Porcupine (*Hystrix brachyura*), Chinese Ferret Badger (*Melogale moschata*), Chinese Pangolin (*Manis pentadactyla*), Chinese Leopard Cat (*Felis bengalensis*) and Pallas's Tree Squirrel (*Callioscuirus erythraeus*) and forest birds Indian Cuckoo (*Cuculus micropterus*) and Red-winged Crested Cuckoo (*Clamator coromandus*) could be recorded in the PCCP. Butterflies are the most valuable ecological treasures of Plover Cove. One of the new butterfly records, Yellow Coster (*Acraea issoria*), was discovered and the rare Bi-spot Royal (*Ancema ctesia*) was also sighted in the PCCP (3). A small part of the PCCP is located within the east of the Study Area.

Pat Sin Leng Country Park (PSLCP) was designated in 1978 and covers 3,125 hectares of natural terrain in the Northeastern New Territories. Near Lau Shui Heung Reservoir and Hok Tau Reservoir, there are plantations and wooded valleys that flaunt both native and exotic flora species (4). Only a small part of the PSLCP is located within the north of the Study Area.

Ting Kok SSSI

Ting Kok SSSI was designated in 1985 (5). The area of the Ting Kok SSSI is about 37.5 ha while the mangrove community occupies approximately 8.8 ha, with seven true mangrove species (*Kandelia candel* (*obovata*), *Aegiceras corniculatum*, *Excoecaria agallocha*, *Acanthus ilicifolius*, *Avicennia marina*, *Bruguiera gymnorrhiza* and *Lumnitzera racemosa*) and two mangrove associated species (*Hibiscus tiliaceus*

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(1) AFCD (2006). *Hong Kong Biodiversity Issue No. 13*. AFCD Newsletter.

(2) AFCD (2006). *Hong Kong Biodiversity Issue No. 13*. AFCD Newsletter.

(3) *Hong Kong Biodiversity Issue No. 13*. AFCD Newsletter.

(4) AFCD (2003). *New Viewpoints-Country Parks in Focus*. Friends of Country Parks

(5) http://www.hk-green.com/news/new74.htm

and *Clerodendrum inerme*) (1) (5). Average mangrove tree height was 1.1 m, average density was 2.8 m^{-2} and average canopy area 0.5 m^2 $tree^{-1}$. According to the mangrove survey conducted by Tam and Wong (1997) (2), the SSSI supported diverse benthic macrofauna community. Over 39 species were recorded in the benthic macrofauna of the mangrove stand and the community was dominated by *Cerithidea species*, *Batillaria species* and *Terebralia sulcatta.* Small part of the Ting Kok SSSI was located at the western edge of the Study Area.

Conservation Area
The Conservation Area located at Ting Kok is approximately 400 m from the Proposed Project Site. The Conservation Area is a pond and of approximately 2.1 ha found within the Study Area bounded by village area, barbeque site and the Plover Cove Country Park. The pond was fenced off and was currently under management for recreational use.

Benthic Community
Benthic studies have been undertaken at locations within Tolo Harbour and Channel (but away from the Proposed Beach Development) (3). Findings from the majority of these studies were that the benthos of the seabed in the areas was dominated by polychaetes and characterized by low species diversity and low species biomass. All the species recorded occur frequently in Hong Kong and no rare species were observed. It should be noted that areas of Tolo Harbour and Channel are subjected to periodic occurrence of hypoxia and thus relatively environmentally disturbed, leading to lower species diversity and evenness in the benthic communities (4).

8.5 Identification of Information Gaps

8.5.1 Introduction

Further to the literature review above, there is limited ecological baseline information available in the Study Area, detailed ecological surveys were therefore required to fill in the data gaps.

8.5.2 Scope of Field Surveys

To supplement the limited available information within the Study Area, more than 6 months of terrestrial and aquatic ecological baseline surveys were conducted to collect ecological baseline information of the Study Area. The surveys were conducted

(1) Zhang et al (2000). The Biogeomorphology of the Ting Kok Mangrove, Tolo Harbour, Hong Kong. Proceedings of the Tenth International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 6-26 April 1998, published by Hong Kong University Press

(5) Tam, N. F. Y. and Wong, Y. S. (2000). Hong Kong Mangroves. The City University of Hong Kong and Agriculture, Fisheries and Conservation Department.

(2) Tam, N. F. Y. and Y. S. Wong. 1997. Ecological study on mangrove stands in Hong Kong. The City University of Hong Kong. Unpublished report to the Agricultural and Fisheries Department.

(3) ERM (2003), EIA Study for the Proposed Submarine Gas Pipelines from Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal, Shenzhen to Tai Po Gas Production Plant, Hong Kong. EIA Report submitted for The Hong Kong and China Gas Company Limited.

(4) City U Professional Services Limited (2002). Final Report for Consultancy Study on Marine Benthic Communities in Hong Kong. Report for AFCD.

during July to October (wet season) and November 2006 to January 2007 (dry season), which included habitat/vegetation, terrestrial mammal, bird, herpetofauna, invertebrates (butterfly and dragonfly) and freshwater fish surveys for terrestrial ecology, and subtidal (dive) surveys, benthic survey and intertidal (include mangrove) survey along the coastal habitats in close proximity of the Study Area.

8.6 Assessment Methodology

8.6.1 Ecological Baseline Surveys

Following a literature review of available ecological data characterising the Study Area, a reconnaissance survey was undertaken in July 2006 to update and field check the validity of the information gathered in the literature review. A number of more focussed baseline field surveys were then identified and carried out to characterise the existing ecological conditions of the Study Area. The surveys were designed to fill the data gaps identified in literature review at *Section 8.4*. Special attention was paid to the remaining natural habitats and those areas which will be directly impacted by the Proposed Beach Development, especially the habitat and wildlife within the Proposed Land Requirement Boundary.

The following baseline ecological surveys were undertaken:

- Terrestrial habitat and vegetation surveys;
- Mammal surveys (including night survey);
- Bird surveys (including night survey);
- Herpetofauna surveys (including night surveys);
- Invertebrates (butterflies and dragonflies) surveys;
- Freshwater fish survey;
- Intertidal (including mangrove) survey;
- Benthic survey ; and
- Subtidal (dive) surveys.

8.6.2 Terrestrial Ecological Resources

Habitats and Vegetation

Habitat and vegetation surveys were performed on 24 July, 17 August, 18 and 19 September 2006, 26 January and 8 March 2007. The aim of the surveys was to establish the ecological profile of habitat and vegetation within the Study Area. A habitat map of the Study Area is shown in *Figure 8.1*.

Habitats were mapped based on aerial photographs of year 2006 (1) and field ground truthing. Representative areas of each habitat type were surveyed on foot. Plant species within each habitat type and their relative abundance were recorded with special attention to rare or protected species. Nomenclature and conservation status of plant species follow Xing *et al* (2), Siu 2000 (3) and AFCD 2001 (4).

Terrestrial Mammal

Surveys of terrestrial mammals within the Study Area were conducted on 17 August, 28 September, 14 November and 10 December 2006 to cover both dry and wet seasons. Night survey for mammals was carried out on 28 September 2006.

As most mammals occur at low densities, all sightings, tracks, and signs of mammals were actively searched along the survey transects (see *Figure 8.2*). Nomenclature for mammals followed AFCD (2006) (5). No quantification of abundance of mammals in the Study Area was made, due to the difficulties in translating sights and tracks (eg burrows) to actual abundance.

Birds

Habitats and areas of potential ecological importance for birds within the Study Area were identified in the reconnaissance survey. Baseline surveys of bird populations were undertaken within those selected habitats using quantitative (point count) and qualitative (transect survey) methods. Bird surveys were conducted on 17 August, 28 September, 14 November and 10 December 2006 to cover both dry and wet seasons. Night surveys were conducted on 28 September 2006.

Bird communities in each major habitat type recorded within the Study Area, including secondary woodland, shrubland, village/modified area, pond, sandy shore with backshore vegetation and the Project Site, surveyed using the point count method. A total of 10 sampling points at the Study Area were selected and their locations are shown in *Figure 8.2*. Ten minutes were spent counting birds at each sampling point. All birds seen or heard within 30m of the sampling points were counted.

Signs of breeding (eg nests, recently fledged juveniles) within the Study Area were also recorded. Observations were made using 8x binoculars and photographic records were taken, if possible. Bird abundance in each major habitat type was expressed in number of birds per hectare (total birds counted divided by total surveyed area).

Bird species encountered outside counting points but within the Study Area were also recorded to produce a complete species list. Signs of breeding (eg nests, recently fledged juveniles) were also recorded. Ornithological nomenclature followed Viney *et al* (6).

(1) Lands Department (2006). Aerial Photograph *CW73371 dated 28 September 2006 at 4000'.*

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

(3) Siu L P (2000). Orchidaceae of Hong Kong. *Memoirs of the Hong Kong Natural History Society*. 23: 137-147.

(4) AFCD (2001). Check List of Hong Kong Plants. Dong Sheng Printing Company.

(5) Chen S K., Cheung K.S., Ho C. Y, Lam F. N., Tang W, S (2006). *A Field Guide to the Terrestrial Mammals of Hong Kong*. AFCD.

(6) Viney, C., Philipps, K. and Lam, C. Y. (2005), *Birds of Hong Kong and South China*. Information Service Department, HK SAR.

Herpetofauna (Amphibians and Reptiles)

Surveys of herpetofauna within the Study Area were conducted on 17 August, 28 September, 14 November and 10 December 2006 to cover both dry and wet seasons. Night surveys of the amphibians were carried out on 28 September 2006. Herpetofauna surveys were conducted through direct observation and active searching in all major habitat types along the survey transects (see *Figure 8.2*) and in potential hiding places such as among leaf litter, inside holes and under stones and logs within the Study Area. Auditory detection of species-specific calls was also used to survey frogs and toads. During the surveys, all reptiles and amphibians sighted and heard were recorded. Nomenclature and status used for reptiles follows Karsen *et al* 1998 (1) while that of amphibians follows AFCD 2005 (2).

Invertebrate (Butterflies and Dragonflies)

Surveys of butterfly and dragonfly species within the Study Area were conducted on 17 August, 28 September, 14 November and 10 December 2006 covering both dry and wet seasons, using quantitative (point count) and qualitative (transect survey) methods (see *Figure 8.2*). A total of 10 sampling points at the Study Area were selected and their locations are shown in *Figure 8.2*. Ten minutes were spent counting butterflies and dragonflies at each sampling point. All butterflies and dragonflies seen within 30m of the sampling points were counted. Nomenclature for butterflies follows Yiu 2004 (3) and dragonfly nomenclature followed AFCD 2004 (4).

Freshwater Fish

Freshwater fish surveys were undertaken on 30 September and 25 October 2006 to identify the water bodies and aquatic resources in the Study Area. Streams identified within the Study Area were visited and stream fauna were studied by direct observation and active searching for sensitive species or individuals using hand nets.

8.6.3 *Marine Ecological Resources*

Intertidal Survey

Surveys of intertidal habitats including sandy shore, mangrove and artificial/ disturbed shoreline, were undertaken within the Study Area on 27 October, 14 November and 27 December 2006. The survey locations were presented in *Figures 8.3*. Quantitative and qualitative surveys were performed depending on the habitat type and site condition. Survey methodologies are described below.

Sandy Shore and Mangrove

Qualitative sandy shore and mangrove surveys were undertaken along the intertidal shore within the Study Area so as to record encountered macrofauna and to identify the true mangrove species, ie *Acrostichum aureum, Aegiceras corniculatum, Avicennia marina, Bruguiera gymnorrhiza, Excoecaria agallocha, Lumnitzera racemosa, Kandelia obovata,* and *Heritiera littoralis,* and their relative abundances.

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

(2) AFCD (2005). *A Field Guide to the Amphibians of Hong Kong*. Friends of Country Park.

(3) Yiu V (2004). *Field Guide to the Butterflies of Hong Kong*. Hong Kong Discovery Ltd.

(4) AFCD (2004). *Field Guide to the Dragonflies of Hong Kong (2nd edition)*. Friends of the Country Parks

Artificial/ Disturbed Shoreline

The artificial/disturbed shoreline identified within the Study Area was surveyed using a quantitative belt transect method. Horizontal (belt) transects were set up along the shore line and surveyed at two heights up the shore at 50cm intervals perpendicular to the waterline starting at 1 m above Chart Datum. On each transect, 5 random quadrats (50 x 50cm) were placed randomly to assess the abundance and distribution of flora and fauna. All animals found in each quadrat were identified and recorded to species level so that density m^{-2} could be determined. Sessile animals such as barnacles and oysters in each quadrat were not counted but estimated as a percentage of coverage on the rock surface. All species of algae (encrusting, foliose and filamentous) were also identified and recorded by estimating the percentage of cover of the rock surface. For the areas that cannot deploy transects (ie vertical seawall), qualitative surveys were undertaken to produce a complete species list.

Benthic Survey

The benthic samples were collected from subtidal area within the Project Area at 0 mCD, -1 mCD and -2 mCD. Three core samples (at least 50m apart) were taken randomly at each depth zone. Each core was taken by a plastic sampler with 10 cm diameter and 20cm depth. The sediments were sieved *in situ*. The sediments were washed onto a sieve stack (comprising 1mm and 500µm meshes) and gently rinsed with seawater to remove all fine material. Material remaining on the two screens following rinsing was combined and carefully rinsed using a minimal volume of seawater into pre-labelled thick triple-bagged ziplock plastic bags. A 20% solution of buffered formalin containing rose bengal in seawater was then added to the bag to ensure tissue preservation. Samples were sealed in plastic containers for shipment to the taxonomy laboratory for sorting and identification. All the samples were collected on 19 October 2006.

Taxonomic identifications were performed using stereo dissecting and high-power compound microscopes. These were generally to the family level except for dominant taxa, which were identified to species. The careful sampling procedure employed minimises fragmentation of organisms. If breakage of soft-bodied organisms occurs, only anterior portions of fragments were counted, although all fragments were retained and weighed for biomass determinations (wet weight).

Subtidal (Dive) Survey

In order to investigate the subtidal hard surface assemblages, as well as confirming the abundance and diversity of corals, along the coastlines potentially affected by the bathing beach, dive surveys in the form of Rapid Ecological Assessment (REA) (1) was conducted on 19 October 2006. The REA technique allows semi-quantitative information on the ecological attributes of a subtidal habitat to be obtained relatively simply without compromising scientific rigour. Transect surveys were undertaken along the artificial/ disturbed shorelines at Tai Mei Tuk, natural coastlines at Yeung Chau and Ma Shi Chau and each site had 5 to 10m transect, running parallel to the shoreline (see *Figure 8.3*). The depth of transects was adjusted accordingly based on the substrate habitat and the presence or absence of hard and soft corals. Qualitative

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(1) De Vantier LM, De'ath G, Done TJ and Turak E (1998). Ecological Assessment of a Complex Natural System: A Case Study from the Great Barrier Reef. *Ecological Applications 8:480-96*.

subtidal surveys, including identification of seabed composition, presence or absence of hard and soft corals, as well as their relative abundance, were conducted within and in the close vicinity of the Proposed Beach Development.

The artificial/ disturbed shorelines at Tai Mei Tuk, natural coastlines at Yeung Chau and Ma Shi Chau were surveyed referring to the Rapid Ecological Assessment. Information was recorded by marine ecologists experienced in the field identification of sessile benthic taxa, swimming down-current at each location using SCUBA gear. Transects were determined with a portable geographic positioning system (GPS) unit and the locations are presented in *Figure 8.3.* A 10m transect was laid out and video footage taken of the benthos along the transect/survey route followed by an assessment of the benthic cover (Tier I) and taxon abundance (Tier II) in a swathe ~ 4m wide, 2m either side of each transect.

Tier I - Categorisation of Benthic Cover

Upon the completion of each transect, seven substratum and six ecological attributes were assigned to one of seven standard ranked (ordinal) categories (*Tables 8.2* and *8.3*).

Table 8.2: Categories Used in the Surveys - Benthic Attributes

Ecological	Substratum
Hard coral	Hard substrate
Dead standing coral	Continuous pavement
Soft coral	Bedrock
Antipatharia	Rubble
Macroalgae	Sand
Turf algae	Silt
	Boulders – large (>50cm), small (<50cm)

Table 8.3: Categories Used in the Surveys - Ordinal Ranks of Percentage Cover

Rank	Percentage Cover (%)
1	<5
2	6-10
3	11-30
4	31-50
5	51-75
6	76-100

Tier II - Taxonomic Inventories to Define Types of Benthic Communities

An inventory of benthic taxa was compiled during each dive (ie each transect). Taxa were identified *in situ* to the following levels:

- Scleractinian (hard) corals to species wherever possible;
- Soft corals, anemones and conspicuous macroalgae were recorded according to morphological features and to genus level if possible; and

- Other benthos (including sponges, zoanthids, ascidians and bryozoans) were recorded to genus level wherever possible but more typically to phylum plus growth form.

At the end of each dive, each taxon in the inventory was ranked in terms of abundance in the community (see *Table 8.4*). These broad categories rank taxa in terms of relative abundance of colonies, rather than the contribution to benthic cover along each transect. The ranks are subjective assessments of abundance, rather than quantitative counts of each taxon.

Table 8.4: Ordinal Ranks of Taxon Abundance

Rank	Abundance
0	Absent
1	Rare
2	Uncommon
3	Common
4	Abundant
5	Dominant

Photographs of representative coral species located in the surveyed areas were taken and, where possible, photographs of the seabed composition were taken. Video footage and photographs were taken for all transects.

8.6.4 Assessment Methodology

The information presented in the following sections has been based on the findings of baseline surveys performed and the requirement of the EIA Study Brief (**No. ESB-138/2006**, *Clause 3.4.5*). The importance of potentially impacted ecological resources identified within the Study Area was assessed using the *EIAO-TM* methodology. The potential impacts (following the guideline of *Annex 16* of the *EIAO-TM*) due to the construction and operation of the Proposed Beach Development and the impacts evaluated (based on the criteria stipulated in *Annex 8* in the *EIAO-TM*).

8.7 Ecological Baselines Conditions

8.7.1 Existing Habitat and Vegetation

The Study Area was a mixture of a variety of terrestrial habitats including secondary woodland, shrubland, stream, pond, sandy shore with backshore vegetation, and village/ modified area, and coastal habitats including mangrove, sandy shore and artificial/ disturbed shoreline (see *Figure 8.1*). Village/ modified area was the dominant terrestrial habitat within the Study Area. A narrow strip of sandy shore with backshore vegetation was found in the Proposed Beach Development. Colour photographs of all recorded habitat types, as well as other features and species of conservation interest, are presented in *Figures 8.4* to *8.7*. The photographs showing the current conditions of the Proposed Beach Development are presented in *Figure 8.8*.

A total of 131 plant species were recorded (*Table 2* of *Appendix G)*. The number of plant species and the size of each identified habitat type are presented *in Table 8.5*.

Table 8.5: Habitat Types Recorded Within the Study Area

Habitat type	Approximately Area(hectare)/Length(km)	Number of Plant Species Recorded
Secondary woodland	8.7ha	71
Shrubland	19.4ha	26
Pond	2.1ha	0
Village/ modified area	50.7ha	46
Streams (Length)		11
S1	0.15km	
S2	0.10km	
S3	0.65km	
S4	0.40km	
S5 (Lo Tsz River)	0.80km	
S6 (Shan Liu River)	0.55km	
Sandy shore with backshore vegetation	1.0ha / 1.0km	6
Mangrove	0.5ha	13
Artificial/ Disturbed Shoreline	1.2km	-
Project Site	7.7ha	28
- land area	2.3ha	
- sea area	5.4ha	

8.7.2 Terrestrial Ecological Resources

Secondary Woodland

Secondary woodlands were found at the east and north of the Study Area and comprised a total area of approximately 8.7ha. The secondary woodlands were mature in age with canopy layer reached the height of 8 meters. The understorey was fully occupied by native shrubs and herbs. A total of 71 plant species dominated by native trees such as *Schefflera heptaphylla*, *Microcos paniculata*, *Mallotus paniculatus* and *Ficus variolosa* were recorded during the surveys. Except the shrub species Red Azalea *Rhododendron simsii* and Incense Tree *Aquilaria sinensis*, all of the recorded plant species are common or very common (*Figure 8.4*). *Aquilaria sinensis* is a common tree in Hong Kong but is a Category II species protected in China. All Rhododendron are protected under *Forestry and Countryside Ordinance* (Cap. 96) while *Rhododendron simsii* is common in Hong Kong. The plant species diversity and structural complexity of the secondary woodland are considered to be moderate to high. The photographic records of secondary woodland are shown in *Figure 8.5*.

Shrubland

Shrubland was found on the hill and mainly located at the north of the Study Area, in form of a continuous patch that comprised a total area of approximately 19.4 ha. The lower part of the shrublands are close to the village area and occasionally disturbed by hill fire and human activities, in which invasive plants such as *Mikania micrantha*, *Ageratum conyzoides* and *Dicranopteris linearis* were recorded in the open area of the shrubland. Shrubland patches found on the hill slopes are generally with 0.5 to 1.5m in height. A total of 26 plant species, which are commonly found in shrubland habitat in Hong Kong, were recorded during the surveys. The shrublands were dominated by several small shrub species, including *Baeckea frutescens*, *Bridelia tomentosa*, *Macaranga tanarius*, *Lantana camara* and *Microcos paniculata.* The species diversity and the structural complexity of shrubland are considered to be low to moderate. The photographic records of shrubland are shown in *Figure 8.5*.

Streams/ Channels

Two channels, S1 and S2, and four streams, S3-S6, were recorded within the Study Area (*Figure 8.6*). The riparian vegetation communities of the streams/ channels were integrated with the surrounding habitats, ie village/ modified area and shrubland, and therefore the plant list was presented in the associated habitats.

Channel S1 was mainly surrounded by village/ modified area with human settlement and observed to be channelised and polluted. The drainage channel S2 was found as the fringe of the Pat Sin Leng Country Park and was concreted with semi-open riparian vegetation canopy. None of the plant species of conservation interests was recorded during the surveys. The overall ecological value of the channels recorded within the Study Area is considered to be low.

The undisturbed sections of the streams (S3, S4 and upper courses of S5 and S6) had remained natural with rocky substratum and the riparian vegetation was open and dominated by weed plants and landscape plants in close vicinity. The middle and lower courses of S5 (Lo Tsz River) and S6 (Shan Liu River) were mainly surrounded by village/ modified area with human settlement and were observed to be partially channelised and polluted. None of the plant species of conservation interests was recorded during the surveys. The overall ecological value of the streams recorded within the Study Area is considered to be low to moderate.

Except S2 running laterally from west to east, all the streams/ channel run longitudally from north to south towards the sea. The length of the streams/ channels was presented in *Table 8.5*. The photographic records of the streams/ channels are shown in *Figure 8.6*.

Pond

A pond of total size approximately 3.4ha (2.1ha within the Study Area) was found at the east of the Study Area and it is located within a Conservation Area. The pond was fenced off and was currently under management for recreational uses. No plants species were found within the pond during the surveys. The structural complexity and ecological value of the pond are considered to be low. The photographic record of the pond is shown in *Figure 8.5*.

Sandy Shore with Backshore Vegetation

Sandy shore with backshore vegetation was recorded as a thin layer along the existing shoreline from Ting Kok to Tai Mei Tuk that comprised of a total of approximately 1ha. Only 6 backshore vegetation including *Thespesia populnea, Hibiscus tiliaceus, Limonium sinense, Sesuvium portulacastrum, Launaea sarmentosa* and *Zoysia sinica* were found on the sandy shores during the surveys. True mangrove plants (generally with a height below 0.5m) and seedlings of *Aegiceras corniculatum, Avicennia marina, Excoecaria agallocha* and *Kandelia obovata* were also found scattered along the sandy shore within the Study Area. Rubbish and construction wastes were observed at the backshore which indicated certain level of human disturbance. The structural complexity and ecological value of the sandshore with backshore vegetation are considered to be low to moderate. The photographic records of the sandy shore are shown in *Figure 8.7*.

Village/Modified Area

Village/modified area was the dominant habitat recorded within the Study Area which comprised of approximately 50.7ha. The village/modified area consisted of rural villages, car parks, recreational areas (ie barbeque sites and sports centre), roads, roadside planters, wasteland, cultivation and abandoned agricultural land. Several villages including Lung Mei Tsuen, Tai Mei Tuk Tsuen, Ng Uk Tsuen, Lo Tsz Tin Tsuen and Ting Kok Tsuen were located within the Study Area. A total of 46 landscape and weed plants were recorded in the habitat during the surveys and all of them are commonly found in Hong Kong. The landscape plants including *Acacia confusa, Delonix regia, Gossampinus malabarica, Michelia alba* and *Hibiscus tiliaceus*, with weed plants such as *Leucaena leucocephala, Mikania micrantha, Pueraria lobata Wedelia chinensis* occupied the wasteland and abandoned agricultural lands. The species diversity and structural complexity of the village/modified area are considered to be low. The photographic records of the village/modified area are shown in *Figure 8.6*.

Terrestrial Mammals

No terrestrial mammal was recorded within the Study Area during the dry and wet season surveys.

Birds

Forty-four bird species were recorded during the quantitative and qualitative surveys (see *Table 3* of *Appendix G*). Thirty-eight species were recorded during dry season and thirty-one species recorded during wet season (see *Tables 4* and *5* of *Appendix G*). All of the bird species, except Black Kite *Milvus migrans*, Osprey *Pandion haliaetus* White-bellied Sea Eagle *Haliaeetus leucogaster*, Pacific Swift *Apus pacificus* and House Swift *Apus*, were recorded during the point count surveys. There were no birds recorded during night survey.

Twenty-eight of the species encountered were resident to Hong Kong. Estimated bird abundance and recorded number of bird species in major habitats are summarised in *Table 8.6a*. The Project Site has the lowest number of bird species recorded but of highest bird abundance recorded during the survey. The highest number of bird species recorded was at the shrubland.

Table 8.6a: Mean Abundance and Number of Bird Species in Different Types of Habitat and Proposed Development Beach in the Study Area

Habitat	Season	W	Sh	S	Pd	D	PS
Survey days	Dry	2	2	2	2	2	2
	Wet	2	2	2	2	2	2
	Overall	4	4	4	4	4	4
Number of individuals	Dry	108	97	62	35	32	79
	Wet	62	64	58	45	75	15
	Overall	170	161	120	80	107	94
Relative Abundance (no. of individuals/ survey point/ survey day)	Dry	27	24.3	15.5	17.5	8	39.5
	Wet	15.5	16	14.5	22.5	18.9	7.5
	Averaged	21.3	20.2	15	20	13.5	23.5
No. of species	Dry	16	24	17	8	9	8
	Wet	13	17	18	12	12	7
	Overall	21	28	24	14	14	12

W = Secondary Woodland, Sh = Shrubland, S = Sandy Shore with Backshore Vegetation, Pd =Pond, D = Village/Modified, PS = Project Site

Four species with conservation interest were recorded during the survey, including Black Kite *Milvus migrans*, White-bellied Sea Eagle *Haliaeetus leucogaster*, Osprey *Pandion haliaetus* and Crested Goshawk *Accipiter trivirgatus*. The locations of these species, except Black Kites, are presented in *Figure 8.4*. As Black Kites were commonly found soaring in the sky in Hong Kong, the exact locations of the bird were not recorded.

The Black Kite is a very widespread and common species in Hong Kong (*Table 8.1*). It is protected in China and listed as a Class 2 Protected Animal of the PRC and in *Appendix II* of CITES. Black Kites were only recorded soaring in the sky during the surveys, the exact locations of the bird cannot therefore be shown in *Figure 8.4*. Black Kites usually forage over a large area and Lung Mei is considered to be part of their foraging areas.

The White-bellied Sea Eagle is resident in Guangdong and southern Fujian and occasionally occurs in Jiangsu and Hainan. It is an uncommon resident in Hong Kong in coastal areas and offshore islands (*Table 8.1*). The White-bellied Sea Eagle is listed as a rare species in the China Red Data Book, Class II protected species in PRC and CITES *Appendix II* (1). The recent unpublished information indicated that a pair of White-bellied Sea Eagles was observed to nest at the east of Yeung Chau, located over 800 m from the nearest boundary of the Proposed Beach Development. The White-bellied Sea Eagle usually forages over a large area and Lung Mei is considered to be one of its foraging areas.

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(1) J. MacKinnon, K. Phillipps, and He F. Q (2000). *Field Guide to the Birds of China*. Oxford Univeristy Press.

The Osprey has been recorded as a migrant along the east coast of China (*Table 8.1*). It is listed in *Appendix II* of CITES and also a Class 2 Protected Animal of PRC. There is no suggestion of breeding activity having ever occurred in Hong Kong. Lung Mei is considered to be a minor foraging site of the Osprey as it is a winter visitor and usually forages over a large area.

The Crested Goshawk has been recorded as a resident in China from Sichuan and Yunnan east to Guangxi and Hainan, and in Taiwan (*Table 8.1*). The species is listed in *Appendix II* of CITES and also Class 2 Protected Animal of PRC (1). Since Crested Goshawk is widespread in the New Territories and the Deep Bay areas, Lung Mei is considered to be a minor foraging site of the Crested Goshawk.

Invertebrates

- **Butterflies:** A total of 56 species of butterflies were recorded during the surveys qualitatively and quantitatively. Forty of which were recorded in the dry season and forty-one in wet season (see *Tables 7* and *8* of *Appendix G*). Woodland habitat have the highest number of butterfly species (29 out of the 56 species) and relative abundance recorded in the wet season while shrubland has the highest number of butterfly species (35 out of the 56 species) and relative abundance in the dry season (see *Tables 7* and *8* of *Appendix G*). The number of butterfly species and total number of individuals recorded in each habitat of the Study Area are summarised in *Table 8.6b.*

Table 8.6b: Butterfly Species Recorded in Each Habitat of the Study Area

Habitat	**Season**	**W**	**Sh**	**S**	**Pd**	**D**	**PS**
No. of species	Dry	12	35	3	0	3	0
	Wet	29	19	4	5	5	0
	Overall	34	44	6	5	7	0
Relative Abundance (no. of individuals/ survey point/ survey day)	Dry	8	20.5	1	0	0.8	0
	Wet	20.5	5.5	1.3	3.5	1.8	0
	Averaged	14.3	13	2.2	1.8	1.3	0
No. of uncommon species		6	8	1	1	0	0

W = Secondary Woodland, Sh = Shrubland, S = Sandy Shore with Backshore Vegetation, Pd =Pond, D = Village/Modified, PS = Project Site

Among the 56 butterfly species, 13 are uncommon and the rest are either common or abundant in Hong Kong. The thirteen uncommon species include Brown Pansy *Junonia iphita,* Common Nawab *Polyura athamas,* Danaid Egg-fly *Hypolimnas bolina,* Dark Evening Brown *Melanitis phedima,* Great Swift *Pelopidas assamensis,* Indian Palm Bob *Suastus gremius,* Painted Jezebel *Delias hyparete,* Plain Tiger *Danaus chrysippus,* Sliver Streak Blue *Iraota timoleon,* South China Bush Brown *Mycalesis zonata,* Tailed Sulphur *Dercas verhuelli,* White-edged Blue Baron *Euthalia phemius*

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(1) J. MacKinnon, K. Phillipps, and He F. Q (2000). *Field Guide to the Birds of China*. Oxford University Press.

and Yellow Orange Tip *Ixias pyrene.* The locations of butterfly species of conservation interests recorded within the Study Area are shown in *Figure 8.4*. The food plants for the butterflies with conservation interests are presented in *Table 8.7*.

Table 8.7: Food Plants of Butterfly Species of Conservation Interests

Common Name	Species Name	Status	Food Plant (1)	Habitat Recorded
Brown Pansy	*Junonia iphita*	UC	Plants in family Acanthaceae, including *Justicea* and *Strobilanthes* species.	Secondary woodland
Common Nawab	*Polyura athamas*	UC	*Acacia sinuata, Albizia lebbek, Leucaena leucocephala*	Secondary woodland, Pond
Danaid Egg-fly	*Hypolimnas misippus*	UC	*Alternanthera philoxeroides, Ipomoea batatas, Ipomoea triloba, Merremia hederacea*	Shrubland
Dark Evening Brown	*Melanitis phedima*	UC	*Capillipedium parviflorum, Micostegium ciliatum*	Shrubland
Great Swift	*Pelopidas assamensis*	UC	*Thysanolaena maxima*	Shrubland
Indian Palm Bob	*Suastus gremius*	UC	*Phoenix hanceana, Phoenix roehelenii*	Secondary woodland
Plain Tiger	*Danaus chrysippus*	UC	*Asclepias curassavica*	Shrubland
Painted Jezebel	*Delias hyparete*	UC	*Microsolen cochinchinensis*	Secondary woodland, shrubland
Sliver Streak Blue	*Iraota timoleon*	UC	*Micostegium ciliatum*	Secondary woodland
South China Bush Brown	*Mycalesis zonata*	UC	*Dalbergia benthami*	Secondary woodland, shrubland
Tailed Sulphur	*Dercas verhuelli*	UC	*Litchi chinensis*	Secondary woodland
White-edged Blue Baron	*Euthalia phemius*	UC	*Capparis cantoniensis*	Shrubland
Yellow Orange Tip	*Ixias pyrene*	UC		Shrubland
Status - UC = Uncommon				

Notes: (1) Information extracted from Bascombe MJ et al *(1999) The Butterflies of Hong Kong.*

- **Dragonflies:** Twelve dragonfly species including Amber-winged Glider, Black-banded Gossamerwing, Black Threadtail, Common Blue Skimmer, Common Red Skimmer, Crimson Dropwing, Indigo Dropwing, Red-faced Skimmer, Saddlebag Glider, Variegated Flutterer, Wandering Glider and Yellow Featherlegs were recorded in the Study Area during the survey (see *Tables 9* to *11* of *Appendix G*). Eleven of which were recorded in the wet season and eight recorded in the dry season. All of the dragonfly species are abundant or commonly found in Hong Kong.

Sandy shore has the highest number of individuals of dragonflies while shrubland has the highest number of species during the survey in the dry season. Woodland has the highest number of individuals of dragonflies while shrubland has the highest number of species during survey in the wet season. The number of dragonfly species and total number of individuals recorded in each habitat are summarised in *Table 8.8*.

Table 8.8: Dragonfly Species Recorded in Each Habitat of the Study Area

Habitat	**Season**	**W**	**Sh**	**S**	**Pd**	**D**	**PS**
No. of species	Dry	0	7	3	0	0	0
	Wet	6	9	2	1	1	1
	Overall	6	10	4	1	1	1
Relative Abundance (no. of individuals/ survey point/ survey day)	Dry	0	2.8	3.3	0	0	0
	Wet	25.8	13	2.8	12.5	4	5
	Averaged	12.9	7.9	6.1	6.3	2	2.5

W = Woodland, Sh = Shrubland, S = Sandy Shore, Pd =Pond, D = Disturbed/Modified, PS = Project Site

Herpetofauna

A total of two species of amphibian (Asian Common Toad and Gunther's Frog) and four species of reptiles (Changeable Lizard, Common Rat Snake, Long-tailed Skink and Reeves' Smooth Skink) were recorded in the Study Area during day-time and night-time surveys (see *Table 12* of *Appendix G).* The Common Rat Snake is listed in *Appendix II* of CITES and considered of potential global concern (1). It can be found in a great variety of habitats and locations in Hong Kong, and is less common in densely wooded areas and mountain grassland (2). A Common Rat Snake *Ptyas mucosus* was recorded in the village/ modified area located within the Project Site during the wet season survey. The location of the Common Rat Snake was presented in *Figure 8.4*. The remaining species are common locally.

Freshwater Fish

A total of five freshwater fish species, including Guppy *Poecilia reticulate*, Mosquito Fish *Gambusia affinis*, Swordtail *Xiphophorus hellerii*, Tilapia *Oreochromis niloticus* and Variable Platyfish *Xiphophorus variatus*, were recorded. All recorded freshwater fish species are introduced exotic species. Common Mudskipper *Periophthalmus modestus* and Common Silver-biddy *Gerres oyena*, which is common in estuarine areas, were also recorded at the river mouth Lo Tsz River (S5) and Shan Liu River (S6). The survey results are presented in *Table 8.9* and *Table 13* of *Appendix G*.

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(1) Fellowes, J. R., Lau, M. W. N., Dudgeon, D., Reels, G. T., Ades, G. W. J., Carey, G. J., Chan, B. P. L., Kendrick, R. C., Lee, K. S., Leven, M. R., Wilson, K. D. P. and Yu, Y. T. (2002). Wild Animal to Watch: Terrestrial and Freshwater Fauna of Conservation Concern in Hong Kong. *Memoirs of Hong Kong Natural History Society* 25: 123-160.

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

Table 8.9: Fish Species and Individuals Recorded from the Stream/ Channels at Lung Mei Study Area

			Relative Abundance							
Scientific Name	**Status**	**Origin**	**S1**	**S2**	**S3**	**S4**	**Lo Tsz River (S5)**		**Shan Liu River (S6)**	
							Lower	**Upper**	**Lower**	**Upper**
Guppy *Poecilia reticulata*	Common	Exotic to China	No fish was recorded in S1 and S2.		+			++	++	++
Mosquito Fish *Gambusia affinis*	Common	Exotic to China			+	+++	++	+++	++	+++
Swordtail *Xiphophorus hellerii*	Common	Exotic to China							++	
Tilapia *Oreochromis niloticus*	Common	Exotic to China				++		+	+	
Variable Platyfish *Xiphophorus variatus*	Common	Exotic to China			+		++	+++		+++
Common Mudskipper *Periophthalmus modestus*	Common	Western Pacific region					+		+	
Common Silver-biddy *Gerres oyena*	Common	Indo-Pacific region					++		++	

+ = less than 20 individuals; ++ = 20-50 individuals; +++ = more than 50 individuals

For Lo Tsz River and Shan Liu River, Lower = Section of the stream located below Ting Kok Road. Upper = Section of the stream above Ting Kok Road.

The species diversity of fish in the streams of the Study Area is considered to be low. The absence of, or restricted number of, freshwater fishes in the Study Area may be due to the low quality and/or lack of undisturbed stream habitats.

8.7.3 *Marine Ecological Resources*

Intertidal Habitats

Sandy Shore

The sandy shores within the Study Area supported low diversity of species. The sandy shores were predominantly covered by coarse grains and rubbles with increasing proportion of finer grains towards the lower intertidal zone. Faunal species recorded were typical species that can be found on sandy and rocky shores in Hong Kong. Sand snails *Batillaria zonalis* and *Batillaria multiformis* were commonly recorded at the sandy bottom area within the Study Area. Other typical rocky shore snails such as *Monodonta labio, Lunella coronata* and *Planaxis sulcatus*, and bivalve *Saccostrea cucullata* were commonly found on the surfaces of small bounders and rubble. All species found are regarded as common or very common species in Hong Kong. Crab species including *Metopograpsus* spp. and *Hemigrapsus penicillatus* were also recorded during the surveys.

Mangrove

Mangroves are generally regarded as habitats of high ecological value, relatively undisturbed mangroves were found at the river mouth of Shan Liu River and Ting Kok SSSI. The recorded dominant mangrove species were *Kandelia obovata*, *Excoecaria agallocha*, *Bruguiera gymnorrhiza* and *Aegiceras corniculatum* with the height ranging from 0.3m to 1.5m. A total of 13 plant species were recorded within the mangrove habitat. The floral species diversity and structural complexity of mangrove are considered to be moderate. The photographic records of mangroves are shown in *Figure 8.7*.

Artificial/ Disturbed Shoreline

Artificial/ disturbed shore was located at the east of the Study Area adjacent to the Tai Mei Tuk barbecue sites. The artificial/ disturbed shoreline support a low diversity of species. Animals recorded (*Table 8.10* and *Table 14* of *Appendix G*) were mainly sessile filter-feeders (*Saccostrea cucullata* and *Isognomon isognomum*), periwinkles *Nodilittorina radiate*, snails *Monodonta labio* and *Planaxis sulcatus*. Barnacle *Balanus amphitrite* was also recorded with low covers (< 1 %) on middle and high intertidal zones. *Ligia exotica* was a highly mobile organism observed during the survey on both artificial shoreline and seawall.

Table 8.10 : Mean Number of Individuals (m^{-2}) (± S.D.) of Intertidal Organisms Recorded from the Artificial / Disturbed Shoreline During the Intertidal Survey

	High intertidal zone		Middle intertidal zone		Low Intertidal zone	
Snail						
Nodilittorina radiata	0.8	± 1.8	0		0	
Planaxis sulcatus	2.4	± 5.4	0		96	± 203.7
Monodonta labio	2.4	± 5.4	18.4	± 15.7	4.8	± 6.6
Bivalves (% cover)						
Saccostrea cucullata	1.8%	± 2.5%	7.0%	± 4.8%	38.0%	± 36.8%
Isognomon isognomum	5.4%	± 8.4%	5.2%	± 6.1%	0.4%	± 0.9%
Barnacles (% cover)						
Balanus amphitrite	0.4%	± 0.9%	0.6%	± 0.9%	0.0%	

Subtidal Soft Bottom Habitat and Benthic Assemblages

Subtidal soft bottom habitat within the Proposed Beach Development was covered by fine sediments with scattered rubbles (refer to the results of the dive surveys in the following section). There were a total of 24 species and 300 individuals of benthic organisms (*Table 8.11*) recorded at the three water depths (0 mCD, -1 mCD, and -2 mCD) by core sampling. The total biomass of benthic organisms recorded was 13.34g. Organisms recorded were either from the Phyla Annelida, or Mollusca. The number of individuals and biomass were highest at shallow water (0 mCD) and lowest in deep water (-2 mCD). On the other hand, the total number of species was highest in deep water (13) and lowest in shallow water (11), but the mean number of species was the same in all depth zones (6.33). No rare species were recorded from the survey. Surveys conducted for this Study concluded that the assemblages were of a lower diversity and abundance than is observed in other areas in Hong Kong.

Table 8.11: Number of Individuals, Species and Biomass (Wet Weight) (± S.D.) of Benthos Recorded Within the Subtidal Bottom of the Project Site.

	Total no. of individuals	Total no. of species	Total biomass (g)	Mean no. of individuals		Mean no. of species		Mean biomass (g)	
Shallow (0 mCD)	125	11	5.99	41.67	± 4.73	6.33	± 1.53	2.00	± 1.04
Middle (-1 mCD)	84	12	4.10	28.00	± 9.17	6.33	± 4.93	1.37	± 0.43
Deep (-2 mCD)	91	13	1.59	30.33	± 3.79	6.33	± 2.08	1.08	± 0.52
Total	300	36	11.68						

Subtidal Hard Bottom Habitat and Dive Surveys within the Proposed Beach Development

Seabed condition

The survey was performed on 19 October 2006. The weather was cloudy and the sea was calm. The visibility was poor, ranging between 0.5m and 1.5m, therefore there is no photographic record of the seabed of the subtidal habitat can be shown. The locations of the subtidal dive survey are shown in *Figure 8.3*. The results of the qualitative survey were shown in *Tables 15-17* of *Appendix G*. Along each transect the seabed composition was identified and conditions were shown in *Table 16* of *Appendix G*. The seabed attributes of the transects are shown in *Table 17* of *Appendix G*. Artificial/ disturbed shoreline at Tai Mei Tuk and natural rocky shore at east of Ma Shi Chau were dominated by rocky substratum, where high cover of bedrocks and boulders were observed with rubbles and sand in-between. Substratum of natural rocky shore at east of Yeung Chau was characterized by high cover of rocks, boulders and sand with some rubbles in-between. Soft bottom habitat within and adjacent to the Proposed Beach Development were covered by fine sediments with scattered bubbles (*Figure 8.8*). The benthic organisms recorded within the Proposed Beach Development were either Annelida or Mollusca which is common and typical in Hong Kong shallow subtidal areas.

Coral Assemblages

No corals were found at the two soft bottom habitats within and adjacent to the Proposed Beach Development. Low number of coral colonies were only found in artificial/ disturbed shoreline at Tai Mei Tuk, natural rocky shore at east of Ma Shi Chau and natural rocky shore at east of Yeung Chau, with less than 10 colonies (coral cover less than 5 %) recorded in each site. Coral species recorded included *Oulastrea crispate*, *Cyphastrea serailia* and *Psammocora superficialis*, which are regarded as common, dominant and abundant species in Hong Kong (1). No Soft or Black corals were recorded during the survey. The relative positions and estimated sizes of corals were listed in *Table 19* of *Appendix G*. The abundance of each hard coral species at each area are shown in *Table 8.12*.

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(1) Chan Alan L.K., Chan Khaki K., Choi Choyce L.S., McCorry D., Lee M.W. and Ang Put Jr. (2005). *Field Guide to Hard Corals of Hong Kong*. Friends of the Country Parks and Cosmos Books Ltd.

Table 8.12: Hard Coral Species Recorded in Transects 1 – 20

	Abundance				
Zone	**Artificial / disturbed shoreline at Tai Mei Tuk**	**Natural rocky shore at the east of Ma Shi Chau**	**Natural rocky shore at the east of Yeung Chau**	**Soft bottom habitat within the Project Site**	**Soft bottom habitat adjacent to the Project Site**
Hard Coral Species					
Cyphastrea serailia	1	-	-	-	-
Oulastrea crispata	7	1	8	-	-
Psammocora superficialis		2			
Total Number of Species	2	2	1	0	0

Note: The three coral species *Oulastrea crispate, Cyphastrea serailia* and *Psammocora superficialis* are regarded as common, dominant and abundant species in Hong Kong

The benthic fauna recorded along the survey route included sponges, ascidians, rock oyster *Saccostrea cucullata*, *Pinctada* sp., the sea cucumber *Holothuria leucospilota,* decorator urchins *Temnopleura reevesi,* sea urchin *Anthocidaris crassispina* and tube anemone *Cerianthus filiformis*.

8.7.4 *Existing Conditions of the Proposed Beach Development*

The Project Site consisted of sandy shore with backshore vegetation (approximately 0.5ha), village/modified area (approximately 1.0ha) and lower course of Lo Tsz River (approximately 100m long) (*Figure 8.8*). The landward site was found to be disturbed by littering, vegetation clearance and dumping of construction waste. A total of 30 plant species were recorded within the Project Site and the dominant plant species were *Albizia lebbeck, Hibiscus tiliaceus, Leucaena leucocephala* and *Macaranga tanarius*. All of the recorded plant species are common or very common in Hong Kong.

The lower course of Lo Tsz River is less disturbed with sandy substratum (scattered with small rocks) and with semi-open riparian vegetation canopy. Floating aquatic plant *Lemna* sp. was found in the section just below the existing culvert during the survey, indicated that the stream water is of high nutrient loading. All of the freshwater fishes recorded were exotic species without any conservation value. The stream mouth of Lo Tsz River is subject to tidal influence.

The sandy shores were predominantly covered by coarse grains and rubbles with increasing proportion of finer grains towards lower intertidal zone. Approximately 80 mangrove seedlings/ plants (with a height below 0.5m) of *Aegiceras corniculatum, Avicennia marina* and *Kandelia obovata* were found scattered along the sandy shore within the site. Subtidal soft bottom habitat within the Project Site was covered by fine sediments with scattered bubbles. All marine organisms found within the Project Site are regarded as common or very common species in Hong Kong.

The subtidal habitats within or adjacent to the Proposed Beach Development were soft bottom habitat covered by fine sediments with scattered bubbles (see *Figure 8.8*). No corals or species of conservation interests were found within and adjacent to the Proposed Beach Development.

The results of the field surveys indicated that the wildlife abundance (except bird) and species diversity recorded within the Proposed Beach Development were relatively low. A Common Rat Snake *Ptyas mucosus*, considered as a species of conservation interests but common in Hong Kong, was found moving within the Project Site. The photographic records of the Project Site are shown in *Figure 8.8*.

In conclusion, the ecological value of sandy shore with backshore vegetation, village/modified area, and the lower course of Lo Tsz River within the Proposed Beach Development are considered to be low.

8.8 Ecological Evaluation

In this section the ecological importance of the habitats and wildlife identified within the Study Area are evaluated in accordance with the criteria stipulated in *Annex 8* of the *EIAO-TM*. The evaluation is based upon the information presented in *Section 8.7*. The ecological importance of each habitat type within the Study Area and the habitats within the Proposed Beach Development are presented in *Tables 8.13* to *8.24*.

Table 8.13: Ecological Evaluation of Secondary Woodland

Criteria	**Secondary Woodland**
Naturalness	Native woodland with limited disturbance.
Size	Native woodland with overall size of approximately 8.7ha. No secondary woodland located within the Project Site.
Diversity	Moderate to high diversity of plant (71 species), low to moderate diversity of birds (13 species), butterfly (29 species) and other fauna.
Rarity	Plant species Red Azalea and Incense Tree, bird species Crested Goshawk, butterfly species Brown Pansy, Common Nawab, Indian Palm Bob, Painted Jezebel, Silver Streak Blue, South China Bush Brown and Tailed Sulphur were recorded.
Re-creatability	Habitat characteristics and species composition are moderate to high. It will take around 30 years for the secondary woodland to be re-created.
Fragmentation	Not applicable.
Ecological Linkage	In close vicinity of a Conservation Area (pond) and functionally linked to the pond.
Potential Value	High
Nursery/ Breeding Ground	Nil
Age	Mature (around 20 years) based on tree size, woodland structure and species composition.
Abundance/ Richness of Wildlife	Low to moderate abundance for wildlife.
Overall Ecological Value	**Moderate to High**

Table 8.14: Ecological Evaluation of Shrubland

Criteria	**Shrubland**
Naturalness	Semi natural habitats with disturbances from human activities of the villages in the close vicinity.
Size	Shrubland has the overall size of approximately 19.4ha and none of the shrubland habitat was found within the Project Site.
Diversity	Low for vegetation (totally 26 species), moderate for faunal diversity.
Rarity	Species of conservation interest included bird species White-bellied Sea Eagle, butterfly species Danaid Egg-fly, Dark Evening Brown, Great Swift, Painted Jezebel, Plain Tiger, South China Bush Brown, white-edged Blue Baron and Yellow Orange Tip.
Re-creatability	Habitat characteristics and species composition are easy to recreate. It will take more than 10 years for the shrubland to be re-created.
Fragmentation	Shrubland mainly exists as a continuous patch.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Medium
Nursery /Breeding Ground	Nil.
Age	Young to moderate.
Abundance/ Richness of Wildlife	Moderate butterflies, low to moderate for avifauna, and low for other wildlife.
Overall Ecological Value	**Moderate**

Table 8.15: Ecological Evaluation of Village/Modified Area

Criteria	**Village/Modified Area**
Naturalness	Man-made habitat with village house, abandoned agricultural land and landscape areas.
Size	The overall size was approximately 50.7ha. Approximately 1.0ha of village/modified area was found within the Project Site.
Diversity	Low for flora and fauna.
Rarity	Species of conservation interests included herpetofauna Common Rat Snake, and bird species Black Kite.
Re-creatability	Readily re-creatable.
Fragmentation	Not applicable.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Low.
Nursery/ Breeding Ground	None.
Age	Not applicable.
Abundance/ Richness of Wildlife	Low.
Overall Ecological Value	**Low**

Table 8.16: Ecological Evaluation of Streams

Criteria	**Streams S3, S4, S5 (Lo Tsz River) and S6 (Shan Liu River)**
Naturalness	Natural, except middle and lower courses of S5 (Lo Tsz River) and S6 (Shan Liu River) which were partially channelised and polluted.
Size	S3: 0.65km S4: 0.40km S5 (Lo Tsz River): 0.80km S6 (Shan Liu River): 0.55km. None of the undisturbed stream habitats were found within the Project Site. Approximately 10 m of lower course of Lo Tsz River was found within the Project Site.
Diversity	Low for plant and low to moderate aquatic fauna recorded.
Rarity	Nil.
Re-creatability	Re-creatable.
Fragmentation	Not applicable.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Low to moderate ecological potential.
Nursery/Breeding Ground	No significant nursery or breeding ground recorded.
Age	Not applicable.
Abundance/ Richness of Wildlife	Nil.
Overall Ecological Value	**Low to Moderate for S3, S4, upper course of S5 (Lo Tsz River) and S6 (Shan Liu River)** **Low for middle and lower course of S5 (Lo Tsz River) and S6 (Shan Liu River)**

Table 8.17: Ecological Evaluation of Channels

Criteria	**Channel S1 and S2**
Naturalness	Man-made habitat
Size	S1: 0.15km S2: 0.10km No channel habitats found within the Project Site.
Diversity	Low for plant and aquatic fauna recorded.
Rarity	Nil.
Re-creatability	Re-creatable.
Fragmentation	Not applicable.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Low ecological potential.
Nursery/Breeding Ground	No significant nursery or breeding ground recorded.
Age	Not applicable.
Abundance/ Richness of Wildlife	Nil.
Overall Ecological Value	**Low**

Table 8.18: Ecological Evaluation of Pond

Criteria	**Pond**
Naturalness	Man-made habitat.
Size	The overall size was approximately 2.1ha. None of the pond habitat was found within the Project Site.
Diversity	Low for flora and fauna.
Rarity	Species of conservation interests included butterfly species Common Nawab.
Re-creatability	Readily re-creatable.
Fragmentation	Not applicable.
Ecological Linkage	Located in close vicinity with PCCP and functionally linked to the secondary woodland within the PCCP.
Potential Value	Low to moderate
Nursery/Breeding Ground	None.
Age	Not applicable.
Abundance/Richness of Wildlife	Low.
Overall Ecological Value	**Low to moderate**

Table 8.19: Ecological Evaluation of Sandy Shore with Backshore Vegetation

Criteria	**Sandy Shore with Backshore Vegetation**
Naturalness	Natural with certain disturbance
Size	Approximately 1.0ha of this habitat was recorded within the Study Area, in which approximately 0.5ha of this habitat was recorded within the Project Site.
Diversity	Low for flora and fauna species.
Rarity	Nil.
Re-creatability	The habitat is readily to be recreated.
Fragmentation	Not applicable.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Low.
Nursery/Breeding Ground	None.
Age	Not applicable.
Abundance/Richness of Wildlife	Low.
Overall Ecological Value	**Low**

Table 8.20: Ecological Evaluation of Mangrove

Criteria	**Mangrove**
Naturalness	Natural with limited disturbance.
Size	Approximately 0.5ha was recorded within the Study Area. None of the mangrove habitats were found within the Project Site.
Diversity	Moderate for flora and fauna
Rarity	Mangroves are generally regarded as habitats of high ecological value.
Re-creatability	The mangrove habitat may take 10 to 20 years to re-establish.
Fragmentation	Not fragmented.
Ecological Linkage	Functionally linked to any highly valued habitat in close proximity.
Potential Value	Moderate.
Nursery/Breeding Ground	Mangrove is considered to be an important nursery ground for marine organisms.
Age	Not applicable.
Abundance/Richness of Wildlife	Moderate.
Overall Ecological Value	**High**

Table 8.21: Ecological Evaluation of the Intertidal Artificial/ Disturbed Shoreline

Criteria	**Intertidal Artificial/ Disturbed Shoreline**
Naturalness	Man-made habitat (slope artificial seawall).
Size	Approximately 1.2km of artificial shoreline was recorded within the Study Area. None of the artificial shoreline habitats were found within the Project Site.
Diversity	Low for intertidal marine floral and fauna.
Rarity	Nil.
Re-creatability	The habitat can be recreated.
Fragmentation	Not applicable.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Low
Nursery/Breeding Ground	None.
Age	Not applicable.
Abundance/Richness of Wildlife	Low
Overall Ecological Value	**Low**

Table 8.22: Ecological Evaluation of Subtidal Soft Benthos Assemblages

Criteria	**Subtidal Soft Benthos**
Naturalness	The assemblages were disturbed due to ecological stress caused by organic enrichment from village area in the vicinity.
Size	Total area of the affected subtidal habitats due to the Project will be approximately 5.4ha.
Diversity	The assemblages were low in diversity
Rarity	No organisms were found that are considered as rare.
Re-creatability	The habitat cannot be recreated on Project Site.
Fragmentation	Not applicable.
Ecological Linkage	The surrounding environment contains many other areas of soft substrate.
Potential Value	Unlikely that the site can develop conservation interest.
Nursery/Breeding Ground	None identified in the review and during the survey.
Age	Not applicable.
Abundance/Richness of Wildlife	Low.
Overall Ecological Value	**Low**

Table 8.23: Ecological Evaluation of Subtidal Natural Rocky Shoreline of Yeung Chau and Ma Chi Chau and the Artificial Shoreline

Criteria	**Subtidal Natural Rocky Shore of Yeung Chau and Ma Chi Chau**	**Subtidal Artificial Shoreline**
Naturalness	The shore is undisturbed by human impact due to its remoteness.	Man-made habitat (slope artificial seawall).
Size	Not applicable. The natural rocky shores at Yeung Chau and Ma Chi Chau are located outside the 500m Study Area. Overall 100m of survey transects were assessed during the survey.	1.2km of artificial shoreline was recorded within the Study Area.
Diversity	A total of 2 hard coral species of less than 10 colonies were recorded.	A total of 2 hard coral species of less than 10 colonies were recorded.
Rarity	Nil.	Nil.
Re-creatability	The habitat can be recreated through the deployment of artificial reefs or through rubble mound /rock armour seawalls.	The habitat can be recreated.
Fragmentation	Not applicable.	Not applicable.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Low to moderate	Low
Nursery/Breeding Ground	None.	None.
Age	Not applicable.	Not applicable.
Abundance/Richness of Wildlife	Low.	Low
Overall Ecological Value	**Low to Moderate**	**Low**

Table 8.24: Ecological Evaluation of the Proposed Beach Development

Criteria	**Proposed Beach Development**
Naturalness	Dominated by man-made habitat (village/modified area, and lower course of Lo Tsz River). Natural habitats included sandy shore with backshore vegetation which has certain degree of disturbance (littering) were recorded.
Size	Approximately 1.0ha of village/ modified area, approximately 0.5ha of sandy shore with backshore vegetation and approximately 10 m of lower course of Lo Tsz River. Approximately 80 mangrove seedlings/ plants (with a height below 0.5 m) of *Aegiceras corniculatum*, *Avicennia marina* and *Kandelia obovata* were found scattered along the sandy shore within the site.
Diversity	Low to moderate for vegetation and fauna.
Rarity	Species of conservation interest Common Rat Snake.
Re-creatability	All of the habitats are readily to be recreated.
Fragmentation	Not applicable.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Low
Nursery/Breeding Ground	Nil
Age	Not applicable.
Abundance/Richness of Wildlife	Abundance and richness of wildlife was low.
Overall Ecological Value	**Low**

The lists and evaluations of the floral and faunal species of ecological interest recorded within the Study Area, according to the *EIAO-TM*, are given in *Table 8.25.*

Table 8.25: Evaluation of Floral and Faunal Species with Ecological Interest within the Study Area

Species	**Location**	**Protection Status**	**Distribution**	**Rarity**
Plant				
Red Azalea *Rododendron simsii*	Secondary Woodland	Protected under the Wild Animals and Plants (Cap 170)	Widespread	Common
Incense Tree *Aquilaria sinensis*	Secondary Woodland	Not protected locally but Category II nationally protected species in China and is listed as vulnerable in the China Plant Red Data Book and by IUCN (2002).	Lowland forests and fung shui woods	Common
Birds				
White-bellied Sea Eagle *Haliaeetus leucogaster*	Flying above the grassland of Study Area, perching.	Class 2 of Protected Animal of PRC; *Appendix II* in CITES	Found in coastal area of Hong Kong, Oriental and Australasian	An uncommon resident in Hong Kong
Black-eared Kite *Milvus lineatus*	Flying over various habitat within the Study Area	Class 2 Protected Animal of PRC; *Appendix II* of CITES	Found in many types of habitats; East Eurasia	Common and widespread in Hong Kong
Osprey *Pandion haliaetus*	Flying over the sea.	Class 2 Protected Animal of PRC; *Appendix II* of CITES	Hong Kong, Oriental	Locally uncommon winter visitor.
Crested Goshawk	Perching in secondary woodland	Class 2 Protected Animal of PRC; *Appendix II* of CITES	Hong Kong, Oriental	Common and widespread in Hong Kong
Butterflies				
Brown Pansy *Junonia iphita*	Secondary woodland within the Study Area.	Not protected	Most country parks	Uncommon
Common Nawab *Polyura athamas*	Secondary woodland and pond within the Study Area.	Not protected	Most country parks	Uncommon
Danaid Egg-fly *Hypolimnas misippus*	Shrubland within the Study Area.	Not protected	Found in most country parks	Uncommon
Dark Evening Brown *Melanitis phedima*	Shrubland within the Study Area.	Not protected	Found in most country parks	Uncommon
Great Swift *Pelopidas assamensis*	Shrubland within the Study Area.	Not protected	Found in most country parks	Uncommon
Indian Palm Bob *Suastus gremius*	Secondary woodland within the Study Area.	Not protected	Most country parks	Uncommon
Painted Jezebel *Delias hyparete*	Secondary woodland and shrubland within the Study Area.	Not protected	Most country parks	Uncommon
Plain Tiger *Danaus chrysippus*	Shrubland within the Study Area.	Not protected	Found in most country parks	Uncommon

Species	**Location**	**Protection Status**	**Distribution**	**Rarity**
Silver Streak Blue *Iraota timoleon*	Secondary woodland within the Study Area.	Not protected	Most country parks	Uncommon
South China Bush Brown *Mycalesis zonata*	Secondary woodland and shrubland within the Study Area.	Not protected	Most country parks	Uncommon
Tailed Sulphur *Dercas verhuelli*	Secondary woodland within the Study Area.	Not protected	Most country parks	Uncommon
White-edged Blue Baron *Euthalia phemius*	Shrubland within the Study Area.	Not protected	Found in most country parks	Uncommon
Yellow Orange Tip *Ixias pyrene*	Shrubland within the Study Area.	Not protected	Found in most country parks	Uncommon
Reptile				
Common Rat Snake *Ptyas mucosus*	Village/modified area within the Project Site.	Not protected in Hong Kong; *CITES Appendix II*	Widespread in Hong Kong	Common
Coral				
Oulastrea crispata, Cyphastrea serailia and *Psammocora superficialis*	Low number of coral colonies were found in artificial/ disturbed shoreline at Tai Mei Tuk, natural rocky shore at east of Ma Shi Chau and natural rocky shore at east of Yeung Chau	Protected under the *Endangered Species of Animals and Plant Ordinance* Cap 586.	Widespread in Hong Kong	Common, dominant and abundant species in Hong Kong

8.9 Potential Impacts and Impact Assessment

The Proposed Beach Development involves removal of vegetation, land formation and reclamation for the construction of the beach building and associated beach facilities. In order to fulfil the criteria of no discharge outlets for effluent disposal locating within 100m of the proposed gazetted beach, a new western drainage and a new eastern culvert will be constructed. The western drainage will divert the water flow from the existing culvert situated across Ting Kok Road and Lo Tsz River, in which the stream bed and banks of Lo Tsz River will not be affected. The sea bed will be dredged and recharged with sand. The construction works of Proposed Beach Development will expect to be completed within 2 years.

8.9.1 Construction Phase

The potential ecological impacts due to the construction of the Proposed Beach Development are described below.

Habitat Loss

- Permanent loss of sandy shore with backshore vegetation (approximately 0.5ha), village/modified area (approximately 0.8ha), lower course of Lo Tsz River (approximately 10m), intertidal and subtidal soft bottomed habitat (approximately 2.3ha) during construction of the Proposed Beach Development;

- Temporary loss of intertidal and subtidal soft bottomed habitat (approximately 3.1ha) during dredging for the Proposed Beach Development;

- Impacts to soft substratum habitats are predicted to occur as a result of the dredging operations and sand filling associated with the Proposed Beach Development. As discussed in *Section 8.7.3*, the intertidal and subtidal marine faunal communities found within the Project Site are common and widespread in Hong Kong. It should be noted that once these operations have ceased some marine ecological resources in the affected area are expected to return due to recolonisation of the seabed by benthic fauna, particularly the temporary affected seabed areas (not affected by sand filling). Given the total small size of affected area (approximately 5.4ha, regarded to be of low ecological value) and there are large extent of similar intertidal and subtidal habitats in the vicinity, unacceptable impacts are not anticipated;

- The results obtained from dive surveys showed that coral habitats (including hard, soft and black corals) of ecological importance were not identified within Project Site. Therefore, direct impacts to coral habitats as a result of the proposed construction works are not anticipated;

- Loss of some individuals (approximately 80) of mangrove seedlings/ plants (with a height of approximately 0.5m) of *Aegiceras corniculatum*, *Avicennia marina* and *Kandelia obovata* scattered along the sandy shore within the Project Site;

- Loss of foraging and feeding ground of the associated wildlife, and loss of habitats of intertidal organisms and benthic assemblages.

Details are presented in *Figure 8.8* and *Table 8.26*.

Table 8.26: Overall Habitat Loss due to the Proposed Beach Development

Impacted Habitats	**Permanent loss (ha)**	**Ecological Value of the Affected Habitat**
Sandy shore with backshore vegetation	0.5	Low
Village/ modified area	1.0	Low
Lower course of Lo Tsz River (S5)	10m	Low
Intertidal and subtidal soft bottomed habitat	2.3 (3.1ha temporary affected due to dredging)	Low

Impacts to Terrestrial Wildlife

- Reduction of wildlife species abundance/diversity and ecological carrying capacity is expected to be minimal due to the loss of a relative small and fragmented area of low quality habitats (as compared with the large extent of similar and less disturbed habitats, ie mangrove, secondary woodland and shrubland, in the close vicinity). Although species of conservation interests Common Rat Snake was recorded within the Project Site, the majority of the Project Site is not the favourite habitat of this species;

- The impacts due to the loss of foraging ground are also considered to be minimal given that the large extent of similar and less disturbed habitats in the vicinity, and the affected areas located next to the currently highly disturbed areas; and

- The impacts due to the drainage diversion work for Lo Tsz River are considered to be low given that the recorded estuarine (Mudskipper and Common Silver-biddy) fish species can still utilise the habitats (majority of the lower course of Lo Tsz River would not be affected), there was low number of exotic freshwater (Mosquito Fish and Variable Platyfish) fishes recorded (those species could recolonise the new drainage channel) and all species are common in the vicinity, no unacceptable impacts to fishes will be expected.

Habitat Fragmentation and Isolation

- Habitat fragmentation and isolation are not expected as the affected terrestrial habitats are already fragmented and either disturbed or located next to the modified areas; and

- Given that the Project Site located at the seashore within the inner bay of Tolo Harbour and next to the artificial/ disturbed shorelines at Tai Mei Tuk, marine habitat fragmentation and isolation are not expected.

Change of Water Quality

Construction Runoff
During land based construction activities for the Proposed Beach Development, impacts to water quality may occur from pollutants, mainly SS, in site runoff which may enter marine waters, if the runoff is not adequately controlled.

Design features and methods that will be used to control surface runoff, reduce the potential for erosion, and prevent the offsite siltation of receiving waters will be adopted. Prior to construction of the drainage diversion at Lo Tsz River, the upstream river water will be diverted. This indicates no river water will pass through the works area and hence the construction works will not affect the water quality of Lo Tze River. Site inspections will be undertaken to ensure the ongoing suitability and good repair of the adopted erosion control measures. In particular, inspections will be undertaken before and after heavy rainfall events. The site runoff will be treated, if required, and checked for compliance with the appropriate standards prior to being discharged.

As construction runoff is expected to be managed through good site practice, no unacceptable impacts to sensitive receivers are predicted.

Associated water quality impacts to marine ecological resources during the construction phase include sediment release associated with dredging and sand filling works. Potential impacts to water quality from sediment release are listed below:

- increased concentrations of suspended solids (SS);
- a resulting decrease in DO concentrations; and,
- an increase in nutrient concentrations in the water column.

Suspended Solids (SS)
Intertidal Habitats: Intertidal habitats within the Study Area, which may be affected by the dredging and sand filling works, include the artificial/ disturbed shorelines at Tai Mei Tuk and mangrove near stream mouth of Shan Liu River and Ting Kok SSSI. Scouring, due to very high SS levels (eg > 100 mg L^{-1}) may inhibit the survival of algae, thereby reducing the food supply to the numerous rocky shore herbivores and causing intolerant or less competitive species to become locally extinct. Mangrove plants and intertidal soft bottom fauna inhabit in soft shore subject to high suspended solid seawater, and adapted muddy environment. Impacts on the mangrove plants and intertidal soft bottom fauna due to the slight elevation of seawater SS concentration would not be expected. Sediment dispersion results predict that SS concentrations will not exceed 10 mg L^{-1} at these shores. It is thus expected that unacceptable impacts to these intertidal assemblages, as well as mangrove plants, arising from elevated SS levels will not occur.

Subtidal Soft Benthos: Sessile organisms within the benthos will be susceptible to the effects of increased sediment loads. Effects can be lethal or sub lethal (eg reduction in reproductive potential due to stress incurred by constantly having to flush out the depositing material). The effects of sedimentation on organisms will also depend on other factors, such as an organism's tolerance, growth orientation of sessile organisms and water movement. Infaunal benthic assemblages in Hong Kong are located in soft muds and sands which are frequently disturbed by storms, seabed currents and constant trawling activity which rework the sediments creating high suspended sediments loads in the water column. Benthic invertebrates are, therefore, not likely to be adversely affected by the dredging operations with respect to sediment suspension and settlement but more so from any direct habitat loss within the Project Site (see above for discussion).

Impacts to benthic assemblages immediately outside of the Proposed Land Requirement Boundary are expected to occur temporarily as deposition rates are predicted to be < 12.5 g m^{-2}. The area is expected to be small, as sediment will be deposited within a short distance of the dredging and sand filling works (*Figures 6.3 – 6.6*). As the affected areas will be recolonised by fauna typical of the area, the temporary loss of these low ecological value assemblages is deemed acceptable.

Subtidal Hard Surface Habitats: Hard corals may be injured by both high suspended sediment concentrations and high deposition rates. Damage (sublethal effects) or mortality (lethal effects) can result from a reduction in light penetration which kills the photosynthesising symbiotic algae associated with the hard corals, and also from the deposition of sediment onto the coral's surface which physically blocks the respiratory and feeding apparatus. As discussed in *Section 6*, a tolerance criterion of 10 mg L^{-1} is adopted in this EIA for hard corals. Elevations of SS in the water column at the coral colonies identified locations are very small and within the tolerance level of the hard corals. Therefore, adverse impacts to the hard corals are not predicted to occur.

Sediment Deposition

Impacts to the hard corals at the artificial/ disturbed seashore, natural rocky shores at Yeung Chau and Ma Shi Chau are unlikely to occur as sediment deposition rates from the dredging and sand filling works are predicted to be less than 12.5 g m^{-2} day^{-1} (see water quality assessment in *Section 6*), which is below the threshold value for hard corals (100 g m^{-2} day^{-1}). Consequently, impacts are not predicted to occur.

Dissolved Oxygen

The relationships between SS and DO are complex, with increased SS in the water column combining with a number of other factors to reduce DO concentrations in the water column. Elevated SS (and turbidity) reduces light penetration, lowers the rate of photosynthesis by phytoplankton (primary productivity) and thus lowers the rate of oxygen production in the water column. This has a particularly adverse effect on the eggs and larvae of fish, as at these stages of development, high levels of oxygen in the water are required for growth due to their high metabolic rate. DO depletions are most likely to affect sessile organisms as they cannot move away from areas where DO is low (unlike mobile species such as fish). Depletions of DO as a result of the dredging and sand filling activities have been predicted to be undetectable and compliant with the relevant WQOs. It is thus expected that unacceptable impacts to the marine ecological habitats and populations present in the vicinity of the Project Site, including habitats that support growth of hard corals, are not expected to occur.

Nutrients

High levels of nutrients (total inorganic nitrogen - TIN and ammonia) in seawater can cause rapid increases in phytoplankton often to the point where an algal bloom occurs. An intense bloom of algae can lead to sharp increases in DO levels in surface water. However, at night and when these algae die there is usually a sharp decrease in the levels of dissolved oxygen in the water, as dead algae fall through the water column and decompose on the bottom. Anoxic conditions may result if DO concentrations are already low or are not replenished. This may result in mortality to marine organisms due to oxygen deprivation. The modelling results have indicated that the levels of TIN and ammonia do not change appreciably from background conditions during the construction works. It is thus expected that unacceptable impacts to the marine ecological habitats and populations present in the vicinity of the Project Site, including habitats that support corals, will not occur.

Impacts to the Plover Cove Country Park and *Pat Sin Leng Country Park*

Both of the Plover Cove Country Park and Pat Sin Leng Country Park are located approximately 450m from the Proposed Land Required Boundary and direct impacts (ie habitat loss and construction runoff) due to the Project are not anticipated. Secondary impacts to the Country Parks associated wildlife may arise from the potential for increased noise impact and human activities. The impacts are expected to be low owing to the remoteness from the Project Site, and given that regular site audits on good construction practice and surface water management system will be employed at the Project Site during the construction phase.

Impacts to the SSSI

Ting Kok SSSI is located approximately 500m from the Proposed Land Requirement Boundary. As the SSSI are of high ecological value it was represented as sensitive receiver in the water quality model. The information from the modelling (presented in *Section 6 Table 4.7*) indicates that depletions of DO and elevations of SS, nutrients and chlorophyll a levels as a result of the project were reported as undetectable and compliant with the relevant WQOs.

Impacts to the Conservation Area

The Conservation Area (pond) is located approximately 400m from the Proposed Project Boundary and direct impacts (ie habitat loss and construction runoff) due to the Project are not anticipated. Secondary impacts to the pond associated wildlife may arise from the potential for increased noise impact and human activities. The impacts are expected to be low owing to the current disturbed nature of the surrounding environments of the Conservation Area (village area, barbeque site and bus terminal), and given that regular site audits on good construction practice and surface water management system will be employed at the Project Site during the construction phase.

Other Impacts

Secondary impacts to the surrounding terrestrial habitats (generally with low ecological value) and associated wildlife may arise from the potential for increased noise impact, human activities and disturbance such as hill fire, import, storage or dumping of construction materials and construction site runoff. The impacts are expected to be low owing to the current disturbed nature of the majority of the Project Site, and given that regular site audits on good construction practice and surface water management system will be employed during the construction phase.

There are 38 mooring buoys for the leisure yachts, which are located in the vicinity of the proposed footprint of the beach development. However, it was suggested that 12 of the existing mooring buoys should be permanently relocated as shown on *Figure 3.1*. Given that the 12 mooring buoys will be relocated next to the existing mooring facilities and the subtidal soft bottomed habitat potentially to be affected are of low ecological value, it is expected that unacceptable impacts to the marine ecological habitats will not occur.

8.9.2 Operation Phase

All waste water generated from the Proposed Beach Development will be collected by a proper sewage system and therefore the associated water quality and ecological impacts will not be anticipated. The main concern of the associated impacts is considered to be due to the change of hydrodynamics and erosion of the bathing beach resulting in change of sedimentation pattern on the nearby coastal habitats, in particular mangrove at the Ting Kok SSSI, during operation. With incorporation of well designed beach dimension and groyne structures, the sediment transport and siltation under the influence of hydraulic forces during the operational phase will be minimal and the net drift of beach sand will not be significant (refer to the details of the wave and sediment transport modelling in *Appendix B*). Therefore the associated impacts due to the change in sedimentation pattern are not expected.

In addition, selection of sand source will be approved by CEDD to ensure that the sand will contain low concentrations of contaminants. The potential sand sources will be either from Haikou, NanSha or Weihai of the Mainland China or from Vietnam. The sand distributors will export sand to Hong Kong following the technical notes of WBTC 10/95 and WBTC 10/95A to ensure the requirement on the particular size and the quality are met. Therefore, no adverse impact on the nearby marine ecological resources would result.

Maintenance dredging is not anticipated during the operation of the Proposed Beach Development. Maintenance sandfilling is not anticipated in the near future during the operation of the Proposed Beach Development. As a result, impacts to marine ecology are not anticipated.

The stream bed and banks of the lower course of Lo Tsz River (of low ecological value) will largely remain untouched (except approximately 10m section close to the existing culvert), but the stream flow will be diverted to the proposed western drainage. As a result the lower course of Lo Tsz River will only be influenced by the seawater without freshwater input from the upper course. Given that the recorded estuarine fish species (Mudskipper and Common Silver-biddy) can still utilise the lower course of Lo Tsz River and there was low number of exotic freshwater fishes (Mosquito Fish and Variable Platyfish, which are common in the vicinity no unacceptable impacts will be expected. It should be noted that the affected exotic fishes can adapt a variety of habitats such as the rocky bottom of the new drainage channel and therefore they are expected to recolonise the new drainage channel quickly from the upper Lo Tsz River. In addition, based on the water quality impact assessment (*Section 6.5.2*), the division is unlikely to cause any significant change in water quality of surrounding waters and hence it is not expected that the diversion works would impact the nearby marine ecological resources.

8.9.3 Cumulative Impact

The Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94) will carry out works connecting the unsewered areas to existing sewage channel from Tung Lo Wan to Tai Mei Tuk, which are in the vicinity of the Proposed Beach Development and may be undertaken concurrently within the construction period of the bathing beach. The construction work of the sewage work will be mainly trenching work within the village area, which is considered of habitat of generally low ecological value. Cumulative impacts are expected to be low owing to the current disturbed nature and low ecological quality of the village areas, and given that regular site audits on good construction practice and surface water management system will be employed at the Project Site during the construction phase.

8.9.4 Impact Evaluation

Construction Phase

Habitat Loss - Potential impacts to ecology have been evaluated according to Table 1 of *Annex 8* of the *EIAO-TM*. *Tables 8.27 – 8.30* present an evaluation of the habitat loss due to the Proposed Beach Development.

Table 8.27: Overall Impact Evaluation for Sandy Shore with Backshore Vegetation

Evaluation Criteria	**Sandy Shore with Backshore Vegetation**
Habitat quality	Low
Species	The potential exists for direct and indirect impacts to the wildlife, particular species of less mobility.
Size/Abundance	Area loss is approximately 0.5ha permanently. Approximately 80 mangrove seedlings/ plants (with a height below 0.5m) of *Aegiceras corniculatum, Avicennia marina* and *Kandelia obovata* potentially affected.
Duration	The impact will persist during the construction and operation phases. Compensatory mangrove seedling planting will expect to be provided during operation phase.
Reversibility	The sandy shore with backshore vegetation is readily re-creatable
Magnitude	The scale of the habitat loss is moderate in the context of the surrounding similar habitats.
Overall Impact Conclusion	**Low**

Table 8.28: Overall Impact Evaluation for Stream

Evaluation Criteria	**Lower Course of Lo Tsz River**
Habitat quality	Low, partially channalised and polluted, subject to tidal influence.
Species	The potential exists for direct and indirect impacts to the wildlife, particular species of less mobility. Small population of estuarine common fish species (Mudskipper and Common Silver-biddy) and exotic freshwater fishes (Mosquito Fish and Variable Platyfish) potentially affected.
Size/Abundance	Area loss is approximately 10m permanently.
Duration	The impact will persist during the construction and operation phases.
Reversibility	Stream habitat can be re-created.
Magnitude	The scale of the habitat loss is low in the context of the surrounding similar habitats.
Overall Impact Conclusion	**Low**

Table 8.29: Overall Impact Evaluation for Village/ Modified Area

Evaluation Criteria	**Village/ Modified Area**
Habitat quality	Low
Species	The potential exists for direct and indirect impacts to the wildlife, particular species of less mobility and species of conservation interests including Common Rat Snake.
Size/Abundance	Area loss is approximately 1.0ha permanently.
Duration	The impact will persist during the construction and operation phases.
Reversibility	The village/ modified area is readily re-creatable.
Magnitude	The scale of the habitat loss is small in the context of the surrounding similar habitats.
Overall Impact Conclusion	**Low**

Table 8.30: Overall Impact Evaluation for Intertidal and Subtidal Soft bottomed Habitat

Evaluation Criteria	**Intertidal and Subtidal Soft bottomed Habitat**
Habitat quality	Low
Species	The potential exists for direct and indirect impacts to the marine faunal species, particular benthic species of less mobility.
Size/Abundance	Area loss is approximately 2.3ha permanently and 3.1ha temporarily.
Duration	The impact will persist during the construction and operation phases.
Reversibility	Impacts to the benthic assemblages inhabiting the soft bottom habitats within the Proposed Land Requirement Boundary are expected to be relatively short term and recolonisation of the sediments is expected to occur for the temporary affected areas (areas to be dredged without sand filling). Certain kind of species may be able to colonise the sandy bottom after the sand filling.
Magnitude	The scale of the habitat loss is small in the context of the surrounding similar habitats.
Overall Impact Conclusion	**Low**

Impacts to Terrestrial Wildlife

Reduction of wildlife species abundance/diversity and ecological carrying capacity is expected to be minimal due to the loss of a relative small area of low quality habitat. Human disturbance has also limited most of the wildlife usage, and the area is not the favourite habitat of general wildlife.

The impacts due to the loss of foraging ground are also considered to be minimal given that the large extent of less disturbed habitats in the vicinity, and the affected areas located next to the currently highly disturbed areas.

In view of similar habitat in the vicinity and high mobility of the fauna species of conservation interest (Common Rat Snake), it is anticipated that the construction and operation of the bathing beach will not cause any adverse impacts to the species.

Habitat Fragmentation and Isolation

Habitat fragmentation and isolation are not expected as the majority of the affected habitats are either disturbed or located next to the modified areas. It should be noted that the marine organisms freely move in the sea, which are less affected by such fragmentation and isolation effects than terrestrial habitats.

Impacts to Marine Ecological Resources

The impacts on the intertidal (organisms in artificial/ disturbed seashore and mangrove) and subtidal (soft benthos and coral) communities, as well as Ting Kok SSSI, due to the marine works (including dredging, sand filling and relocation of mooring buoys) are considered low given that unacceptable impacts on the water quality, sediment deposition and are not predicted to be occurred.

The proposed orientation of the beach is aligned at 145° to the north and the wave and sediment modelling results presented in *Appendix B* shows that the net longshore drift of the sediment is not significant (10 to 150 m^3 per year) for sediment sizes of 0.25mm, 0.3mm and 0.5mm. However, with the groynes in position, the sediment will eventually drift towards the western groyne and in general be contained by the groynes. In addition, there is no significant problem with cross-shore sediment movement under storm wave conditions. Therefore, the sediment transport and siltation under the influence of environmental forces during the operational stages will be negligible with the groynes constructed at both sides of the beach, and impacts on the surrounding ecological sensitive habitats in particular mangrove are not expected to be anticipated.

Other Impacts

Secondary impacts to the surrounding habitats (generally with low ecological value) and associated wildlife may arise from the potential for increased noise impact, human activities and disturbance such as hill fire, import, storage or dumping of construction materials and construction site runoff. The impacts are expected to be low owing to the current disturbed nature of the majority of the Proposed Beach Development, and given that regular site audits on good construction practice and surface water management system will be employed during the construction phase.

Operation Phase

The associated impacts of operation of the Proposed Beach Development due to the change in sedimentation pattern will be minimised by incorporation of well designed beach dimension and groyne structures and therefore unacceptable impacts are not expected. The impacts due to the western drainage diversion works are expected to be minimal given the low quality of the lower water course of Lo Tsz River and affected estuarine (Mudskipper and Common Silver-biddy) and exotic (Mosquito Fish and Variable Platyfish) freshwater fishes could utilise the lower water course of Lo Tsz River and new drainage channel.

8.10 Mitigation Measures

Annex 16 of the *EIAO-TM* states that the general policy for mitigation of significant ecological impacts, in order of priority, is:

Avoidance: Potential impacts should be avoided to the maximum extent practicable by adopting suitable alternatives;

Minimisation: Unavoidable impacts should be minimised by taking appropriate and practicable measures such as constraints on intensity of works operations or timing of works operations; and

Compensation: The loss of important species and habitats may be provided for elsewhere as compensation. Enhancement and other conservation measures should always be considered whenever possible.

At each stage, residual impacts are to be re-assessed to determine whether there is a need to proceed to the next stage of mitigation. The following measures have been modified in accordance with this approach to mitigate the impacts.

8.10.1 Avoidance

As part of the site selection process for the Proposed Beach Development, potential sites within Tai Po have been analysed (see Section of this EIA Report). Disturbance to ecological resources of acknowledged conservation significance was avoided by screening out the following areas from consideration:

- Areas with significant ecological interests, such as Plover Cove Country Parks, Ting Kok SSSI, Coastal Protection Area and Conservation Area;
- Direct loss of mangrove habitat; and
- Impacts due to the dredging and sand filling to the Fish Culture Zone at Yim Tin Tsai (East).

The Proposed Beach Development avoided ecological sensitive areas and is not considered to contain important wildlife and floristic habitat. Furthermore, the Proposed Beach Development will be mainly located in habitats already disturbed (ie village/ disturbed area) and reduced size of reclamation.

8.10.2 Minimisation

The previous discussion in *Sections 8.9* and *8.10.1* has indicated that the Project Site already avoided ecological sensitive areas and the potential ecological impacts due to the construction and operation of the Proposed Beach Development are considered to be low. Although the mitigation of avoidance effectively avoided significant ecological impacts, the following measures are recommended to further reduce the potential impacts and disturbance to the surrounding habitats.

Measures for Common Rat Snake

- To undertake a search of the Common Rat Snake within the land based Project Site just before the commencement of the construction works. Due to the small size of the Project Site and given that there are no optimal habitats for Common Rat Snake, one day-time search is considered sufficient. The surveyor(s) should actively search the areas within the Project Site and pay special attention to the leaf litters and rocks. All recorded Common Rat Snake should be caught by hand and translocated to the shrubland at the north of the Study Area, immediately after the search. The Common Rat Snake search and translocation works should be undertaken by a qualified ecologist with relevant experience in faunal translocation works.

Dredging and Sand Filling Operations

It is predicted that the sediment plume and the sediment deposition will not be large in extent and no unacceptable water impacts including DO depletion, release of contaminants and nutrients are expected. Although no unacceptable water quality impacts would result, the following good construction site practice and proactive precautionary measures are recommended to ensure dredging and sandfilling operations would be undertaken in such a manner as to avoid any uncontrolled or unexpected incidents during the marine works:

- A movable cage type / metal frame type silt curtain, as shown in *Figure 6.20*, should be deployed around the dredging area next to the grab dredger prior to commencement of dredging works;

- Standing type silt curtains, as shown in *Figure 6.21*, should be deployed around the proposed sandfilling extent prior to commencement of sandfilling works;

- Proper equipment, dredging rate, filling rate and good construction practices should be implemented, details refer to *Section 6.6.1*.

Measures for Controlling Construction Runoff

- Storm water run-off from the construction site should be directed into existing drainage channel via adequately designed sand/silt removal facilities such as sand/silt traps and oil interceptors. Channels, earth bunds or sand bag barriers should be provided on site to properly direct storm water to such silt removal facilities.

Planting along the Western Drainage Diversion

- Provide tree/ shrub/ climber planting along the gabion wall of the new drainage channel. Tree/ shrub species with fruits to provide food for birds such as *Ficus microcarpus*, *Syzygium jambos*, *Cinnamomum camphora*, *Ilex asprella* and *Ilex rotunda* are recommended. Regular monitoring and manual removal of the weed plant *Mikania micrantha* during the establishment and maintenance period is recommended.

Good Construction Practices

- Erect fences along the boundary of the proposed site before the commencement of works to prevent vehicle movements, and encroachment of personnel, onto adjacent areas; and

- Regularly check the work site boundaries to ensure that they are not breached and that damage does not occur to surrounding areas.

Further to the implementation of the above recommended mitigation measures, no unacceptable ecological impacts will expect to be anticipated.

8.10.3 Compensation

A total of about 6.9ha (3.8ha permanent loss and 3.1ha temporary affected) of habitats will be impacted by the construction and operation of the Proposed Beach Development, of which about of about 0.5ha of backshore vegetation shrubland, about 0.8ha village/modified area and about 10m of Lo Tsz River will be lost, and 5.4ha (2.3ha permanent loss and 3.1ha temporary loss) of intertidal and subtidal soft bottomed habitats will be impacted (see *Table 8.26*). The ecological values of the impacted habitats are considered to be low (see *Table 8.26*). It is therefore considered not necessary to compensate for these impacted habitats.

It is noted that approximately 80 mangrove seedlings/ plants (with a height below 0.5m) within the Project Site may be removed during construction. As an additional measure to further minimise the ecological impact, mangrove seedling planting prior the operation of the beach is recommended for the Proposed Beach Development. Due to the limited available size of within the Project Site, the mangrove seedling planting is proposed to be undertaken along the outer sides of the groynes and western drainage channel at a level of about 1.2 to 1.6 mPD with a total size of 300m^2 (exact location refers to *Figure 10.19*). The planting mix is recommended at a ratio 1:1:1 for *Aegiceras corniculatum, Avicennia marina* and *Kandelia obovata.* Assuming the planting distance between each planting individual will be 0.5m, a total of approximately 382 mangrove seedlings will be provided. Detailed mangrove seedling planting proposal providing information of planting methodology, recipient sites, planting species and mix, implementation programme, post-planting monitoring and personal involved shall be submitted to and approved by EPD and AFCD. Mangrove seedling planting should be undertaken and supervised by a suitably qualified botanist/ horticulturist. After planting, one year monitoring should be undertaken to check the performance and health conditions of the planted individuals on a monthly basis. Regular monitoring and manual removal of the weed plant *Mikania micrantha* during the establishment and maintenance period is recommended, as it was found in the modified area and shrubland in Lung Mei area. Remedial actions should be discussed with AFCD in the event of unsuccessful mangrove seedling planting and follow an approved Event and Action Plan as indicated in *Table 8.31*.

Table 8.31: Event and Action Plan for Mangrove Seedling Planting

Monitoring Criteria	**Event**	**Action**	
		Environmental Team Leader/ Environmental Manager (employed by CEDD)	**CEDD**
Mangrove Seedling Survival	More than 25% of mortality of mangrove seedling recorded during the establishment of planting.	1. Notify CEDD and check with horticulturist to find out the cause of the event(s).85	1. Identify and report the cause(s) of the event.
		2. Undertake bi-weekly monitoring to observe the growth performance of the seedling. The normal monitoring schedule will be resumed if the cause(s) of the event have been identified.	2. Notify relevant government departments (ie EPD and AFCD).
	More than 50% of mortality of mangrove seedling recorded during the establishment of planting.	1. Notify CEDD and check with horticulturist to find out the cause of the event(s).	1. Identify and report the cause(s) of the event.
		2. Undertake weekly monitoring to observe the growth performance of the seedling. The normal monitoring schedule will be resumed if the cause(s) of the event have been identified.	2. Submit proposals to relevant government departments (ie EPD and AFCD) for remedial action and implement the action to solve the event.

The proposed mitigation measures will expect to effectively mitigate the identified ecological impacts.

8.11 Residual Impacts

There will be the permanent loss of approximately 0.5 ha backshore vegetation, approximately 0.8 ha village/modified area, approximately 10 m of Lo Tsz River, approximately 2.3 ha intertidal and subtidal soft bottomed habitat due to the Proposed Beach Development. Due to the loss of low quality habitats and high mobility of faunal species to be impacted, the residual impacts are considered to be low. With the implementation of the proposed mitigation measures including provision of mangrove seedling planting (over 320 mangrove seedlings to compensate for the loss of approximately 80 individuals) and undertaken of good construction practice, no adverse residual impact due to the construction and operation of the Proposed Beach Development is expected.

8.12 Environmental Monitoring and Audit

8.12.1 Construction Phase

The implementation of the ecological mitigation measures stated in *Section 8.10* should be checked as part of the environmental monitoring and audit procedures during the construction phase.

8.12.2 Operation Phase

The implementation of the ecological mitigation measures stated in *Sections 8.10* and 8.*11* should be checked as part of the environmental monitoring and audit procedures during the operation phase.

As an additional measure, mangrove seedlings of *Aegiceras corniculatum, Avicennia marina* and *Kandelia obovata* should be planted before the operation of the Proposed Beach Development. Detailed mangrove planting proposal providing information of planting methodology, recipient site, planting species and mix, implementation programme, post-planting monitoring and personal involved shall be submitted to and approved by EPD and AFCD. Mangrove seedling planting should be undertaken and supervised by a suitably qualified botanist/ horticulturist. After planting, one year monitoring should be undertaken to check the performance and health conditions of the planted individuals on a monthly basis. Remedial actions should be discussed with AFCD in the event of unsuccessful mangrove seedling planting.

8.13 Conclusions

The ecological resources recorded within the Study Area include secondary woodland, shrubland, stream, pond, sandy shore with backshore vegetation, village/modified area, mangrove, sandy shore and artificial/ disturbed shoreline, as well as subtidal soft and hard bottom and associated wildlife. Of these habitats, mangrove has high ecological value, secondary woodland has moderate to high ecological value and shrubland has moderate ecological value. The remaining habitats are of low to low to moderate ecological value.

A total of 3 coral species (including *Oulastrea crispate, Cyphastrea serailia* and *Psammocora superficialis* which considered as common species in Hong Kong) and 20 terrestrial species of conservation interest were recorded within the Study Area, including 2 plant species (Red Azalea and Incense Tree), 4 bird species (Black Kite, White-bellied Sea Eagle, Osprey and Created Goshawk), 13 uncommon butterfly species (Brown Pansy, Common Nawab, Danaid Egg-fly, Dark Evening Brown, Great Swift, Indian Palm Bob, Painted Jezebel, Plain Tiger, Silver Streak Blue, South China Bush Brown, Tailed Sulphur, White-edged Blue Baron and Yellow Orange Tip) and one reptile species (Common Rat Snake).

The Proposed Beach Development will be located mainly in low quality habitats, including village/modified area, sandy shore with backshore vegetation, and partially channelised stream. The potential impacts on the natural habitats are considered to be low and the corals within the Study Area and area in the close vicinity would not subject to any direct loss (due to construction works) or indirect impact (due to change of water quality). No adverse residual impacts are expected after the implementation of the recommended mitigation measures. The measures include the adoption of good construction practices and provision of mangrove seedling planting. These measures will reduce potential disturbance to the surrounding environment. Environmental monitoring and audit measures in form of regular checks as part of site inspections are recommended.

9 FISHERIES IMPACT ASSESSMENT

9.1 Introduction

This Section of the EIA Report presents the findings of an impact assessment on existing fisheries resources, fishing operations and fish culture activities from the construction and operation of the Proposed Beach Development. The assessment is based on the Project Description (*Section 3*) and the findings of the Water Quality Assessment (*Section 6*).

9.2 Relevant Legislation and Guidelines

9.2.1 Technical Memorandum

The criteria for evaluating fisheries impacts are laid out in the EIAO-TM. Annex 17 of the EIAO-TM prescribes the general approach and methodology for the assessment of fisheries impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential impacts. EIAO-TM Annex 9 recommends the criteria that are to be used for evaluating fisheries impacts.

9.2.2 Other Legislation

Other legislation which applies to fisheries includes:

- *Fisheries Protection Ordinance* (Cap 171) 1987 which provides for the conservation of fish and other aquatic life and regulates fishing practices.

- *Marine Fish Culture Ordinance* (Cap 353) 1983 regulates and protects marine fish culture and other related activities.

- *Environmental Impact Assessment Ordinance* (cap. 499), Section 5(7) - *Environmental Impact Assessment Study Brief* no. *CE-59/2005 (EP) Section 6.2.9* which outlines the key fisheries impacts to be reviewed and assessed in the EIA report.

9.3 Literature Review

In Hong Kong, marine-based commercial fishing operations are classified as either capture or culture fisheries.

9.3.1 Capture Fisheries

In 2005, Hong Kong's capture fisheries' fishing fleet comprised about 4,200 vessels. The Hong Kong fleet was manned by 9,200 local fishers, mainly family members, and also employed 4,250 Mainland deckhands. In terms of production, in 2005, the capture fisheries industry yielded about 162,000 tonnes of fisheries produce valued at about HK$1,600 million (1). Fishing activities are mainly conducted in waters of the adjacent continental shelf in the South China Sea.

Some recent data on the local capture fisheries industry are shown in *Table 9.1*. Since 1999, Mainland Authorities have implemented a fishing moratorium for two months during midsummer for South China Sea fishing grounds. This fishing ban (from 1 June to 1 August) prohibits fishing activity by all Hong Kong fleet, including the trawlers and purse seiners in the South China Sea outside Hong Kong Special Administrative Region (HKSAR) waters except by gill-netting, long-lining, hand-lining and cage trapping.

Table 9.1: Hong Kong Capture Fisheries Industry Figures (2)

	1999	2000	2001	2002	2003	2004	2005
Fishing fleet size (No. of vessels)	5,170	5,250	5,100	4,770	4,630	4,330	4,150
Portion of fishing fleet comprising sampans (P4) and non-mechanised vessels	44%	51%	54%	53%	No data	No data	No data
Local fishers engaged in capture fisheries	12,900	11,900	11,560	10,860	10,100	9,770	9,170
Mainland deckhand employed	6,300	5,200	4,560	4,100	3,800	4,090	4,250
Production (tonnes)	127,780	157,010	174,000	169,790	157,400	167,500	161,960
Value of produce (HK$ million)	1,500	1,600	1,700	1,600	1,500	1,600	1,600

Based on the latest Agriculture, Fisheries and Conservation Department (AFCD) Port Survey data (i.e. 2001/2002) (3), the highest fisheries production (600 to 1,000 kg ha^{-1}) in Hong Kong was recorded near Cheung Chau, Penny's Bay, Kau Yi Chau, Po Toi, Ninepin Group and Tap Mun. The top 10 families captured in Hong Kong were rabbitfish (Siganidae), sardine (Clupeidae), croaker (Sciaenidae), scad (Carangidae), squid, shrimp, anchovy (Engraulidae), crab, seabream (Sparidae) and threadfin bream (Nemipteridae).

9.3.2 *Culture Fisheries*

Culture fisheries activities occur at 26 gazetted fish culture zones (FCZs) located in various sheltered bays across the HKSAR and occupy about 209ha of sea area. Fish farms are typically small scale, family-run operations that consist of one or two rafts with an average size of about 260m^2. In 2006, there were 1,080 licensed operators at these FCZs (4). Since June 2002, operators have been allowed to transfer licences following an amendment to the Marine Fish Culture Ordinance. According to the latest available information, in 2006 the annual production by the marine fish culture industry was about 1,488 tonnes of fish valued at HK$89 million and catering for about 7.9% of local demand for live marine fish. Some recent figures on the local marine culture fisheries are presented in *Table 9.2*.

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(1) Data from Agriculture, Fisheries and Conservation Department. Web site www.afcd.gov.hk. Accessed on 28 Aug 2007.

(2) Data from Hong Kong Yearbook. Website: http://www.yearbook.gov.hk. Accessed on 28 Aug 2007.

(3) Agriculture, Fisheries and Conservation Department (2002). Port Survey 2001/2002. Web site www.afcd.gov.hk. Accessed on 28 Aug 2007.

(4) Data from Agriculture, Fisheries and Conservation Department. Web site www.afcd.gov.hk. Accessed on 28 Aug 2007.

Table 9.2: Hong Kong Culture Fisheries Industry Figures (1)

	1999	2000	2001	2002	2003	2004	2005	2006
Licensed mariculturists	1454	1418	1320	1237	1157	1125	1104	1080
Production (tonnes)	1250	1770	2470	1210	1490	1540	1540	1488
Value (HK$ million)	66	102	136	57	76	79	76	89

9.4 Assessment Methodology

The Study Brief has defined the Study Area as all areas within 500m distance from the Proposed Beach Development and any other areas likely to be impacted. It also specified special attention be paid to the Yim Tin Tsai (East) Fish Culture Zone.

A desktop literature review was conducted in order to examine the fisheries baseline conditions and establish the importance of the area. This review included the latest relevant fisheries baseline data presented in AFCD's Port Survey 2001/2002 and incorporated the most recent information available in other reports and publications.

The importance of potentially impacted fishing resources and fisheries operations identified within the Study Area was assessed using the approach described in the EIAO-TM. The potential impacts due to the construction and operation of the Project and associated developments were then assessed (with reference to the EIAO-TM Annex 17 guidelines) and the impacts evaluated (with reference to the criteria in EIAO-TM Annex 9).

9.5 Baseline Conditions and Fisheries Sensitive Receivers

9.5.1 Capture Fisheries

Fishing Vessels

The overall number of fishing vessels that operated in 2001 and 2002 in the waters adjacent to the Proposed Beach Development is presented in *Figure 9.1* (2). It was reported that there were approximately 100 to 400 fishing vessels that operated in the waters adjacent to Lung Mei. Of these, the majority of the vessels were sampans (100 – 400 vessels). The only other vessels types to operate in these waters were gill-netters and purse seiners, which were reported to number less than 10 vessels each. No trawlers were reported to operate within 500m of the project boundary, presumably on account of the shallow nature of the water and because the area is obstructed to a certain degree by moored leisure craft.

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(1) Data from websites of Hong Kong Yearbook and Agriculture, Fisheries and Conservation Depart. *Op. Cit.*

(2) Agriculture, Fisheries and Conservation Department (2002). *Op. Cit.*

Fisheries Production

Adult Fish by Weight: With reference to the grid system developed by AFCD (*Figure 9.2*), about 100 - 200 kg ha^{-1} of adult fish production was recorded in 2001 and 2002 around the Proposed Beach Development, which is considered to be low to medium level compared to other Hong Kong waters. Production of rabbitfish, sardine and squid was reported to amount to 10 – 20 kg ha^{-1} each, whilst for scad and crab, production levels were reported at 5 – 10 kg ha^{-1} each. For croaker, shrimp, anchovy, seabream and threadfin bream, low production levels of <5 kg ha^{-1} for each were reported.

Fish Fry by Weight: A moderate level of fish fry production (100 - 500 tails ha^{-1}) was reported from around Lung Mei as is the case throughout the Tolo embayment (*Figure 9.3*). Fish fry production is used to supply grow out stock for the mariculture industry.

Adult Fish & Fish Fry by Value: Based on the AFCD 2001/2002 Port Survey data, the overall catch value of both adult fish and fish fry recorded for the waters surrounding the Proposed Beach Development was in the range of HK$ 2000 – 5000 (*Figure 9.4*) whereas the value was in the range of HK$ 5000 – 10,000 in most of the areas within Tolo Harbour outside the Proposed Beach Development. Compared to other Hong Kong waters the catch value in the Proposed Beach Development was considered to be at a medium level. Compared to the other areas within Tolo Harbour, the catch value in the Proposed Beach Development was considered to be lower.

Spawning and Nursery Areas

The waters surrounding Lung Mei do not coincide with areas previously identified in the literature as important nursery or spawning grounds for commercial fisheries resources. Outside the 500m Study Area and approximately 3km from the project boundary, the waters of the Tolo Channel are reported to be part of a nursery area for commercial fisheries resources which covers a swathe of Hong Kong northeast waters spanning Tolo Harbour and part of Mirs Bay (1). This nursery area is located sufficiently remote from the Proposed Land Requirement Boundary as to not be affected by the works.

9.5.2 *Culture Fisheries*

The closest designated Fish Culture Zone (FCZ) to the Study Area is located approximately 1.5 km to the south of the project boundary at Yim Tin Tsai East. This FCZ of 149,50 m^2, has 289 licensed rafts in a licensed area of 20,556m^2 and which are operated under 81 licences (2).

Although there are other FCZs located around the Tolo embayment (eg Yim Tin Tsai, Kau Lau Wan, Lo Fu Wat, Sham Wan, Tap Mun and Yung Shue Au), their location is sufficiently remote that they would not be affected by the project works.

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(1) ERM-Hong Kong, Ltd. (1998). Fisheries Resources and Fishing Operations in Hong Kong Waters, Final Report for Agriculture, Fisheries and Conservation Department.

(2) Maunsell Consultants Asia Ltd. (2007). Drainage Improvement in Sha Tin and Tai Po. EIA Report.

Although there are no figures available for individual production of designated FCZs, it is known that the main species cultured in Hong Kong are the spotted grouper (*Epinephelus coioides*), gold-lined seabream (*Rhabdosargus sarba*), mangrove snapper (*Lutjanus argentimaculatus*) and the pompano (*Trachinotus blochii*).

9.5.3 Proposed Fisheries Protection Area

A Fisheries Protection Area has been proposed under the Fisheries Protection Ordinance which encompasses most of the Tolo embayment and includes Plover Cove where Lung Mei is located. Although designated to provide specific controls on fishing activities, the area can be regarded as a sensitive water body and any impacts should be minimised as far as possible during construction to achieve compliance with the Water Quality Objectives or Assessment Criteria.

9.5.4 Fisheries Importance

The importance of the fisheries resources within the Study Area is addressed based on the baseline information provided above. The fishing areas within Tolo Harbour are generally of medium to high commercial values when compare with other areas of Hong Kong Waters. The fishing areas at the Proposed Beach Development are of medium commercial value.

9.5.5 Fisheries Sensitive Receivers

Based on the information review presented above on the fisheries resources of the Study Area and its immediate vicinity, the sensitive receivers which may be potentially affected by the proposed project are:

- Yim Tin Tsai East Fish Culture Zone; and,
- Proposed Fisheries Protection Area.

9.6 Evaluation of Impacts

9.6.1 Identification of Potential Impacts

Construction Phase

The construction activities associated with the Proposed Beach Development that have the potential to cause impacts to fisheries are:

- Dredging associated with groynes and box culverts construction;

- Dredging associated with beach development; and

- Sandfilling associated with the groynes construction and beach development.

The construction of the Proposed Beach Development will involve dredging in the beach area and at the box culverts as well as sand filling in the beach area. Overall, the dredging level will vary between 0.5m to 1m at the proposed beach area and groynes, and less than 3m at the box culverts, subject to the bathymetry of the existing seabed.

Construction phase impacts to fisheries resources and fishing operations arising from the construction works of the proposed beach may be divided into those due to direct disturbances to that habitat and those due to indirect perturbations to key water quality parameters.

Direct Impacts

Up to 5.4ha of existing seabed will be affected as the result of dredging works and be replaced by sand materials and designated as gazetted beach after 2010, in which only approximately 4.7ha is defined as the beach area during operation (between the high tide mark of the shoreline and the shark prevention net). The marine work activities will also be restricted within the project and works area (up to 5.4ha) which may restrict the fishing operation. Occupation of the foreshore area by such marine works will cause a temporary loss of fishing ground, which does not cause any significant adverse impacts on local fisheries. The bathymetry of the existing beach is less than 1m close to the shore to approximately 5m at the outward boundary of the proposed beach. Due to the small area of the marine habitat permanently lost for the beach development, the adverse impacts to local fisheries resources are not predicted to be significant. It should be noted that the proposed beach is not a suitable fishing ground for trawling types of fishing vessels due to its shallow nature of water and the area is obstructed to a certain degree by moored leisure craft.

According to the fishing activities information published by AFCD (*Figures 9.1 – 9.4*), the Proposed Beach Development at Lung Mei has a lower fisheries production value (adult and fish fry) than most of the other areas within Tolo Harbour.

In view of the relative small area of the loss of fisheries habitat which has a lower fisheries production value at the Proposed Beach Development than other areas within Tolo Harbour, no significant impacts are expected to be associated with the construction works.

Indirect Impacts

Indirect impacts to fisheries resources and fishing operations during the construction phase are primarily associated with the suspension of sediments due to the marine works. Potential impacts to water quality from sediment release are listed below:

- Increased concentrations of suspended solids (SS);
- Increased turbidity and a resulting decrease in dissolved oxygen (DO) concentrations;
- Increase in nutrient concentrations in the water column; and
- Release of heavy metals and toxic chemicals from the sediment.

Suspended Solids: Suspended solids (SS) fluxes occur naturally in the marine environment (1); consequently, fish have evolved behavioural adaptations to tolerate changes in SS load (e.g., clearing their gills by flushing water over them). However, the increase in SS concentrations that would arise from the dredging would be uncharacteristic of the normal variation in marine conditions. Concentrations of SS generated via dredging are expected to be greater, particularly in the immediate vicinity of the dredger. Beyond the active dredging area, dispersion will cause a rapid decrease in the SS concentrations.

Larvae and post-juvenile fish are more susceptible to variations in SS concentrations than more mature fish since their sensory system is less developed. Adult fish are more likely to move away when they detect sufficiently elevated SS concentrations and therefore are unlikely to be significantly impacted. Larvae and post-juvenile fish are more likely to be impacted as they may not be able to detect and avoid areas with elevated levels of SS.

The SS level at which fish move into clearer water is defined as the tolerance threshold and varies from species to species at different stages of the life cycle. If SS levels exceed tolerance thresholds and the fish are unable to move away from the area, the fish are likely to become stressed, injured and may ultimately die. Susceptibility to SS generally decreases with age such that eggs are the most vulnerable and adults the least sensitive to the effects of high SS concentrations. The rate, timing and duration of SS elevations will influence the type and extent of impacts upon fish and potentially crustaceans (2) (3).

Literature reviews indicate that lethal responses had not been reported in adult fish at values below 125 mg L^{-1} (4) and that sublethal effects were only observed when levels exceeded 90 mg L^{-1} (5). However, guideline values have been identified for fisheries and selected marine ecological sensitive receivers as part of the study for AFCD, *Consultancy Study on Fisheries and Marine Ecological Criteria for Impact Assessment* (6). The values are based on international marine water quality guidelines for the protection of ecosystems. No Water Quality Objective for SS was established in Tolo Harbour. However, the AFCD study recommends a maximum SS concentration of 50 mg L^{-1} (based on half of the no observable effect concentration). Thus, this will be used as the assessment criteria for water quality impact assessment (see *Section 6.3.1*).

(1) Natural SS values for South Soko (Water Quality Assessment sampling station SM 20 - Section 6) range between 1 - 180 mg/l (EPD Water Quality Data 1998-2004)

(2) Species Profiles: Life Histories and Environmental Requirement (Gulf of Mexico) - Brown Shrimp, US Fish and Wildlife Service, 1983.

(3) The Shrimp Fishery of the Gulf of Mexico – A regional Management Plan, Gulf Coast Research Laboratory, 1977

(4) References cited in BCL (1994) *Marine Ecology of the Ninepin Islands* including Peddicord R and McFarland V (1996) *Effects of suspended dredged material on the commercial crab, Cancer magister.* in PA Krenkel, J Harrison and JC Burdick (Eds) Dredging and its Environmental Effects. Proc. Speciality Conference. American Society of Engineers.

(5) Alabaster JS & Lloyd R (1984) Water Quality Criteria for Freshwater Fisheries. Butterworths, London.

(6) City University of Hong Kong (2001). Agreement No. CE 62/98, Consultancy Study on Fisheries and Marine Ecological Criteria for Impact Assessment, AFCD, Final Report July 2001.

Temporarily elevated levels of SS are likely to occur in the immediate vicinity of the marine works (see *Section 6* - Water Quality Assessment). However, the mixing zones during the dredging and sandfilling works in marine water are small and localised. There are no predicted exceedances of the assessment criteria (50 mg L^{-1}) at the sensitive receivers including at the Yim Tin Tsai East Fish Culture Zone (Highest predicted SS level at the nearest EPD's monitoring station (TM5) is 8 mg L^{-1}) as a result of the beach construction works. As a precautionary measure, silt curtain will be provided during the dredging and sandfilling works in marine water to further minimise the potential impact that may arise.

Dissolved Oxygen: The relationships between SS and DO are complex, with increased SS in the water column combining with a number of other effects to reduce DO concentrations. Elevated SS (and turbidity) reduces light penetration, lowers the rate of photosynthesis by phytoplankton (primary productivity) and thus lowers the rate of oxygen production in the water column. Furthermore, the potential release of sediment contaminants into the water column has the potential to consume DO in the receiving water. The resulting overall DO depletion may cause an adverse effect on the eggs and larvae of fish and crustaceans, as at these stages of development high levels of oxygen in the water are required for growth to support high metabolic growth rates.

The results of the water quality assessment (*Section 6.5.1*) examining the dispersion of sediment plumes associated with all marine works has shown that the predicted maximum levels are localised. Concentrations at the sensitive receivers within the Study Area will remain compliant with the assessment criteria. The subsequent effect on dissolved oxygen within the surrounding waters is, therefore, predicted to be minimal. Unacceptable impacts to fisheries from the reduction of DO concentration are not expected to occur.

Nutrients: High levels of nutrients in seawater can cause rapid increases in phytoplankton, on occasions to the point where an algal bloom occurs. An intense bloom of algae can lead to sharp decreases in the levels of dissolved oxygen. This decrease will initially occur in the surface water, and then deepen as dead algae fall through the water column and decompose on the seabed. Anoxic conditions may result if DO concentrations are already low or are not replenished. As discussed above, reduced levels of DO can impact the eggs and larvae of fish and crustaceans which require high levels of oxygen for development. Significantly low levels of DO may also result in mortality to fish.

As with dissolved oxygen, the effect of the localised increases in suspended solid concentrations on nutrients within the surrounding waters is expected to be minimal (see *Section 6.5.1*). Unacceptable impacts to fisheries are not, therefore, anticipated.

Heavy Metals and Toxic Chemicals: The water quality assessment has shown that unacceptable water quality impacts due to the release of heavy metals and organic micro-pollutants associated with SS are not expected to occur (see *Section 6.5.1*).

The elutriate test results (undertaken for this study in 2006) indicate that concentrations of PAHs, total PCBs, TBT and all chlorinated pesticides were found below the reporting limits for all sampling locations. Moreover, the concentrations of dissolved metals in most of the samples are compliant with the assessment criteria. This indicates that dredging the sediments is unlikely to cause a detectable increase in contaminant levels in the surrounding water. Unacceptable impacts to fisheries and fish culture zone are not, therefore, anticipated.

Operation Phase

The potential impacts of the Operational Phase of the Project on the fisheries of the Study Area and the sensitive receivers can be divided into two main categories:

- Impacts arising from the altered land use due to the presence of the beach, mainly loss of fisheries habitat and the alteration of the natural marine hydrodynamic regime; and

- Impacts arising from the alteration of the benthic habitat due to the maintenance dredging and sandfilling.

As no sewage and wastewater generated from the beach building facilities will be discharged into the beach or marine environment, water quality impact due to sewage and wastewater discharge is not anticipated (see *Section 6*).

Habitat Loss

The estimated overall permanent loss of the existing shoreline will be approximately 200m (not more than 4.7ha, which defined as the beach area and will not allow for any fishing activities during operation (between the high tide mark of the shoreline and the shark prevention net)) which is deemed to be too small to cause any significant adverse impacts on the local fisheries.

Maintenance Dredging and Sandfilling

Maintenance dredging is not anticipated during the operation of the beach. Maintenance sandfilling is not anticipated in the near future during the operation of the beach. As a result, impacts to fisheries resources are not anticipated.

9.7 Assessment of Impacts

From the information presented above, the fisheries impact associated with the Proposed Beach Development is not considered to be significant. An evaluation of the impact according to *Annex 9* of the *EIAO-TM* is presented below.

- *Nature of Impact and Size of the Affected Area*: Temporary and permanent impacts will occur as a result of the loss of not more than 5.4 ha and 4.7 ha respectively of existing seabed and be replaced by sand materials in the area to be used for the proposed beach. Short-term impacts will occur to fisheries resources in the vicinity of the works area as a result of the dredging and sandfilling activities for the beach, groynes and box culverts. Temporary and localised impacts to pelagic and demersal fisheries resources as a result of perturbations to water quality are predicted to occur only in the immediate vicinity of the works areas. No significant adverse impacts to fisheries resources are expected from the construction phase of the beach and during its operation.

- *Size of Fisheries Resources/Production*: Fisheries resources and production rates are generally medium in terms of catch weight and value, when compared to other areas in Tolo Harbour and overall in Hong Kong. However, due to the shallow water and frequent recreational use of the Proposed Beach Development area for water sports, fishing operations are generally low at the Proposed Beach Development, thus the fisheries resources and production rates are lower in the Proposed Beach Development and majority of the Study Area.

- *Destruction and Disturbance of Nursery and Spawning Grounds*: The waters surrounding Lung Mei do not coincide with areas previously identified in the literature as important nursery or spawning grounds for commercial fisheries resources. Outside the 500m Study Area and approximately 3km from the project boundary, the waters of the Tolo Channel are reported to be part of a nursery area for commercial fisheries resources which covers a swathe of Hong Kong northeast waters spanning Tolo Harbour and part of Mirs Bay (1). This nursery area is located sufficiently remote from the project boundary as to not be affected by the works.

- *Impact on Fishing Activity*: Due to the small size of the beach area as well as limited fishing operations, the impacts on fishing activities are expected to be minimal.

- *Impact on Aquaculture Activity*: The closest designated Fish Culture Zone to the Study Area is located approximately 1.5km to the south of the project boundary at Yim Tin Tsai East. Water quality modelling results indicated that the SS and DO levels complied with the assessment criteria. Dredging the sediments is unlikely to cause a detectable increase in contaminant levels in the surrounding water. Thus adverse impacts on aquaculture activity are not anticipated.

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(1) ERM-Hong Kong, Ltd. (1998). Fisheries Resources and Fishing Operations in Hong Kong Waters, Final Report for Agriculture, Fisheries and Conservation Department.

9.8 Mitigation Measures and Residual Impacts

In accordance with the guidelines in the EIAO-TM on fisheries impact assessment, the policy adopted in this EIA for mitigating impacts to fisheries, are:

- **Avoidance:** Potential impacts should be avoided to the maximum extent practicable by adopting suitable alternatives;

- **Minimisation:** Unavoidable impacts should be minimised by taking appropriate and practicable measures such as confining works in specific area or season, restoration (and possibly enhancement) of disturbed fisheries resources and habitats;

- **Compensation:** When all possible mitigation measures have been exhausted and there are still significant residual impacts or when the impacts are permanent and irreversible, consideration shall be given to off-site compensation. It may include enhancement of fisheries resources and habitats elsewhere.

Construction impacts to fisheries resources and fishing operations have largely been avoided and minimised through the planning and design of the works; in particular those associated with dredging and sandfilling. Dredging volume has been substantially reduced in the design process from approximately 49,500m^3 to 10,500m^3, which includes the dredging for the beach area as well as for the proposed eastern box culvert. Sandfilling volume has also been substantially reduced from approximately 47,200m^3 to 37,500m^3. Silt curtain will be provided during the dredging and sandfilling works as a precautionary measure. The main works have been designed to control water quality impacts to within acceptable levels and hence are also expected to control and minimise impacts to fisheries resources. No fisheries-specific mitigation measures are required during construction.

Significant operational phase impacts to fisheries resources and fishing operations are not expected to occur. Sewage and wastewater generated from the beach building facilities will be discharged into the public sewer. No additional fisheries-specific mitigation measures or compensation are required during operation.

The identified residual impact occurring during the construction and operation phase is the permanent loss of not more than 5.4ha and 4.7ha of existing seabed respectively which will be replaced by sand materials after the completion of beach development. Once the dredging and sandfilling works have been completed, the fish can rehabilitate in the intertidal part of beach area. No exceedance of assessment criteria is anticipated at the sensitive receivers including the Yim Tin Tsai East Fish Culture Zone during the construction works. Approximately 4.7ha of coastal waters will be restricted for fishing operation during the operation of the beach. Due to the small size of the affected area, adverse impacts to fisheries are not expected to be anticipated.

Overall, the residual impacts to fisheries during both the construction and operation phases are considered as acceptable.

9.9 Cumulative Impacts

9.9.1 Construction Phase

At present, there is a committed project 'Tolo Harbour Sewerage of Unsewered Areas Stage 1 Phase IIC' that could have potential cumulative impacts with the construction of the Proposed Beach Development. However, the wastewater generated from the construction of the Proposed Beach Development will be collected and treated before discharge. No untreated discharge of wastewater will be allowed from the construction site. For the wastewater discharge from 'Tolo Harbour Sewerage of Unsewered Areas Stage 1 Phase IIC', it is recommended that treatment/minimization of wastewater generation should be included as part of their contractual requirements.

With the adoption of the wastewater treatment for site runoff and the water pollution control measures described in *Section 6 Water Quality Assessment*, cumulative water quality impacts to fishery resources are not anticipated during the construction of the Proposed Beach Development.

9.9.2 Operation Phase

At present there are no committed projects that could have cumulative impacts with the operation of the beach. The completion of the Tolo Harbour Sewerage of Unsewered Areas Stage 1 Phase IIC at Lung Mei and surrounding area would further reduce the wastewater releasing into the marine environment. Thus, cumulative impacts to fishery resources are not anticipated during the operation of the Proposed Beach Development.

9.10 Environmental Monitoring and Audit Requirements

9.10.1 Construction Phase

As no unacceptable impacts have been predicted to occur during the construction of the beach at Lung Mei, monitoring of fisheries resources during the construction phase is not considered necessary. However, water quality monitoring will be conducted (see EM&A Manual *Section 12.6*) at the Yim Tin Tsai East Fish Culture Zone.

9.10.2 Operation Phase

As no unacceptable impacts have been predicted to occur during the operation of the beach at Lung Mei, monitoring of fisheries resources during the operation phase is not considered necessary.

9.11 Conclusions

Reviews of existing information on commercial fisheries resources and fishing operations surrounding the waters adjacent to the proposed beach have been undertaken. Information from a study on fishing operations in Hong Kong and the AFCD Port Survey 2001/2002 indicate that fisheries production values in the vicinity of the assessment area are generally medium. Sensitive receivers including the marine waters within the Study Area have been identified. Fish culture zones are generally too remote to be affected by the construction and operation of the beach.

Potential impacts to fisheries resources and fishing operations, as well as impacts to fish fry, may arise from the temporary and permanent loss of habitat due to dredging and sandfilling, disturbances to benthic habitats on which the fisheries resources depend for food, or through changes to key water quality parameters, as a result of the marine works. Given the small size of marine habitat lost/disturbed, the associated impacts to fisheries resources are not considered to be unacceptable.

Impacts arising from the proposed dredging or sandfilling works are predicted to be largely confined to the specific works areas and the predicted elevations in suspended sediment concentrations at the sensitive receivers including Yim Tin Tsai Fish Culture Zone are not predicted to cause exceedances of the assessment criterion. Silt curtain will be provided during the dredging and sandfilling works in the marine water as precautionary measure. Adverse impacts to water quality and consequential adverse impacts to fisheries resources are not predicted to occur. Water quality monitoring will be conducted at Yim Tin Tsai Fish Culture Zone during the dredging and sandfilling works.

Significant operational phase impacts to fisheries resources and fishing operations are not expected to occur. Approximately 4.7ha of coastal waters will be restricted for fishing operation during the operation of the beach. Adverse impacts to fisheries are not expected to be anticipated given the small size of the affected area. Impact from sewage and wastewater discharge is not anticipated to occur as the sewage and wastewater generated from the beach building facilities will be discharged into the public sewer. No additional fisheries-specific mitigation measures are required during operation.

10 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

10.1 Introduction

This *Section* presents the Landscape and Visual Impact Assessment (LVIA) for the construction and operation of the Proposed Beach Development at Lung Mei.

10.2 Assessment Methodology

In accordance with the *EIAO Guidance Note No. 8/2002*, the main components of the LVIA are as follows:

- Description of the Project;
- Review of the planning and development control framework;
- Tree survey results;
- Baseline study of landscape character and landscape resources of the Study Area;
- Landscape impact assessment during construction and operation of the Project;
- Visual impact assessment during construction and operation of the Project;
- Assessment of night lighting and glare; and
- Recommendations for landscape and visual mitigation measures for both the construction and operation phases;
- Assessment of the residual impacts and conclusion on the acceptability of the Project.

10.3 Project Description

Generally, the Proposed Beach Development will comprise of the following elements:

- Modifications to Ting Kok Road;
- A new car park to provide 113 fee-paying parking spaces for 100 private cars, 10 motorcycles and 3 coaches, 2 coach loading/unloading bays and 2 passenger car/taxi unloading bays;
- Drainage diversion works for an existing box culvert and downstream of Lo Tsz River;
- Male change room facilities approximately 39m x 11.8m x 5.95m(1) high;

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(1) Building height was estimated by considering the finished floor level (12.70m) of the change room and the average ground floor level (6.75m) [i.e. 5.95m = 12.70m – 6.75m]

- Female/ Family change room facilities approximately 37.5m x 9.4m x 5.95m(1) high;
- Management building containing, staff room, boat storage and related infrastructure 38m x 12m x 10.3m(2) tall;
- 2 rubble mound groynes 1 x 120m and 1 x 100m in length to contain the new beach;
- 2 x 6m tall look out towers (a maximum of 3 towers may be required subject to detailed design), and;
- New beach 200m in length.

During the EIA process the scale of the development has been reviewed to reduce the potential landscape and visual impacts. In particular, the Management Building has been substantially reduced from 18m to 10.3m tall. It should be noted that the average building height of 10.3m of the Management Building is the minimum requirement for effective operation including the accommodation of water tanks, and staff office with panoramic view of the whole beach on upper level. As confirmed by Architectural Services Department, there is no scope to further reduce the building height.

The layout of the Proposed Beach Development is illustrated in *Figure 10.1*.

10.4 Legislation Requirements and Evaluation Criteria

The LVIA was undertaken in accordance with the guidelines and requirements stipulated in *Annexes 10* and *18* of the *EIAO-TM* under the *EIAO* (Cap.499, S16), entitled "Criteria for Evaluating Visual and Landscape Impact" and "Guidelines for Landscape and Visual Impact Assessment", respectively and the *EIAO Guidance Note No. 8/2002 "Preparation of Landscape and Visual Impact Assessment Under the Environmental Impact Assessment Ordinance*." The landscape assessment considers the potential impacts of the Project on the existing landscape and particularly on the landscape resources within 100m of the Project Site.

The visual assessment analyses the potential visual impacts of the Proposed Beach Development on the existing views and the visual amenity, particularly from the Visually Sensitive Receivers (VSR) within the viewshed (sometimes referred to as the Zone of Visual Influence (ZVI). This report will use the term "viewshed". In order to illustrate the visual impacts of the development, photomontages prepared from selected viewpoints compare the existing conditions with the view after commissioning. The residual impacts are evaluated qualitatively, in accordance with the requirements of *Annex 10* of the *EIAO-TM*.

(1) Building height was estimated by considering the finished floor level (12.70m) of the change room and the average ground floor level (6.75m) [i.e. 5.95m = 12.70m – 6.75m]

(2) Building height was estimated by considering the roof floor level (17.05m) of the building and the average ground floor level (6.75m) [i.e. 10.3m = 17.05m – 6.75m]

10.4.1 Planning

The Proposed Beach Development is situated in an area covered by the draft Ting Kok Outline Zoning Plan S/NE-TK13. *Figure 10.2* shows the OZP layout for Hong Kong. The Project Site itself is located in the area designated as Open Space. The Planning Intention of this Zone is:

> 'This zone is intended primarily for the provision of out-door open air public space for active and/or passive recreational uses serving the needs of local residents as well as the general public.'

The Proposed Beach Development is generally in accordance with the Planning Intention of this zone. The Proposed Beach Development will complement the existing BBQ areas, the restaurants, and the recreational hire facilities including the boat hire and bicycle facilities.

Lung Mei is a popular destination for locals and residents of greater Hong Kong and the addition of this Proposed Beach Development will enhance this areas existing and planned uses.

10.5 Tree Survey

A tree survey of the Proposed Beach Development was undertaken. A total of a maximum of 157 trees were identified.

10.5.1 Methodology

Topographical surveys, including identification of the location of the trees, were undertaken by CEDD in late 2005. The tree survey was undertaken within the Project Site in accordance with Clause 6.2.14 of the Brief (or *Section 3.4.7.4* of EIA Study Brief No. ESB-138/2006), the guideline from Works Branch Technical Circular No. 3/2006, No. 55/2002, No. 2/2004, LAO Practice Note No. 6/2000 and 8/2002.

The most commonly occurring tree species include *Albizia lebbeck, Celtis sinensis, Hibiscus tiliaceus, Leucaena leucocephala, and Macaranga tanarius.*

Colour photographs of each of the identified tree species are presented in *Appendix H1*. The tree species (botanical name) and general conditions of the trees are identified and evaluated and are presented in *Appendix H2.*

Appendix H3 shows the location of the trees, relative to the Project Site.

Those trees in conflict with the development will be removed. The exact numbers of trees to be removed, retained and transplanted will be described in the Tree Felling Application at a later stage of the Proposed Beach Development. However, the preliminary estimates of the numbers of trees to be affected are:

1. 38 trees recommended for retaining
2. 82 trees recommended for felling of which
    a. 29 trees recommended for felling(non-invasive trees)
    b. 49 trees recommended for felling(invasive trees)
    c. 4 dead trees
3. 37 trees recommended for transplanting

A Landscape Plan will be submitted before the commencement of Works.

10.6 Landscape Impact Assessments

In accordance with *Annex 18* of the *EIAO-TM*, the landscape impact assessment will cover the following:

- Describe the baseline landscape within 100m of the Project Site and the works area of the enabling works along the access routes.

- Describe the Landscape Character Areas (LCAs) and Landscape Resources (LRs) including describing edges as different LRs.

- Map the distribution of the LCAs and LRs.

- Propose a qualitative and quantitative assessment of significant thresholds which reflect the magnitude of change and sensitivity to change of a particular LCAs and LRs.

- Analyse the landscape impacts during construction, impact after development, and off-site landscape impacts. This section analyses the extent to which these landscape units and edges are changed, using both quantitative and qualitative assessments.

- Examine landscape measures that will contribute to reducing any landscape impacts or will enhance the landscape associated with the Proposed Beach Development. This may include planting, new landscaped areas and re-vegetation. The residual landscape impacts are also analysed.

- Provide conclusions on the impacts of the Project.

10.6.1. Baseline Landscape Conditions

As specified by the EIA Study Brief, the area for the Landscape Impact Assessment covers the area within 100m of the Proposed Beach Development. The landscape baseline study examines the potential impacts on the Project Site and surrounding areas in terms of both the LCAs and the LRs.

The LCAs and LRs of the Study Area have been categorised according to the presence of common elements. These include factors such as:

- Topography;
- Vegetation type (both species and age);
- Built forms;
- Evidence on human modifications;
- Land use (past and present); and
- Edges.

10.6.2 General Landscape Description

The baseline landscape character of the greater area of Lung Mei is dominated by the coastline to the south and the vegetated hill slopes further to the north. The low-rise residential village houses and restaurants are the dominant signs of human activity. The area also has a relaxed atmosphere with a focus on recreation created by the BBQ areas, restaurants, and the bicycle and boat hire facilities.

The topography is generally flat falling down to the sea edge. The Proposed Beach Development is also secluded as a result of the small peninsula at Tei Mei Tuk and the hills to the north in the Pat Sin Leng Country Park.

10.6.3 Landscape Sensitivity

An understanding of the sensitivity to change of the LCAs and LRs is important when analysing the overall landscape impact of the Proposed Beach Development upon the LCAs and LRs.

Factors affecting the sensitivity of change for evaluation of landscape are:

- Quality of LCAs and LRs;
- Importance and rarity of special landscape elements;
- Ability of the landscape to accommodate change;
- Significance of the change in the local and regional context, and;
- Maturity of the landscape.

The degree of sensitivity of the LCAs and LRs is classified as follows:

i) High – eg;. important components or landscape of particularly distinctive character susceptible to small changes;

ii) Medium – eg; a landscape of moderately valued characteristics reasonably tolerant to change; and

iii) Low – eg; a relatively unimportant landscape which is able to accommodate extensive change.

The following section describes each of the LCAs and LRs within the Study Area.

10.6.4 Landscape Character Areas (LCAs)

Description of Landscape Character Areas

The Landscape Character Map of Hong Kong identifies three different Landscape Character Types within the Study Area.

- Inter-tidal Coast Landscape;
- Inshore Waters Landscape, and;
- Rural Coastal Plain Landscape.

In order to gain a greater insight into the site itself, three Landscape Character Areas have been adopted.

The locations of the Landscape Character Areas are illustrated in *Figure 10.6* and are described in more detail below.

LCA1 Foreshore Landscape (Refer to *Figure 10.3*)

This LCA is characterised by muddy tidal flats gently rising to scrubby sparsely vegetated dune areas and it is generally natural in appearance. The area is not commonly found in this region of Hong Kong and does not have a high ability to accommodate change due to its relatively natural appearance. It also is generally of high landscape quality. This LCA is considered to have a *high* sensitivity to change.

LCA2 Inshore Waters Landscape (Refer to *Figure 10.4*)

The LCA is commonly found in the surrounding region and is characterised by generally calm waters with passing marine vessels. There are a number of nearby surrounding islands and shores that gives this marine environment an intimate atmosphere. The shorelines range from sandy beaches in the western part of the Study Area to man made retaining walls where the sea meets Ting Kok Road. This LCA is generally significant in the local regional context and is a feature of Tai Po. It has a moderate ability to accommodate change. This LCA is considered to have a *medium* sensitivity to change.

LCA3 Coastal Rural/Suburban Landscape (Refer to *Figure 10.5*)

This LCA is characterised by man made elements such as roads with three storey village houses and restaurants. It also includes Ting Kok Road. This LCA can accommodate change, is common in the surrounding region and is a relatively immature landscape. This LCA is considered to have a *medium* sensitivity to change.

10.6.5 Landscape Resources (LRs)

Seven LRs have been identified. The location of these LRs is shown in *Figure 10.16*

LR 1 Shrubland

LR 2 Trees/Backshore Vegetation

LR 3 Water

LR 4 River

LR5 Sand/Rocky Beach

LR6 Road

LR7 Village/Developed Area

LR1 Shrubland (Refer to *Figure 10.9*)

A small patch of shrubland was identified to the north of the villages. This LR shows signs of occasional disturbance by hill fire and human activities. Invasive plants such as *Mikania micrantha, Ageratum conyzoides* and *Dicranopteris linearis* were recorded in the open area of the shrubland. Shrubland patches found on the hill slopes are generally with 0.5 to 1.5m in height. A total of 26 plant species, which are common to shrubland habitat in Hong Kong, were recorded. The shrublands were dominated by several small shrub species, including *Baeckea frutescens, Bridelia tomentosa, Macaranga tanarius, Lantana camara* and *Microcos paniculata.* This LR is relatively immature and is commonly found in the surrounding region. The sensitivity of this LR is considered to be *medium.*

LR2 Trees/Backshore Vegetation (Refer to *Figure 10.10*)

There are a number of trees and vegetation located to the south of Ting Kok road between the road and the beach area. The tree and shrub species including *Limonium sinense, Sesuvium portulacastrum* and *Zoysia sinica* were found. The area further to the south west contains some scattered mangrove species and other vegetation including *Thespesia populnea, Hibiscus tiliaceus, Kandelia obovata, Excoecaria agallocha, Bruguiera gymnorrhiza* and *Aegiceras corniculatum* ranging from the height of 0.3m to 4m. This LR is not uncommon in the region, and is relatively immature. It does however, have a low ability to accommodate change. The sensitivity of the Trees/Backshore Vegetation is considered to be *medium.*

LR3 Water (Refer to *Figure 10.11*)

The water area is comprised of the sea to the south of the beach. This LR is very commonly found within the region and it has a high ability to accommodate change. The sensitivity of the water area is considered to be *low*.

LR4 River (Refer to *Figure 10.12*)

A section of the Lo Tze Tin River is located within the study area. The river runs from the village areas of Lo Tze Tin to the ocean. The river is partially channelised and there are signs of pollution from the nearby village development. Drainage of sewage and litter were recorded in the river section along the village area. The vegetation present is dominated by weed species. The river has limited water flows during dry season with higher water flow occurs in wet season. The river is general of low quality. The sensitivity of the river is considered to be *low*.

LR5 Sandy/Rocky Beach (Refer to *Figure 10.13*)

Sandy/Rocky Beach exists from Ting Kok to Tai Mei Tuk. This location is a popular visitor destination; this LR is relatively uncommon in this region and has a high landscape value. The sensitivity of the Sandy/Rocky Beach is considered to be *high*.

LR6 Road (*Refer to Figure 10.14*)

The road area is comprised by Ting Kok Road that dissects the study area in an east-west direction. The road has single lane in each direction and typical associated infrastructure such as lighting, signage etc. This LR can easily accommodate change, is very common and has no regional significance. The sensitivity of the Road is considered to be *low*.

LR7 Village/Developed Area (Refer to *Figure 10.15*)

Several local villages including Lung Mei Tsuen, Tai Mei Tuk Tsuen, Ng Uk Tsuen, Lo Tsz Tin Tsuen and Ting Kok Tsuen are located in the surrounding areas. The village/developed areas are highly developed and dominated by blocks of village houses, concrete paths, landscaped areas and fenced off abandoned lands occupied by weeds and construction materials. A total of 46 landscape and weed plants were recorded in these areas and all of them are commonly found in Hong Kong. The village/developed area was dominated by landscape plants including *Acacia confusa, Delonix regia, Gossampinus malabarica, Michelia alba* and *Hibiscus tiliaceus*, with weed plants such as *Leucaena leucocephala*, *Mikania micrantha*, *Pueraria lobata Wedelia chinensis* dominant in the open areas and abandoned lands. This LR is relatively common in the region and can accommodate change, and is generally of low landscape quality. The sensitivity of the Village/Developed area is considered to be *low*.

Table 10.1 below shows the areas of each of the LRs and LCAs within the Study Area.

Table 10.1: The Distribution of LRs

LCA/LR	Area (hectare)/ Length (km) Within Study Area
Foreshore Landscape	3.6ha
Inshore Waters	16.4ha
Coastal Rural/Suburban Landscape	6.9ha
Shrubland	0.06ha
Trees/Backshore Vegetation	1.23ha
Water	16.39ha
River	0.09ha
Sandy/Rocky Beach	0.83ha
Road	1.37ha
Village/Developed Area	6.94ha

10.6.6 Landscape Impacts During Construction

The two key factors that affect the evaluation of LCA and LR impacts are the magnitude of change and the sensitivity of the landscape areas/resources. The sensitivity to change for each of the LCAs and LRs has been described above and the factors affecting the magnitude of change are outlined below.

Factors affecting the magnitude of change for assessing landscape impacts are:

- Compatibility of the Proposed Beach Development with the surrounding landscape, ie how well will it fit with its surrounds;

- Scale of the development, ie how big is the development relative to its surroundings, and;

- Reversibility of change. ie to how easily the changes to the landscape can be reversed.

The magnitude of change is classified as follows:

- Large – notable change in the landscape characteristics over an extensive area ranging to very intensive change over a more limited area;

- Intermediate – moderate changes to a local area;

- Small – changes to specific landscape components; and

- Negligible – no substantial changes to the baseline condition.

The landscape impact is a product of the magnitude of change the Proposed Beach Development will have and the sensitivity of the LR. *Table 10.2* shows the significance threshold of the LR impacts.

Table 10.2: Significance Threshold of Potential Landscape Resource Impact

	Sensitivity to Change			
Magnitude of Change Caused by Project		**Low**	**Medium**	**High**
	Large	Moderate Impact	Moderate/Significant Impact	Significant Impact
	Intermediate	Slight/Moderate Impact	Moderate Impact	Moderate/ Significant Impact
	Small	Slight Impact	Slight/Moderate Impact	Moderate Impact
	Negligible	Negligible Impact	Negligible Impact	Negligible Impact

Table 10.3 provides some definitions of the significance thresholds for LR and LCA impacts.

Table 10.3: Adverse / Beneficial Impact of Landscape Impact

Level of Impacts (Negative / Beneficial/ Neither)			
Significant:	**Moderate:**	**Slight:**	**Negligible**
Adverse / beneficial impact where the Project would cause significant degradation or improvement in existing landscape baseline conditions	Adverse / beneficial impact where the Project would cause noticeable degradation or improvement in existing landscape baseline conditions	Adverse /beneficial impact where the Project would cause a barely noticeable degradation or improvement in existing landscape conditions or where the changes brought about by the Project would not be apparent in visual terms	The Project does not affect the existing landscape baseline conditions

Figures 10.7 and *10.8* show the impacts on the LCAs.

Figures 10.17 and *10.18* shows the impacts of the Proposed Beach Development on the LRs

10.6.7 Unmitigated Landscape Impacts During Construction

Table 10.4 shows the impact of the Project on each of the LRs and LCAs and the overall impact based on the preceding Landscape Impact Assessment Matrix.

Table 10.4: Unmitigated Landscape Impact Significance Threshold Matrix

LR/LCA	Area / Length	Area Affected by Proposed Development	% of Area / Length Affected	Sensitivity to Change	Magnitude of Change	Significance Threshold of Landscape Impact
Foreshore Landscape	3.6ha	1.21ha	34%	High	Large	Significant
Inshore Waters	16.4ha	5.73ha	35%	Medium	Intermediate	Moderate
Coastal Rural/Suburban Landscape	6.9ha	0.44ha	6%	Medium	Small	Slight
Shrubland	0.06ha	Nil	0%	Medium	Negligible	Negligible
Trees/Backshore Vegetation	1.23ha	0.62ha	50%	Medium	Large	Significant
Water	16.39ha	5.74ha	35%	Low	Intermediate	Moderate
River	0.09ha	0.01ha	11%	Low	Small	Slight
Sandy/Rocky Beach	0.83ha	0.61ha	73%	High	Large	Significant
Road	1.37ha	0.05ha	4%	Low	Small	Slight
Village/Developed Area	6.94ha	0.32ha	5%	Low	Small	Slight

10.6.8 Summary of Un-mitigated Impacts on Landscape Character Areas During Construction

LCA1 Foreshore Landscape

This LCA is relatively uncommon in the surrounding region and it is generally natural in appearance. It therefore has a high sensitivity to change. The project will potentially affect approximately 34% of the LCA which is considered to be a large magnitude of change within the study area. The significance threshold for this LCA is considered to be *significant.*

LCA2 Inshore Waters Landscape

The LCA is commonly found in the surrounding region is generally significant in the local regional context and has a moderate ability to accommodate change. This LCA is considered to have a *medium* sensitivity to change. The project will potentially affect approximately 35% of the LCA which, given the abundance of this LCA in the region is considered to be an intermediate magnitude of change within the study area. The significance threshold for this LCA is considered to be *moderate.*

LCA3 Coastal/Rural Suburban Landscape

This LCA can accommodate change, is common in the surrounding region and is a relatively immature landscape and has a *medium* sensitivity to change. There will be small magnitude of change resulting in a *slight/moderate* significance threshold. Due the ability of this LCA to accommodate change and its abundance in the region, the overall significance threshold is considered to be *slight.*

10.6.9 Summary of Un-mitigated Impacts on Landscape Resources During Construction

LR1 Shrubland

The Shrubland LR has medium sensitivity, however due to its distance from the project site, there will be no impacts on this LR. The significance threshold is therefore *negligible.*

LR2 Trees/Backshore Vegetation

This LR is considered to have a moderate sensitivity to change mainly due to the immature nature of many of the plantings and the low number of native trees found within this LR. Approximately 50% of this LR will be affected by the project, resulting in a *significant* impact according to *Table 10.4*. However, as this LR is relatively uncommon, the significance threshold is considered to be *significant.*

LR3 Water

Whilst this LR has a high quality but is also very common in the region. The 35% removal of the water by reclamation within the study area is considered to be an intermediate magnitude of change. The resulting significance threshold for this LR is therefore *moderate.*

LR4 River

The generally low landscape quality of the river and its ability to accommodate change result in a low sensitivity to change. There is also a small magnitude of change on this LR. The resulting significance threshold for this LR is therefore *slight.*

LR5 Sandy/Rocky Beach

The Sandy/Rocky Beach is uncommon in the surrounding area and has a high landscape value. Approximately 73% of the LR will be affected by the project will creating a large magnitude of change. This may result in a significance threshold that is *significant.*

LR6 Road

The road area has a high ability to accommodate change, and is common in the surrounding region. There will also be a small magnitude of change due to the construction of the carpark entry and modifications to the kerb and channel. The significance threshold for this LR is *slight.*

LR7 Village/Developed Area

The Village Developed Area is relatively common, can accommodate change and has a low landscape value. The area to be affected is a small area or bare ground that will be replaced with the new carpark. Only 4% of this LR will be affected by the project, resulting in a small magnitude of change. The resulting significance threshold for this LR is *slight.*

10.6.10 Landscape Mitigation

The landscape mitigation measures proposed will be implemented progressively throughout the construction of the Proposed Beach Development.

The following mitigation measures are proposed to reduce the potential impacts on the existing LRs and LCAs as illustrated in *Figures 10.19.*

LMM 1 – Cultivation of areas impacted during construction. Areas impacted during the construction phase that are not required during the operation phase, are to be cultivated to a depth of 300mm in accordance with accepted Hong Kong practice and guidelines. The cultivation shall involve ripping of compacted soil by mechanical means and the addition gypsum and/or organic fertiliser if required.

LMM 2 – Car Park Tree Planting. Advanced trees are to be planted to provide shade to the carpark areas and to reduce the mass of the paved areas.

LMM 3 – Tree and Shrub Planting. All planting of trees and shrubs is to be carried out in accordance with the relevant best practice guidelines. Plant densities are to be provided in future detailed design documents and are to be selected so as to achieve a finished landscape that matches the surrounding, undisturbed, equivalent landscape types. This mitigation measure will require establishment maintenance which will be the responsibility of the Project Proponent.

LMM 4 – Roof Terrace Planting. Trees, shrubs and climbers shall be established in planters on the roof terraces of the new structures where possible to soften the built elements.

LMM 5 – Natural Rock Groynes. New rock groynes are needed to contain the sand of the new beach. Natural stones will be used for construction of the groynes so that this new man-made feature will be more compatible with the surroundings.

LMM 6 – Inter-Tidal Re-generation. It is likely that a build up of sediment and sand will occur at the outer edges of the rock groyne. This is a natural process and the development proponent has no control over the implementation of this mitigation measure.

LMM 7 – Mangrove Re-generation. Mangroves of similar species to existing to be manually established by planting of droppings.

LMM 8 – Buffer Planting. Trees and shrubs are to be planted along Ting Kok Road to screen the development from the nearby Village/Developed Areas.

LMM 9 – Early Planting Works Where technically feasible, new plantings are to be installed during the construction works to reduce landscape impacts.

LMM 10 – Tree Protection/Transplantation. Where technically feasible, existing trees in the Trees/Backshore Vegetation LR are to be retained. Those trees that cannot be retained that are of value are to be transplanted.

Table 10.5 describes the predicted un-mitigated and mitigated impacts on the landscape resources and landscape character areas of the project area in construction phase. *Table 10.6* shows the predicted un-mitigated and mitigated impacts on day 1 of operation and year 10 of operation.

Table 10.5: Mitigated Landscape Impacts

	Un-mitigated Construction impacts			Mitigated Construction Impacts	
	Construction Impact threshold	**Adverse/ Beneficial/Neither**	**Recommended Construction Mitigation Measures**	**Construction Impact threshold following mitigation**	**Adverse/ Beneficial/Neither**
Foreshore Landscape	Significant	Adverse	1, 9, 10	Moderate	Adverse
Inshore Waters	Moderate	Adverse	Nil (1)	Moderate	Adverse
Coastal Rural/Suburban Landscape	Slight	Adverse	1, 9, 10	Slight	Adverse
Shrubland	Negligible	Neither	Nil	Negligible	Neither
Trees/Backshore Vegetation	Significant	Adverse	1, 9, 10	Moderate	Adverse
Water	Moderate	Adverse	Nil (1)	Moderate	Adverse
River	Slight	Adverse	1,9	Negligible	Neither
Sandy/Rocky Beach	Significant	Adverse	Nil (1)	Significant	Adverse
Road	Slight	Adverse	1, 9, 10	Negligible	Neither
Village/Developed Area	Slight	Adverse	1, 9, 10	Negligible	Neither

Note 1: There will not be any available mitigation measure for inshore waters landscape, water, and the sandy/rocky beach during construction.

Table 10.6: Un-Mitigated and Mitigated Operation Landscape Impacts

	Un-Mitigated Impacts			Mitigated Impacts		
	Operation	**Adverse/ Beneficial/Neither**	**Recommended Mitigation**	**Operation Day 1**	**Operation Year 10**	**Adverse/ Beneficial/Neither**
Foreshore Landscape	Significant	Adverse	2, 3-8	Significant	Moderate	Neither
Inshore Waters	Moderate	Neither	5-6	Moderate	Slight	Neither
Coastal Rural/Suburban Landscape	Slight	Adverse	2,4,8	Slight	Negligible	Neither
Shrubland	Negligible	Neither	Nil	Negligible	Negligible	Neither
Trees/Backshore Vegetation	Significant	Adverse	2-4,7-8	Significant	Moderate	Adverse
Water	Moderate (2)	Adverse	Nil	Moderate (2)	Moderate (2)	Adverse
River	Slight	Adverse	3,7	Slight	Negligible	Neither
Sandy/Rocky Beach	Significant	Adverse	5,6	Significant	Moderate	Adverse
Road	Slight	Adverse	2-3,8	Slight	Negligible	Neither
Village/Developed Area	Slight	Adverse	2,8	Slight	Negligible	Neither

Note 2: Although the impacts assessed for LR3 (water) during operation are moderate and there are no available mitigation measures for the loss of this LR within the study boundary, the overall impacts in a regional context, which are not reflected in this table, are considered *slight*.

10.6.11 Effectiveness of Landscape Character Areas and Landscape Resource Mitigation Measures

The proposed mitigation measures will effectively help to reduce the impacts on the LCAs and LRs to an acceptable level.

10.6.12 New Landscape Character Areas

Figure 10.8 shows that as a result of the project, two new Landscape Character Areas will be created. LCA4, Recreational Beach Landscape will be characterised by the new bathing beach and rock groynes. LCA5 Coastal Urban Recreational Landscape will be characterised by the new car park, buildings, and the new bathing beach. The creation of the 2 New LCAs is the direct results of the project. The mitigation measures proposed in *Table 10.6* and *Figure 10.19* will alleviate the potential impacts on existing landscape character of the area. As the new Landscape Character areas mature the impacts on them will become less noticeable.

10.6.13 New Landscape Resources

The construction and operation of the project will create a new Landscape Resource. LR8 Sandy Beach will comprise the new sand area for bathing and the rock groynes at either end. The creation of the 2 New LRs is the direct results of the project. The mitigation measures proposed in *Table 10.6* and *Figure 10.19* will alleviate the potential impacts on existing landscape resources of the area. As the new Landscape Resource areas mature the impacts on them will become less noticeable.

10.6.14 Summary of Residual Impacts on the Landscape During Construction

The construction period for the project is expected to be approximately 2 years long. During this period it is not possible to mitigate all of the potential impacts, however, the Cultivation of Areas Compacted During Construction, Early Planting Works and Transplantation of valuable trees will all help to reduce these impacts.

10.6.15 Summary of Residual Impacts on Landscape Character Areas During Operation

LCA1 Foreshore Landscape

The un-mitigated significance threshold for this LCA was considered to be *significant.* With the implementation of the Landscape Mitigation Measures described in *Table 10.5*, particularly the Car-Park Planting and Tree and Shrub Planting, these impacts will reduce having a residual significance threshold of *moderate* after year 10 of implementation.

LCA2 Inshore Waters Landscape

The un-mitigated significance threshold for this LCA was considered to be *moderate*. However, this is somewhat reduced due to the relative abundance of this LCA in the surrounding region and its moderate ability to accommodate change. With the implementation of the Landscape Mitigation Measures described in *Table 10.5*, including the Natural Rock Groynes and Inter-tidal Regeneration, these impacts will reduce having a residual significance threshold of *slight* after year 10 of implementation.

LCA3 Coastal Rural/Suburban Landscape

Due the ability of this LCA to accommodate change and its abundance in the region, the overall un-mitigated significance threshold was considered to be *slight*. With the implementation of the Landscape Mitigation Measures described in *Table 10.5*, including Car Park, Buffer and Roof Top plantings, these impacts will reduce having a residual significance threshold of *negligible* after year 10 of implementation.

10.6.16 Summary of Residual Impacts on Landscape Resources during Operation

LR1 Shrubland

The un-mitigated significance threshold for this LR was considered *Negligible*. Consequently, no mitigation is proposed for this LR. The resulting residual significance threshold will remain *negligible*.

LR2 Trees/Backshore Vegetation

The un-mitigated significance threshold was considered to be *significant*. However with the implementation of the Landscape Mitigation Measures described in *Table 10.5*, particularly the Car Park, Buffer and Roof Top plantings, these impacts will reduce having a residual significance threshold of *moderate* after year 10 of implementation.

LR3 Water

Due to the beach development, part of the sea will be reclaimed and it may appear that portion of LR3 will be lost. There were no available mitigation measures for the loss of water and the impact significance threshold for this LR with and without mitigation measure during operation was considered *moderate*. However, the loss of water is relatively small in a regional/ global context. Therefore, the overall residual impact of this LR is considered to be *slight*.

LR4 River

The un-mitigated significance threshold for this LR was considered *slight*. Following the implementation of the Landscape Mitigation Measures described in *Table 10.5*, including tree and Shrub Planting and Mangrove Regeneration, these impacts will reduce having a residual significance threshold of *negligible* after year 10 of implementation.

LR5 Sandy/Rocky Beach

The un-mitigated significance threshold for this LR was considered *significant*. Following the creation of the new LR8 'Sandy Beach' and the implementation of the Landscape Mitigation Measures described in *Table 10.5*, particularly the use of a Natural Rock Groyne and the Inter-tidal Regeneration, these impacts will be reduced. The residual significance threshold of this LR after year 10 of implementation will be *moderate.*

LR6 Road

The un-mitigated significance threshold for this LR was considered *slight*. Following the implementation of the Landscape Mitigation Measures described in *Table 10.5*, including Tree and Car Park Planting, Tree and Shrub Planting and Buffer Planting will reduce the impact on this LR resulting in a residual significance threshold of *negligible* after year 10 of implementation.

LR7 Village/Developed Area

The un-mitigated significance threshold for this LR was considered *slight*. Following the implementation of the Landscape Mitigation Measures described in *Table 10.5*, including Tree and Car Park Planting, Tree and Shrub Planting and Buffer Planting will reduce the impact on this LR resulting in a residual significance threshold of *negligible* after year 10 of implementation.

10.7 Visual Impact Assessments

10.7.1 Introduction

The following tasks were undertaken in the visual impact assessment.

Define the viewshed that would be potentially impacted by the Project and map the areas of visual impact.

This task describes the viewshed of the Proposed Beach Development, which was developed based on both the planning guidelines and the parameters of human vision. Geographical Information System (GIS) software was then utilised to determine areas that could potentially see the development. This GIS viewshed analysis was based solely on topography and did not take into account the screening potential of vegetation, which would further reduce the actual viewshed. The GIS viewshed analysis also mapped the visibility of the development from roads and houses.

Discuss atmospheric conditions

This task discusses the mitigating effects of weather, particularly sea haze and rainfall.

Assess indicative viewpoints as a means of assessing the visual impact on the broader landscape

This task describes a number of Visually Sensitive Receiver (VSR) viewpoints around the development, which have been selected as indicative of the range of views from accessible locations within the viewshed. Photomontages have been prepared to show the existing landscape and the landscape with the development at the key VSRs.

Discuss visual mitigation measures

This task examines measures (if required) that will reduce any potential visual impacts. This may include planting and recommendations for material and finishes. These measures will also help improve the overall amenity of the Project. Residual impacts are also discussed.

Assess night lighting and glare impacts

This task examines the potential glare and night lighting impacts associated with the Proposed Beach Development.

10.7.2 Viewshed Determination and Areas of Potential Visual Impact

The baseline for a visual impact assessment is an understanding of the existing visual qualities within the region that can be visually affected by a development. This area is referred to as the viewshed.

Defining an appropriate viewshed is the starting point to understanding the visual impacts of a development as the area of the viewshed will vary depending on the nature and scale of the proposed development. The larger a development the greater the viewshed as it may be visually apparent for a greater distance. Once the viewshed is established, locations can be identified within the viewshed that are either particularly sensitive or indicative of the visual impact for a number of locations. In some circumstances, viewpoints may be identified beyond the viewshed to recognise the visual impact on locations of particularly high sensitivity.

The Management Building is the major visual element of the Proposed Beach Development and may visually impact on the surrounding landscape. As the viewer moves further away from the Management Building the visual impact decreases until it is no longer visible. However, before the point of non-visibility is reached, the Management Building has reduced in scale such that it no longer has a significant visual impact on the landscape. In most landscapes, especially those which have some degree of human intervention, the limit of the viewshed is defined as that point at which the Management Building would have an insignificant effect on the view.

10.7.3 Types of Viewshed

In recognising that the viewshed is not the limit of visibility, but rather the extent to which the development would have an insignificant visual impact on the landscape, then the extent of a viewshed differs in the context of different landscapes.

A viewshed in a man-modified landscape is different to a viewshed in a pristine landscape or landscapes where there are no apparent signs of human influence. This is because in landscapes that appear 'natural' or pristine, a man made element such as a Management Building, can visually influence the landscape for as long as a viewer can discern that newly introduced element. A man made element in a pristine landscape irrevocably changes a pristine landscape from natural to man modified. Therefore, viewsheds in pristine areas are extended to the limit of human visibility.

However in man modified landscapes, in which there are many other existing built forms or modifications to the landscape, the viewshed extends to that distance at which the Management Building becomes a minor element in the landscape to all but the most sensitive of viewers. The structure may still be visible beyond this viewshed, however it is considered that beyond this viewshed the visual impact will be insignificant.

10.7.4 Viewshed Determination

The visual impact of a development can be quantified by reference to the degree of influence on a person's field of vision. *Figures 10.21* and *10.22* illustrate the typical parameters of human vision and are based on anthropometric data (1). This data provides a basis for assessing and interpreting the impact of a development by comparing the extent to which the development would intrude into the central field of vision (both horizontally and vertically).

Horizontal Cone of View

The central field of vision for most people covers an angle of between 50° and 60°. Within this angle, both eyes observe an object simultaneously. This creates a central field of greater magnitude than that possible by each eye separately. This central field of vision is termed the 'binocular field' and within this field images are sharp, depth perception occurs and colour discrimination is possible. These physical parameters are illustrated in on *Figure 10.21*.

The visual impact of a development will vary according to the proportion in which a development impacts on the central field of vision. Developments, which take up less that 5% of the central binocular field, are usually insignificant in most landscapes (5% of 50° = 2.5°).

In assessing the visual impact of the Proposed Beach Development structures it is assumed that the largest horizontal component is the Management Building and the Female/Family change room which in total is approximately 75.5m wide.

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(1) *Human Dimension & Interior Space – A Source Book of Design Reference Standards*, *Julius Panero and Martin Zelnik, The Architectural Press Ltd. London, 1979.*

Table 10.7: Visual Impact Based on the Horizontal Field of View

Horizontal Field of View	Impact	Distance from an Observer to 75.5m Wide Building
<2.5° of view	***Insignificant*** The development will take up less than 5% of the central field of view. The development, unless particularly conspicuous against the background, will not intrude significantly into the view. The extent of the vertical angle will also affect the visual impact.	>1.7km
2.5° – 30° of view	***Potentially noticeable*** The development may be noticeable and its degree of visual intrusion will depend greatly on its ability to blend in with its surroundings.	140m-1.7km
>30° of view	***Potentially visually dominant*** Developments that fill more than 50% of the central field of vision will always be noticed and only sympathetic treatments will mitigate visual effects.	<140m

An assessment of the visual impact based on the horizontal field of view is provided in *Table 10.7*. These calculations suggest that the impact of a 75.5m wide building would reduce to insignificance at about 1.7km, as it would form less than 5% or 2.5° of the horizontal field of view.

Vertical Field of View

A similar analysis can be undertaken based upon the vertical line of sight for human vision. As can be seen in the *Figure 10.22* the typical line of sight is considered horizontal or 0°. A person's natural or normal line of sight is normally a 10° cone of view below the horizontal and, if sitting, approximately 15°.

Objects, which take up 5% of this cone of view (5% of 10° = 0.5°) would only take up a small proportion of the vertical field of view, and are only visible when one focuses on them directly. Objects that take up such a small proportion of the vertical view cone are not dominant, nor do they create a significant change to the existing environment when such short objects are placed within a disturbed or man-modified landscape.

Table 10.8 shows the relationship between impact and the proportion that the development occupies within the vertical line of sight.

Table 10.8: Visual Impact Based on Vertical Field of View

Vertical Line of Sight	Impact	Distance from an Observer to a 12m high building
< 0.5° of vertical angle	***<u>Insignificant</u>*** A thin line in the landscape.	>1.3km
0.5° – 2.5° of vertical angle	***<u>Potentially noticeable</u>*** The degree of visual intrusion will depend on the development's ability to blend in with the surroundings.	275m-1.3km
> 2.5° of vertical angle	***<u>Visually evident</u>*** Usually visible, however the degree of visual intrusion will depend of the width of the object and its placement within the landscape.	<275m

These calculations suggest distances at which the magnitude of visual impact of the Management Building will reduce with distance. At distances greater than 1.3km, a fully visible Management Building would be an insignificant element within the landscape.

These calculations seem closer to the observed distances at which levels of impact seem to change. It is stressed that these ranges will only provide a guide for the visual impact assessment.

An apparent discrepancy will occur when analysing horizontal and vertical parameters separately. Generally, the more conservative figures form the basis for the assessment. In this example it is proposed to extend the viewshed to 1.7km, although it could be argued that a lesser extent would also be valid.

For the Proposed Beach Development it is proposed that the distances described in *Table 10.9* are used for the viewshed analysis.

Table 10.9: Viewshed and Degrees of Visual Influence

Impact	Distance from an Observer to the Management Building
Insignificant A thin line in the landscape, both horizontally and vertically.	>1.7km
Potentially noticeable The degree of visual intrusion will depend on the development's ability to blend in with the surroundings.	275m-1.7km
Visually evident Usually visible, however the degree of visual intrusion will depend on the degree to which the development will blend into the landscape.	<275m

10.7.5 Areas of Potential Visual Impact

A GIS viewshed analysis can determine those areas that can potentially be visually impacted by the Proposed Beach Development. Such analysis is based on topography only, and shows those areas that would be screened by intervening hills etc. It does not account intervening vegetation or buildings, nor does it take into account small variations in topography, such as road cuttings. Therefore it is a conservative assessment of those areas that may be potentially able to view the Proposed Beach Development structures.

Figure 10.23 shows the areas that can potentially view the Proposed Beach Development.

10.7.6 Atmospheric Factors Which Will Affect Visual Impact

Many climatic conditions result in changes to visibility. For example, sea haze, rainfall and other atmospheric conditions will alter the visibility of the Proposed Beach Development. The diminution of visual clarity bought about by atmospheric conditions increases with distance.

Sea Haze

Sea haze is a climatic condition along coastlines that can reduce visibility even on days when the weather is fine. Wind which blows across the ocean or other atmospheric conditions can cause a sea haze, limiting views to the development from surrounding areas.

However sea haze is unlikely to have much impact on the visibility of the development when viewed from close proximity, say less than 1.5km. When the same features are viewed from greater distances within the viewshed the effect of sea haze will greatly reduce visibility and any potential visual impact.

Cloud Cover

Cloudy days can also reduce the visibility of a development. During site inspections of a similar facility it was apparent that a backdrop of grey cloud reduced the visual impact. Full cloud cover also reduced the apparent contrast on elements that extend above the landscape backdrop and as these elements were neither strongly shadowed nor reflective.

Figure 10.24 shows that in Hong Kong, for much of the year the percentage of cloud cover exceeds 50%.

Rainfall

The effect that rainfall has on visibility can be measured in two ways. Firstly the event of falling rain reduces visibility as the water droplets obscure vision. This varies greatly depending on the heaviness of the precipitation, but even light rain obscures distant objects greatly. Secondly, the event of rain, particularly sustained rain periods, reduces visitor numbers. Therefore, the visual impact is reduced on those days as lesser viewers are visiting the area and looking at the development.

Figure 10.24 also shows that during the wetter months, particularly from May through September, Hong Kong receives on average approximately 10mm of rain per day. These rain events reduce visibility.

Assessment Scenarios

Whilst the above *Section 10.7.6* describes some of the climatic conditions that reduce the visibility of the Proposed Beach Development, the following assessment is based on a worst case impact scenario on visual quality and character assuming perfectly clear viewing conditions. Mitigation measures are proposed to reduce these impacts.

10.7.7 Baseline Visual Character

The general baseline visual character of the development site is dominated by the Hills of Pat Sin Leng Country Park to the north and the waters of Plover Cove to the south. The village of Lung Mei is nestled on the sloping lands between the hills and the sea. The developed areas are all three storey low rise, typical of villages in Hong Kong, and the presence of the BBQ's, boat hire facilities and restaurants all exude an atmosphere of recreation.

Visually Sensitive Receivers

To determine the likely VSRs, a desktop assessment and detailed site assessment were carried out. The most sensitive VSRs were then identified and to encompass the likely range of potentially affected VSRs. These include VSRs in the following areas:

- Residents; including Lung Mei, and Lo Tsz Tin
- Visitors; including the BBQ areas and restaurants
- Visitors on Marine vessels; these include visitors on passing ferries as well as recreation visitors to the area.

VSR Assessment

The following factors have been considered in the visual impact assessment.

VSR Sensiti*vity*

The first set of criteria relate to the sensitivity of the VSRs. They include:

- Value and quality of existing views;
- Availability and amenity of alternative views;
- Type and estimated number of receiver population;
- Viewer numbers;
- Duration of frequency of view; and
- Degree of visibility.

The views available to the identified VSRs were rated in accordance with their sensitivity to change using high, medium or low and are defined as follows:

- High
    - i. The nature of the viewer groups who expect a high degree of control over their immediate environment; and
    - ii. The viewer groups are in close proximity to the Proposed Beach Development.
- Medium
    - iii. The nature of the viewer groups who expect a medium degree of control over their immediate environment; or
    - iv. The nature of the viewer groups who have some degree of control over their immediate environment, eg; people in transit.
- Low
    - v. The nature of the viewer groups does not expect a high degree of control over their immediate environment.

It should be noted that the above provided are a guide only, and each VSR regardless of type is assessed according to its specific circumstances.

Magnitude of Change

This set of criteria is related to the specific details of the proposal and how it relates to the existing landscape and the visible magnitude of change it will cause. The criteria to be assessed are:

- Compatibility of the Proposed Beach Development with the surrounding landscape;
- Scale of the development;
- Reversibility of change;
- Viewing distance;
- Potential blockage of view; and
- Duration of impact under construction and operation phases.

The magnitude of change to a view was rated as large, intermediate, small or negligible and are defined as follows:

- Large: eg major change in view;
- Intermediate: eg moderate change in view;
- Small: eg minor change in view, and;
- Negligible: eg no discernible change in view.

The degree of visual impact or significance threshold was rated in a similar fashion to the landscape impact, ie significant, moderate, slight and negligible. Therefore, the visual impact is a product of the magnitude of change to the existing baseline conditions, the landscape context and the sensitivities of VSRs. The significance threshold of visual impact was rated for the construction phase and for Day 1 and Year 10 of the operation phase.

Photomontage Preparation

The visual impact assessments were also partly based on photomontages, which showed the view with and without the Proposed Beach Development.

Photographs that form the base of the photomontages are taken with a 70mm Nikon lens on a 35mm film single lens reflex camera. A 70mm lens has a picture angle of 34.34° and a horizontal angle of view of 28.84° (1). When two photographs taken with a 70mm lens are overlapped approximately 1/3, the resultant image has a picture angle of approximately 50°, which is very similar to the central cone of view of human vision.

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[1] http://www.europepress.com/lenses/nikon_standard_zoom.htm

Figure 10.25 above shows two photographs overlapped 1/3 to create an Image approximately the same as the central cone of view of human vision.

The central field of human vision is approximately 50° - 60°. Two photographs taken with a 70mm lens with approximately 1/3 overlap best show this static view.

10.7.8 Visual Impact Assessment from Visually Sensitive Receivers (VSR)

Figure 10.26 shows the indicative viewpoints from publicly accessible locations, which have been selected for analysis. The viewpoints have been selected to represent the range of views from accessible locations.

VSR1 – View from Tai Mei Tuk BBQ

The location of this VSR is shown in *Figure 10.27* and this VSR represents passive and active recreational users. This location is approximately 380m from the closest rubble mound groyne and the largest of the Proposed Beach Development structures is 540m from the site. This location experiences varying visitor numbers, from low during mid-week winter periods, to high to during summer holidays. Users of recreational marine vessels will also experience a similar view.

The photomontage shown in *Figure 10.28* shows that from this viewpoint, the Proposed Beach Development will be visually prominent.

Table 10.10: Sensitivity / Quality of VSR

Value and quality of view	High
Visitor numbers	Medium
Availability and amenity of alternative views	Medium
Duration and frequency of views to devebpment	High
Degree of visibility of Development	High
Sensitivity/Quality of VSR	High

Table 10.11: Magnitude of Change of VSR

Items	Construction	Operation
Compatibility with surrounding landscape	Low	Low
Viewing distance to Development	380m	380m
Potential blockage of view	Moderate	Moderate
Duration of impacts	2 years	Indefinite
Scale of development	Large	Large
Reversibility of change	Irreversible	Irreversible
Magnitude of change	Large	Large

Table 10.12: Significance Threshold during Construction

		Sensitivity / Quality			**Beneficial**
		Low	**Medium**	**High**	
Magnitude of Change	**Large**	Moderate Impact	Moderate - significant impact	***Significant impact***	**Neither beneficial nor adverse**
	Intermediate	Slight – Moderate impact	Moderate Impact	Moderate-significant impact	
	Small	Slight impact	Slight – Moderate impact	Moderate impact	***Adverse***
	Negligible	Negligible impact	Negligible impact	Negligible impact	

Table 10.13: Significance Threshold during Operation

		Sensitivity / Quality			**Beneficial**
		Low	**Medium**	**High**	
Magnitude of Change	**Large**	Moderate Impact	Moderate - significant impact	***Significant impact***	**Neither beneficial nor adverse**
	Intermediate	Slight – Moderate impact	Moderate Impact	Moderate-significant impact	
	Small	Slight impact	Slight – Moderate impact	Moderate impact	***Adverse***
	Negligible	Negligible impact	Negligible impact	Negligible impact	

Table 10.10 shows that this VSR has a *High* sensitivity to change. *Table 10.11* shows that the magnitude of change of view of VSR 1 will be Large during both of the construction and operation phases. *Table 10.12* therefore indicates that the visual impact on VSR 1 in the construction phase is significant. However, this impact will only be experienced for a short period, i.e. 2 years construction period. Further, with the adoption of site hoardings, which will be in comparable colour to match with the surroundings, during the construction phase, it is considered that the impact could be reduced to moderate/significant. The proposed beach development, due to its large development scale on visually prominent waterfront, would have significant visual impact when viewed from VSR 1 (*Table 10.13* refers). With the adoption of appropriate architectural design features and screen planting (refer to *Section 10.7.9* for details), the visual impact is considered to be moderate/significant at the Operation Day 1. The maturity of the plantings at later stage would further help to soften and break down the bulk of the beach buildings. The visual impact would be reduced to moderate (*Figure 10.28* refers) at Operation Year 10.

VSR2 – View from Lung Mei Residents

This VSR represents a worst case-scenario of viewers in the nearby residential areas of Lung Mei as well as road users and visitors to the restaurants. *Figure 10.29* shows that the development is only 75m from this viewpoint, although the largest structure is approximately 165m away.

The photomontage shown in *Figure 10.30* illustrates that the Proposed Beach Development will dominate the view from this viewpoint. This represents a worst-case scenario for these VSRs.

Table 10.14: Sensitivity / Quality of VSR at Lung Mei

Value and quality of view	High
Visitor numbers	Moderate
Availability and amenity of alternative views	Moderate
Duration and frequency of views to development	High
Degree of visibility of Development	High
Sensitivity/Quality of VSR	High

Table 10.15: Magnitude of Change

Items	**Construction**	**Operation**
Compatibility with surrounding landscape	Low	Low
Viewing distance to Development	75m	75m
Potential blockage of view	Moderate	Moderate
Duration of impacts	2 years	Indefinite
Scale of development	Large	Large
Reversibility of change	Irreversible	Irreversible
Magnitude of change	Large	Large

Table 10.16: Significance Threshold during Construction

		Sensitivity / Quality			**Beneficial**
		Low	**Medium**	**High**	
Magnitude of Change	**Large**	Moderate Impact	Moderate - significant impact	***Significant impact***	**Neither beneficial nor adverse**
	Intermediate	Slight – Moderate impact	Moderate Impact	Moderate-significant impact	
	Small	Slight impact	Slight – Moderate impact	Moderate impact	***Adverse***
	Negligible	Negligible impact	Negligible impact	Negligible impact	

During the construction phase, site hoardings will be erected along Ting Kok Road and they will be visible from this VSR.

Table 10.17: Significance Threshold during Operation

		Sensitivity / Quality			**Beneficial**
		Low	**Medium**	**High**	
Magnitude of Change	**Large**	Moderate Impact	Moderate - significant impact	***Significant impact***	**Neither beneficial nor adverse**
	Intermediate	Slight – Moderate impact	Moderate Impact	Moderate-significant impact	
	Small	Slight impact	Slight – Moderate impact	Moderate impact	***Adverse***
	Negligible	Negligible impact	Negligible impact	Negligible impact	

Table 10.14 shows this VSR has a *High* sensitivity to change and *Table 10.15* shows that the magnitude of change of view of VSR 2 will be Large in both construction and operation phases. *Table 10.16* indicates that the visual impact on VSR 2 in the construction phase is significant. However, this impact will only be experienced for a short period, i.e. 2 years construction period. Further, with the adoption of site hoardings, which will be in comparable colour to match with the surroundings, during the construction phase, it is considered that the impact could be reduced to moderate/significant. The proposed beach development, upon completion, will affect waterfront views for some of the residents of Lung Mei. Due to the closeness of the site and the blocking of the sea views, the visual impact on VSR 2 is considered significant in the operation phase (*Table 10.17* refers). With the adoption of screen plantings on the road side to screen off the concrete beach development, the visual

impact could be reduced to moderate/significant in the Operation Day 1 and further reduced to moderate in Operation Year 10 (*Figure 10.30* refers).

VSR3 – View from BBQ's west of site

Figure 10.31 shows this VSR is located approximately 200m from the development with the largest visible structure being 275m away. The visitors to this area are all recreational users.

The photomontage in *Figure 10.32* shows that the development will be prominent from this viewpoint.

Table 10.18: Sensitivity / Quality of VSR

Value and quality of view	High
Visitor numbers	Low
Availability and amenity of alternative views	Moderate
Duration and frequency of views to development	High
Degree of visibility of Development	High
Sensitivity/Quality of VSR	Medium

Table 10.19: Magnitude of Change

Items	**Construction**	**Operation**
Compatibility with surrounding landscape	High	High
Viewing distance to Development	200m	200m
Potential blockage of view	Low	Low
Duration of impacts	2 years	Indefinite
Scale of development	Large	Large
Reversibility of change	Irreversible	Irreversible
Magnitude of change	Large	Large

Table 10.20: Significance Threshold during Construction

		Sensitivity / Quality			**Beneficial**
		Low	**Medium**	**High**	
Magnitude of Change	**Large**	Moderate Impact	***Moderate - significant impact***	Significant impact	**Neither beneficial nor adverse**
	Intermediate	Slight – Moderate impact	Moderate Impact	Moderate-significant impact	
	Small	Slight impact	Slight – Moderate impact	Moderate impact	***Adverse***
	Negligible	Negligible impact	Negligible impact	Negligible impact	

Table 10.21: Significance Threshold during Operation

		Sensitivity / Quality			**Beneficial**
		Low	**Medium**	**High**	
Magnitude of Change	**Large**	Moderate Impact	***Moderate - significant impact***	Significant impact	**Neither beneficial nor adverse**
	Intermediate	Slight – Moderate impact	Moderate Impact	Moderate-significant impact	
	Small	Slight impact	Slight – Moderate impact	Moderate impact	***Adverse***
	Negligible	Negligible impact	Negligible impact	Negligible impact	

Table 10.18 shows that this VSR has a *Medium* sensitivity to change. *Table 10.19* shows that the magnitude of change of view of VSR 3 will be Large in both construction and operation phases. *Table 10.20* shows that the proposed beach development will result in a moderate/significant visual impact during the construction phase. However, this impact will only be experienced for a short period, i.e. 2 years construction period. Further, with the adoption of site hoardings, which will be in comparable colour to match with the surroundings, during the construction phase, it is considered that the impact could be reduced to moderate. Upon completion, the proposed beach development would have moderate/significant impact on VSR 3 (*Table 10.21* refers). With the adoption of mitigation measures, it is expected that the impact could be reduced to moderate in Operation Day 1 and slight in Operation Year 10 (*Figure 10.32* refers).

VSR 4 - View from Lo Tsz Tin

This VSR represents a worst case-scenario of viewers in the nearby residential areas of Lo Tsz Tin *Figure 10.33* shows that the development is only 80 m from this viewpoint, although the largest structure is approximately 140 m away.

The photomontage shown in *Figure 10.34* illustrates that the Proposed Beach Development will dominate the view from this viewpoint. This represents a worst-case scenario for these VSRs.

Table 10.22: Sensitivity / Quality of VSR at Lung Mei

Value and quality of view	High
Visitor numbers	Moderate
Availability and amenity of alternative views	Moderate
Duration and frequency of views to development	High
Degree of visibility of Development	High
Sensitivity/Quality of VSR	High

Table 10.23: Magnitude of Change

Items	**Construction**	**Operation**
Compatibility with surrounding landscape	Low	Low
Viewing distance to Development	75m	75m
Potential blockage of view	Moderate	Moderate
Duration of impacts	2 years	Indefinite
Scale of development	Large	Large
Reversibility of change	Irreversible	Irreversible
Magnitude of change	Large	Large

Table 10.24: Significance Threshold during Construction

		Sensitivity / Quality			**Beneficial**
		Low	**Medium**	**High**	
Magnitude of Change	**Large**	Moderate Impact	Moderate - significant impact	***Significant impact***	**Neither beneficial nor adverse**
	Intermediate	Slight – Moderate impact	Moderate Impact	Moderate-significant impact	
	Small	Slight impact	Slight – Moderate impact	Moderate impact	***Adverse***
	Negligible	Negligible impact	Negligible impact	Negligible impact	

During the construction phase, site hoardings will be erected along Ting Kok Road and they will be visible from this VSR.

Table 10.25: Significance Threshold during Operation

		Sensitivity / Quality			**Beneficial**
		Low	**Medium**	**High**	
Magnitude of Change	**Large**	Moderate Impact	Moderate - significant impact	***Significant impact***	**Neither beneficial nor adverse**
	Intermediate	Slight – Moderate impact	Moderate Impact	Moderate-significant impact	
	Small	Slight impact	Slight – Moderate impact	Moderate impact	***Adverse***
	Negligible	Negligible impact	Negligible impact	Negligible impact	

Table 10.22 shows this VSR has a high sensitivity to change and *Table 10.23* shows that the magnitude of change of view of VSR 4 will be Large in both construction and operation phases. *Table 10.24* indicates that the proposed beach development will have significant visual impact on VSR 4 in construction stage. However, this impact will last only for a short period, i.e. 2 years construction period. Further, with the adoption of site hoardings, which will be designed in comparable colour to match with the surroundings, in the construction stage, it is considered that the impact would be reduced to moderate/significant. The proposed beach development, upon completion, will change the existing views towards the seaward side for the residents of Lo Tsz Tin. Due to the closeness of the site and the large scale of the development, the visual impact arising from the beach development on VSR 4 is considered significant. However, with the adoption of the mitigation measures including screen plantings and

the provision of green buffer, the impact could be reduced to moderate/significant in Operation Day 1 and moderate in Operation Year 10.

10.7.9 Visual Mitigation Measures

The analysis in *Section 10.7.8* above has identified some visual impacts. The following visual mitigation measures are proposed to enhance the views of the development.

VMM 1 Design of Structures

The structure shown in the photomontages are to illustrate the mass of the structures only. During the design phase of the development, features such as the location of doors, windows, eaves etc. will be detailed. All of these elements will greatly improve the appearance of the structures. Where possible, built structures will utilise appropriate designs to complement the surrounding landscape. Some of the design elements to be adopted for the Management Building include:

1. The roof level will be further reduced from +18.6mPD to +17.05mPD after reviewing the water tank sizes and the landscape approach on the roof top. Hence, the building height will be reduced from 12.1m to 10.3m;

2. The solid parapet wall at the roof level will be constructed to be visually transparent to reduce the mass of the façade adjacent to the beach;

3. The colour, finishes and the texture of the south facing wall will be further detailed to reduce the bulk of the Management Building and help integrate the building with the surrounding landscape;

4. Planters and containing climbing plants will be proposed at the roof level to cascade down the façade. Trees will also be planted in front of the building to further integrate the building with the surrounding landscape and reduce its visual impact.

Materials and finishes will also be considered during detailed design. Moreover, layout plan, elevations and sections of the preliminary design of the beach buildings are attached in *Appendix I* for reference.

VMM 2 Colours

Colours for the structures can be used to complement the surrounding area. Lighter colours such as shades of light grey, off-white and light brown may be utilised where technically feasible to reduce the visibility of the structures.

VMM 3 Plantings

In addition to the landscape mitigation plantings proposed in *Section 10.6.*9 of this report, appropriate new plantings will be installed as appropriate to help integrate the new structures into the surrounding landscape.

VMM 4 Colour of Site Hoardings

In order to mitigate the visual impact of these temporary hoardings, it is recommended that the hoardings be erected at a uniform height, with a uniform colour that complements the existing surrounding landscape.

These Visual Mitigation Measures are shown in *Figure 10.19.*

Table 10.26 shows how these mitigation measures will affect the significance thresholds of the visual impacts on each of the VSRs.

Table 10.26: Mitigated Visual Impacts

VSR	Un-Mitigated Visual Impact		Recommended Mitigation	Mitigated Impacts		
	Construction	**Operation**		**Construction**	**Operation Day 1**	**Operation Year 10**
1 Tai Mei Tuk	Significant	Significant	VMM 1-4	Moderate/ Significant	Moderate/Significant	Moderate
2 Lung Mei Residents	Significant	Significant	VMM 1-4	Moderate/Significant	Moderate/Significant	Moderate
3 BBQ's West	Moderate /Significant	Moderate/Significant	VMM 1-4	Moderate	Moderate	Slight
4 Lo Tsz Tin	Significant	Significant	VMM 1-4	Moderate/Significant	Moderate/Significant	Moderate

10.7.10 Visual Impact Summary

Table 10.26 shows the un-mitigated impacts and the residual mitigated impacts following the installation of the recommended mitigation measures. The photomontages prepared for each of the viewpoints also show the effectiveness of the mitigation measures in reducing the impacts. For VSR 1 (Tai Mei Tuk), VSR 2 (Lung Mei Residents) and VSR 4 (Lo Tsz Tin residents), the un-mitigated visual impacts in operation stage will be significant. However, with the implementation of the mitigation measures, the impact will be more acceptable resulting in moderate/significant in Operation Day 1 and moderate in Operation Year 10. For VSR 3 (BBQ Site - West of the site), the visual impact will be moderate in Operation Day 1 and slight in Operation Year 10. In sum, the proposed beach development will inevitably change the existing waterfront view of the area. However, there will be no significant residual impacts for any VSRs. With the adoption of the mitigation measures, the residual impact will be reduced to a large extent and is considered acceptable.

10.7.11 Night Lighting and Glare

The above analysis examined the visual impacts of the proposal during daylight hours. Detailed lighting plans and specifications are not available at this preliminary design stage, however a preliminary assessment can be made based on similar developments.

The degree to which night lighting has an impact on the surrounding areas is dependent on the following criteria:

- The spacings, intensity and operation hours of the source lighting;
- The distance between the source lighting and the VSR;
- The surrounding ambient lighting conditions of the VSR; and
- The surrounding lighting conditions of the source.

Source Lighting

The lighting of the Proposed Beach Development will generally comprise the following:

- **Car park lighting**. This will be in the form of overhead pole lights to illuminate the car park area. These fittings will be selected to minimise light spill.
- **General access lighting**. These fittings will generally be in the form of bollards and wall-mounted spotlights. These will provide safe access and operational lighting conditions around the site. Baffles will be fitted where possible to reducing upward light spill.
- **Emergency lighting**. These lights will provide safe levels of illumination to facilitate evacuations or repairs in emergency situations. The use of these lights will be infrequent.
- **General Ornamental Lighting.** This lighting will generally be in the form of low voltage ornamental spotlights, signage lights and spotlights.

Distances Between Source Lighting and the VSRs

Due to the relatively close proximity of some of the proposed development, the source lighting emitted from the Proposed Beach Development will be visible.

Surrounding Ambient Light of the VSR

Night lighting from the source is more highly visible when one is observing in darkness. As the surrounding ambient light increases, the visibility of distant objects reduces. This includes viewers in restaurants, near streetlights, or inside illuminated homes. Due to the surrounding light sources, viewers looking towards the Proposed Beach Development in darkness are expected to be low in number.

Surrounding Lighting Conditions of the Source

There is substantial lighting in the areas surrounding the development. These include the restaurants and residents in Lung Mei, the streetlights along Ting Kok Road and particularly the car park at Tai Mei Tuk, which contains a number of light fixtures.

Lighting Impact Summary

Whilst there will be an increase in the lighting sources in the Lung Mei area resulting from the project, these light emissions will generally be in accordance with the existing light sources of the surrounding area. The night lighting and glare impacts are considered acceptable.

10.8 Conclusions

Three Landscape Character Areas (LCAs) were identified and the residual impacts on the LCA1 (Foreshore Landscape) will be *moderate*. For LCA2 (Inshore Waters Landscape), the residual impact will be *slight* and for LCA3 (Coastal Rural/Suburban Landscape) the residual impact will be *negligible*. Two new LCAs will also be created 'Recreational Beach Landscape' and 'Coastal Urban Recreational Landscape' as a consequence of the project.

Of the seven Landscape Resources (LRs) identified, there will be no *significant* residual impacts on any of the LRs after the implementation of mitigation measures. There will be *moderate* residual impacts on Trees/Backshore Shrubland and the Sandy/Rocky Beach LRs. There will be *slight* residual impacts on the Water LR and for the Shrubland, River, Road and Village, the residual impacts will be negligible. One new LR will also be created 'Sandy Beach' as a consequence of the project.

Four visually sensitive receivers (VSRs) including VSR 1 (Tai Mei Tuk), VSR 2 (Lung Mei Residents), VSR 3 (BBQ site) and VSR 4 (Lo Tsz Tin residents) were identified. The un-mitigated visual impacts for VSR 1 (Tai Mei Tuk), VSR 2 (Lung Mei Residents) and VSR 4 (Lo Tsz Tin residents) in operation stage will be *significant*. However, with the implementation of the mitigation measures, the impact will be more acceptable resulting in *moderate/significant* in Operation Day 1 and *moderate* in Operation Year 10. For VSR 3 (BBQ Site - West of the site), the unmitigated visual impacts will be *moderate/significant.* However, with the implementation of the mitigation measures, the impact will be reduced to *moderate* in Operation Day 1 and *slight* in Operation Year 10. In sum, the proposed beach development will inevitably change the existing waterfront view of the area. However, there will be no significant residual impacts for any VSRs. With the adoption of the mitigation measures, the residual impact will be reduced to a large extent and is considered acceptable.

There will be various lighting fixtures associated with the project, with the most visible light source being the carpark lighting. Whilst these lights will contribute to the general ambient light levels of the area, the impacts are not expected to be significant.

According to *Annex 10* of the *Technical Memorandum on the Environmental Impact Assessment Process* (EIAO-TM) the Landscape and Visual Impacts are considered *acceptable with mitigation.*

11 ENVIRONMENTAL MONITORING AND AUDIT REQUIREMENTS

11.1 Introduction

This *Section* describes the requirements for environmental monitoring and audit during the construction and operation of the Proposed Beach Development. With respect to the scale of the Proposed Beach Development, the low potential impacts and the nature and frequency of the monitoring and audit to be undertaken, it is considered that real-time reporting of the monitoring data is not applicable. The Implementation Schedule, containing the recommended mitigation measures, monitoring and audit requirements, and implementation agent of the mitigation measures for the Proposed Beach Development, is also presented.

11.2 Environmental Management Plan

The Contractor will be contractually bound to produce and implement an Environmental Management Plan (EMP). EMP's are similar in nature to safety or quality plans and provide details of the means by which the Contractor (and all subcontractors working for the Contractor) will implement the recommended mitigation measures and achieve the environmental performance standards defined both in Hong Kong environmental legislation and in the Implementation Schedule. The primary reason for making the EMP a contractual requirement is to ensure that the Contractor is fully aware of his environmental responsibilities and to ensure his commitment to achieving the specified standards.

To evaluate Contractor's commitment, each contract bidder shall be required to produce a preliminary EMP as part of the tendering process. The skeletal EMP will indicate the determination and commitment of the bidding Contractor and indicate how the contractor intends to meet the environmental performance requirements laid out in the EIA. Upon Contract Award, the successful bidder(s) will be required to submit a draft and final version of the EMP for approval by the project proponent (Civil Engineering and Development Department) prior to the commencement of the work.

11.3 EM & A Manual

The EPD requires the submittal for approval of an EM&A Manual prior to the commencement of construction. The EM&A Manual defines the mechanisms for implementing the EM&A requirements specific to each phase of the work. The EM&A Manual provides a description of the organisational arrangements and resources required for the EM&A programme based on the conclusions and recommendations of this EIA. The EM&A Manual stipulates details of the construction monitoring required and actions that shall be taken in the event of exceedances of the environmental criteria. In effect, the EM&A Manual forms a handbook for the on-going environmental management during construction.

The EM&A Manual comprises descriptions of the key elements of the EM&A programme including:

- Appropriate background information on the construction of the Proposed Beach Development with reference to relevant technical reports;
- Organisational arrangements, hierarchy and responsibilities with regard to the management of environmental performance during the construction phase. The EM&A team, the Contractor(s) team and the CEDD's representatives are included;
- A broad construction programme indicating those activities for which specific mitigation is required and providing a schedule for their timely implementation;
- Descriptions of the parameters to be monitored and criteria through which performance will be assessed including: monitoring frequency and methodology, monitoring locations (typically, the location of sensitive receivers as listed in the EIA), monitoring equipment lists, event contingency plans for exceedances of established criteria and schedule of mitigation and best practice methods for reduced adverse environmental impacts;
- Procedures for undertaking on-site environmental performance audits as a means of ensuring compliance with environmental criteria; and
- Reporting procedures.

The EM&A Manual will be a dynamic document which will undergo a series of revisions, as needed, to accommodate the progression of the construction programme.

11.3.1 Objectives of EM&A

The objectives of carrying out EM&A for the Proposed Beach Development include:

- Providing baseline information against which any short or long term environmental impacts of the projects can be determined;
- Providing an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards;
- Monitoring the performance of the Proposed Beach Development and the effectiveness of mitigation measures;
- Verifying the environmental impacts identified in the EIA;
- Determining Proposed Beach Development compliance with regulatory requirements, standards and government policies;
- Taking remedial action if unexpected results or unacceptable impacts arise; and
- Providing data to enable an environmental audit to be undertaken at regular intervals.

The following sections summarise the recommended EM&A requirements and further details are provided in the EM&A Manual.

11.4 Construction Phase Air Quality Impact (Dust)

Dust should be monitored once every 6 days at two locations at ASRs A4 (No. 101 Lung Mei Tsuen) and A6 (No. 79 Lo Tsz Tin Tsuen) throughout the construction phase. The parameters to be monitored include 1-hr and 24-hr total suspended particulates (TSP).

11.5 Noise Impact

11.5.1 Construction Phase

Noise monitoring should be carried out during the construction phase to ensure compliance with the noise criterion at the NSRs. Weekly noise monitoring should be undertaken at the representative NSRs (N1 – N4) (*Table 11.1*). If house No. 101 Lung Mei (N2a) is changed to residential use, noise monitoring should be conducted at N2a instead of N2. Regular site audits at the frequency of twice a month should be conducted to ensure that the recommended mitigation measures are properly implemented during the construction stage.

Table 11.1: Locations for Construction Noise Monitoring

NSR	Location
N1	Village house - No. 165A Lung Mei
N2	Village house - No. 103 Lung Mei
N3	Village house - No. 70 Lo Tsz Tin
N4	Village house - No. 79 Lo Tsz Tin

11.5.2 Operational Phase

The predicted operational noise levels at the representative NSRs are expected to comply with the daytime criteria based on the assessment using a set of specified maximum SWLs for the fixed plant to be installed at the Proposed Beach Development. Attenuation measures, if required, will be provided to the fixed plant for achieving the guaranteed noise levels during the detailed design stage, and therefore operational phase noise monitoring is not required.

11.6 Water Quality

In accordance with the recommendations of the EIA, mitigation measures have been proposed during the construction phase of the Project. Details of the mitigation measures are presented in *Table 11.3 Implementation Schedule* in this Report.

In accordance with the recommendations of the EIA, water quality EM&A is required during dredging and sandfilling activities. In addition, baseline water quality monitoring will be required prior to the commencement of construction activities.

11.6.1 *Construction Phase*

Water Quality Parameters Measurements of Dissolved Oxygen (DO) concentration (mg L^{-1}), DO saturation (%), Salinity (mg L^{-1}), Temperature (ºC) and Turbidity (NTU) should be taken in situ by the EM&A team at monitoring stations identified below. Water samples for the measurements of SS (mg L^{-1}) and chlorophyll-*a* (µg L^{-1}) should also be collected for laboratory analysis. In addition to the water quality parameters, other relevant data should also be measured and recorded in Water Quality Monitoring Logs including the location of the sampling stations, water depth, time, weather conditions, sea conditions, tidal stage, current direction and speed, special phenomena and work activities undertaken around the monitoring and works area that may influence the monitoring results. The monitoring station locations should be presented in the EM&A Manual.

The monitoring stations should be sampled during Baseline Monitoring (prior to the dredging works), Impact Monitoring (during dredging and sandfilling works) and Post Project Monitoring (after completion of sandfilling work).

For baseline, impact and post-project monitoring, monitoring should be undertaken 3 days per week, at mid-flood and mid-ebb tides, with sampling/ measurement at the designated stations.

Measurements shall be taken at 3 water depths: 1m below water surface, mid-depth and 1m above sea bed, except where the water depth less than 6m, the mid-depth station may be omitted. Should the water depth be less than 3m, only the mid-depth station will be monitored.

11.6.2 *Post-Construction Phase*

The Post-Construction Phase is defined as after completion of construction works but before the operation of the beach. No sewage and wastewater generated from the beach building facilities will be discharged into the beach or marine environment, water quality impact due to sewage and wastewater discharge from the beach building facilities is not anticipated (refer to EIA Report Section 6).

E. coli Monitoring

Monitoring for *E. coli* is recommended at the outfall of the eastern culvert and western channel within six weeks after the completion of construction works. The purpose of the monitoring is to investigate the characteristics of *E. coli* loading in the box culvert/channel and to establish relationship with *E. coli* levels at the beach. Samples will be collected at the locations specified in *Figure 5.2* at/near the outlet of the outfall when no influx of seawater occur (e.g. during low tide). During the same tide, *E. coli* samples should be collected at EPD's routine beach monitoring stations. The sampling team should confirm the locations of EPD's routine monitoring stations prior to the commencement of any sampling events. In some occasions, it is not practicable to take the samples at EPD's routine monitoring stations, for example, the water is too shallow. Then the sampling team should determine the nearest sampling locations which should be as close to EPD's stations as possible. The coordinates of all the sampling locations should be recorded.

E. coli samples should be stored in cool box (4°C) during the sampling and transportation and should be delivered to the HOKLAS accredited laboratory, or equivalent, to determine the *E. coli* content in the sample.

Other water quality parameters, i.e., pH, Dissolved Oxygen (DO) concentration (mg L^{-1}), DO saturation (%), Salinity (mg L^{-1}), Temperature (ºC) and Turbidity (NTU) should be taken in situ by the sampling team at same monitoring stations as for *E.coli* measurements. Observations such as and weather and beach conditions, should also be recorded.

Sampling should be conducted twice per week within six weeks after the completion of construction works.

11.6.3 Operational Phase(1)

Routine Monitoring of Beach Water Quality

EPD has well established a comprehensive water quality monitoring programme for all gazetted beaches to detect any deterioration of beach water quality, which will also be implemented for this Lung Mei bathing beach.

EPD's current monitoring programme requires all gazetted beaches are monitored at least three times per month during bathing seasons. During non-bathing seasons, gazetted beaches are monitored once per month. The monitoring data assists to detect any deterioration of beach water quality. In case the beach water quality tends to be deteriorated, EPD will continue monitoring of the beach water quality and provide Leisure and Cultural Services Department (LCSD) the monitoring data. In case the beach water quality tends to be deteriorated, LCSD will decide the most appropriate method of improving the beach water quality.

In case the beach water quality at Lung Mei tends to be deteriorated and becomes not desirable for swimming, LCSD will close the beach temporarily until the beach water quality becomes suitable for swimming. EPD will continue monitoring the beach water quality and provide LCSD the monitoring results.

Red Tides

In the event of red tide that may occur naturally, similar to the practice adopted for other gazetted beaches by LCSD, Lung Mei beach may be closed to swimmers in accordance with the relevant procedures.

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(1) The operation phase of the Proposed Beach Development is considered as commencement of the handover date to LSCD so that the proposed measures recommended under EM&A should be carried out as appropriate after the handover. However, there may be a time lapse between the handover date and the formal opening for public use due to the application of the beach gazette by LCSD.

11.7 Waste Management

11.7.1 Construction Phase

In order to ensure that the Contractor has implemented the recommendations of the EIA Report, regular site audits should be conducted of the waste streams, to determine if wastes are being managed in accordance with the approved procedures and the site Waste Management Plan. The audits should look at all aspects of waste management including waste generation, storage, recycling, transport and disposal. An appropriate audit programme should be undertaken with the first audit conducted at the commencement of the construction works. Routine weekly site inspections should also include waste management.

11.7.2 Operational Phase

As it is not expected that large quantities of waste will be generated from the operation of the Proposed Beach Development and no adverse environmental impacts will arise with the implementation of good waste management practices. Waste monitoring and audit programme for the operational phase of the Proposed Beach Development will not be required.

11.8 Ecology

11.8.1 Construction Phase

To undertake a one day-time search of the Common Rat Snake within the land based Proposed Beach Development just before the commencement of the construction works. All recorded Common Rat Snake should be caught by hand and translocated to the shrubland at the north of the Study Area, immediately after the search. The Common Rat Snake search and translocation works should be undertaken by a qualified ecologist.

For the mitigation measures and monitoring requirement to minimise the water quality impact to the marine ecology during the construction phase of the Proposed Beach Development, details should be referred to *Section 6.6* and *Table 11.3*.

Good construction site practices as specified in *Section 6.6* and *Table 11.3* should be adopted to minimise the potential ecological impacts during the construction phase of the Proposed Beach Development.

11.8.2 Operational Phase

Due to the loss of some mangrove plants and seedlings recorded within the Proposed Beach Development, the EIA has recommended that compensation mangrove seedling planting should be implemented before the operation of the Proposed Beach Development. The mangrove seedling planting should be located along the diverted eastern box culvert (*Figure 10.19* of EIA Report *Section 10*). The planting mix should be at a ratio 1:1:1 for *Aegiceras corniculatum, Avicennia marina* and *Kandelia obovata*. Detailed mangrove planting proposal providing information of planting methodology, recipient site, planting species and mix, implementation programme, post-planting monitoring and personal involved shall be submitted to and approved by AFCD. Mangrove seedling planting would be undertaken and supervised by a suitably qualified botanist/ horticulturist.

After planting, one year monitoring should be undertaken to check the performance and health conditions of the planted individuals on a monthly basis. Remedial actions should be discussed with AFCD in the event of unsuccessful mangrove seedling planting.

11.9 Fisheries

11.9.1 Construction Phase

As no unacceptable impacts have been predicted in the EIA to occur during the construction of the beach at Lung Mei, monitoring of fisheries resources during the construction phase is not considered necessary. However, water quality monitoring will be conducted (see EM&A Manual *Section 12.6*) at the Yim Tin Tsai East Fish Culture Zone.

11.9.2 Operational Phase

In accordance with the recommendation of the EIA regarding fisheries impact assessment, EM&A is not required during the operation phase of the Proposed Beach Development.

11.10 Landscape and Visual Impact

11.10.1Construction Phase

Regular site inspections during the construction phase should be undertaken to maintain the quality of the constructed landscape. Inspection of the proposed plant material should also be undertaken prior to delivery on site.

11.10.2Operational Phase

Ongoing monitoring and maintenance to approved Hong Kong standards should be undertaken to ensure the long term health of the plant materials.

11.11 Implementation Schedule

This section summarises all the mitigation measures recommended in the *EIA Study* and presents them in the form of an Implementation Schedule in accordance with the requirements of Section 3.4.9.3 of the *EIA Study Brief No. ESB-138/2006* (*Table 11.3*).

The Implementation Schedule has the following column headings:

EIA Reference

This denotes the section number or reference from the EIA Report Main text.

EM&A Reference

This denotes the sequential number of each of the recommended mitigation measures specified in the Implementation Schedule.

Recommended Mitigation Measures

This denotes the recommended mitigation measures, courses of action or subsequent deliverables that are to be adopted, undertaken or delivered to avoid, reduce or ameliorate predicted environmental impacts.

Objectives of the Recommended Measure and Main Concerns to be Addressed

This denotes the objectives of the recommended mitigation measures and main concerns to address.

Location/Duration of Measures/Timing of Completion of Measures

This indicates the spatial area in which the recommended mitigation measures are to be implemented together with details of the programming or timing of their implementation.

Implementation Agent

This denotes where the responsibility lies for the implementation of the recommended mitigation measures.

Implementation Stage

This denotes the stage at which the recommended mitigation measures are to be implemented either during the Design, Construction, Operation or Decommissioning phases.

Relevant Legislation

This defines the controlling legislation that is required to be complied with.

Table 11.3 Implementation Schedule

EIA Ref.	**EM&A Ref**	**Environmental Protection Measures**	**Objectives of the Recommended Measure & Main Concerns to address**	**Location/Duration of Measures/Timing of Completion of Measures**	**Implementation Agent**	**Implementation Stage**				**Relevant Legislation Guidelines**
						Des	C	O	Dec	
Air Quality – Construction Phase										
4.5.1	-	Dust Control								
		a Vehicle washing facilities should be provided at the designated vehicle exit point; b Every vehicle should be washed to remove any dusty materials from its body and wheels immediately before leaving the worksite; c The load carried by the trucks should be covered entirely to ensure no leakage from the vehicles; d Hoarding of not less than 2.4 m high from ground level should be provided along the entire length of that portion of the site boundary adjoining a road or other area accessible to the public except for a site entrance or exit; e The main haul road should be kept clear of dusty materials and should be sprayed with water so as to maintain the entire road surface wet at all the time;	To ensure dust emission is controlled and compliance with relevant statutory requirements	Project Site / During construction	Contractor		✓			*Air Pollution Control (Construction Dust) Regulations*

EIA Ref.	**EM&A Ref**	**Environmental Protection Measures**	**Objectives of the Recommended Measure & Main Concerns to address**	**Location/Duration of Measures/Timing of Completion of Measures**	**Implementation Agent**	**Implementation Stage**				**Relevant Legislation Guidelines**
						Des	C	O	Dec	
		f The stockpile of dusty materials should be either covered entirely by impervious sheets; place in an area sheltered on the top and three sides; or sprayed with water to maintain the entire surface wet at all the time;								
		g Belt conveyor system should be enclosed on the top and two sides;								
		h The height of the belt conveyor should be kept as low as possible to avoid delivery at height; and								
		i All the exposed area should be kept wet always to minimise dust emission.								
4.5.1	-	<u>Air Quality Control</u>								
		a All dump trucks entering or leaving the Project Site should be provided with mechanical covers in good service condition; and	To ensure air quality standards compliance with relevant statutory requirements	Project Site / During construction	Contractor		✓			*ETWC TC No 19/2005*
		b Ultra-low-sulphur diesel (ULSD) should be used for all construction plant on site.								

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage				Relevant Legislation Guidelines
						Des	C	O	Dec	
4.7.1	-	<u>EM&A Requirements</u>								
		Regular site audits (at a frequency of not less than once every two weeks) are recommended.	To ensure that appropriate dust control measures are implemented and good site practices are adopted	Project Site / During construction	ET and Contractor		✓			*Air Pollution Control (Construction Dust) Regulations*
4.7.1	3.0-3.7	Implementation of a construction dust monitoring in every six days	To ensure compliance with the relevant criterion during the construction works.	ASRs A4 (No. 101 Lung Mei Tsuen) and A6 (No. 79 Lo Tsz Tin tsuen) / during construction	ET and Contractor		✓			*Air Pollution Control (Construction Dust) Regulations*
Noise – Design Phase										
5.4.2 (Table 5.7)		The maximum allowable SWLs presented in Table 5.7 of the EIA Report should be included in the tender specification to ensure the assumptions for the operational noise impact assessment remain valid. The suppliers of equipment should guarantee the specified SWLs, with the characteristics of tonality, impulsiveness and intermittency accounted for, by providing certificate of measurement and verify the SWL during testing and commissioning in accordance with international standard procedures. If necessary, the suppliers should apply attenuation measures (eg use of silencers) to achieve the guaranteed noise levels during the detailed design stage.	To reduce the operational noise impact.	Project Site / During design	CEDD/LCSD	✓				*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*

EIA Ref.	**EM&A Ref**	**Environmental Protection Measures**	**Objectives of the Recommended Measure & Main Concerns to address**	**Location/Duration of Measures/Timing of Completion of Measures**	**Implementation Agent**	**Implementation Stage**				**Relevant Legislation Guidelines**
						Des	C	O	Dec	
Noise – Construction Phase										
5.6.1		Site hoardings at the particular work site boundary may be provided for achieving screening effect, provided that the hoardings have no openings or gaps and meet the same specifications for movable noise barriers. The proposed movable noise barriers should be at least 3m high with a surface density of not less than 7 kg m^{-2}, which could provide a minimum of 5 dB(A) attenuation. Skid footing of movable noise barriers should be located at a distance not more than a few metres of stationary plant and mobile plant such that the NSRs would not have direct line of sight to the plant. The length of the barriers should also be at least five times greater than its height.	To reduce the construction noise impact.	Project Site / During construction	ET and Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*
5.7.1 (Table 5.12)	-	The following Quiet Powered Mechanical Equipment (PME) should be used during the construction Phase. • Mobile Crane, SWL listed in the data base of quality powered mechanical equipment prepared by the Noise Control Authority, 107 dB(A); • Tracked Loader, British Standard 5228 – Table C3, Reference No. 16, 104 dB(A);	To reduce the construction noise impact.	Project Site / During construction phase	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage				Relevant Legislation Guidelines
						Des	C	O	Dec	
		• Pneumatic breaker, British Standard 5228 – Table C2, Reference No. 10, 110 dB(A); • Concrete Lorry Mixer British Standard 5228 – Table C6, Reference No. 23, 100 dB(A); and • Excavator British Standard 5228 - Table C3, Reference No. 97, 105 dB(A).								
5.7.1 (Table 5.13)	-	<u>Construction Works on Land</u> Movable noise barrier should be provided for excavator and mobile crane; Timber sawing machine should be operated behind site hoarding/ movable noise barrier; and Concrete lorry mixer should be operated behind site hoarding/movable noise barrier.	To reduce the construction noise impact.	Project Site / During the Site Formation, construction of seawall, ramp, staircase, retaining walls, sump tanks for grey water system and superstructure foundation	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*
5.7.1 (Table 5.13)	-	Timber sawing machine should be operated behind movable noise barrier; and Movable noise barrier should be provided for excavator and mobile crane.	To reduce the construction noise impact.	Project Site / During the localised road widening works along Ting Kok Road	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*
5.7.1 (Table 5.13)	-	<u>Car Park Paving</u> Movable noise barrier should be provided for excavator.	To reduce the construction noise impact.	Project Site / During the car park paving	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*

EIA Ref.	**EM&A Ref**	**Environmental Protection Measures**	**Objectives of the Recommended Measure & Main Concerns to address**	**Location/Duration of Measures/Timing of Completion of Measures**	**Implementation Agent**	**Implementation Stage**				**Relevant Legislation Guidelines**
						Des	C	O	Dec	
5.7.1 (Table 5.13)	-	Building Works Movable noise barrier should be provided for excavator, mobile crane and earth auger; and Timber sawing machine should be operated behind site hoarding/ movable noise barrier.	To reduce the construction noise impact.	Project Site / During foundation and tanking works	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*
5.7.1 (Table 5.13)	-	Movable noise barrier should be provided for mobile crane; and Timber sawing machine should be operated behind site hoarding/ movable noise barrier.	To reduce the construction noise impact.	Project Site / During superstructure works	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*
5.7.1 (Table 5.13)	-	Movable noise barrier should be provided for mobile crane.	To reduce the construction noise impact.	Project Site / During building finishes & internal fitting-out	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*
5.7.1 (Table 5.13)	-	Rock filling for the Groynes Movable noise barrier should be provided for excavator and derrick lighter.	To reduce the construction noise impact.	Project Site / During the construction of gabion channel	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*
5.7.1 (Table 5.13)	-	Box Culvert Construction Movable noise barrier should be provided for excavator.	To reduce the construction noise impact.	Project Site / During the construction of gabion channel	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*

EIA Ref.	**EM&A Ref**	**Environmental Protection Measures**	**Objectives of the Recommended Measure & Main Concerns to address**	**Location/Duration of Measures/Timing of Completion of Measures**	**Implementation Agent**	**Implementation Stage**				**Relevant Legislation Guidelines**
						Des	C	O	Dec	
5.7.1 (Table 5.13)	-	Movable noise barrier should be provided for excavator, mobile crane; and Concrete lorry mixer should be operated behind site hoarding/movable noise barrier.	To reduce the construction noise impact.	Project Site / During the construction of western culvert	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex* 5 of the *EIAO-TM*
5.7.1 (Table 5.13)	-	Concrete lorry mixer should be operated behind site hoarding/movable noise barrier.	To reduce the construction noise impact.	Project Site / During the construction of eastern culvert	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex* 5 of the *EIAO-TM*
5.7.1 (Table 5.13)	-	Site hoarding should be provided for work site.	To reduce the construction noise impact.	Project Site / During the construction of 90m box culvert	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex* 5 of the *EIAO-TM*
5.7.1 (Table 5.13)	-	Sand Filling								
		Movable noise barrier should be provided for excavator.	To reduce the construction noise impact.	Project Site / During the construction of gabion channel	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex* 5 of the *EIAO-TM*
5.7.1	-	Good Site Practice								
		Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme; Silencers or mufflers on construction equipment should be utilized and should be properly maintained during the construction programme;	To reduce the construction noise impact.	Project Site / Throughout the construction period	Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex* 5 of the *EIAO-TM*

EIA Ref.	**EM&A Ref**	**Environmental Protection Measures**	**Objectives of the Recommended Measure & Main Concerns to address**	**Location/Duration of Measures/Timing of Completion of Measures**	**Implementation Agent**	**Implementation Stage**				**Relevant Legislation Guidelines**
						Des	C	O	Dec	
		Mobile plant, if any, should be sited as far from NSRs as possible; Machines and plant (such as trucks) 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, wherever possible, be orientated so that the noise is directed away from the nearby NSRs; and Material stockpiles and other structures should be effectively utilised, wherever practicable, in screening noise from on-site construction activities.								
5.9.1	4.1	EM&A Requirements								
		Implementation of weekly construction noise monitoring at the representative NSRs.	To ensure compliance with the relevant criterion during the construction works.	N1, N2/N2a, N3 & N4/ Throughout the	ET and Contractor		✓			*Noise Control Ordinance* (NCO) and *Annex 5* of the *EIAO-TM*
Noise – Operational Phase										
5.9.2	-	EM&A Requirements	-	-	-					-
		No noise monitoring is required during operational phase.								

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage				Relevant Legislation Guidelines
						Des	C	O	Dec	
Water Quality – Construction Phase										
6.6.1	-	Dredging and Sandfilling Operations Sandfilling works should be carried out after the completion of groyne construction.	To further minimise the SS level during sandfilling works	Project Site / During sandfilling	Contractor		✓			-
6.6.1 and Figure 6.20	-	A movable cage type / metal frame type silt curtain will be deployed around the dredging area next to the grab dredger prior to commencement of dredging works.	To further minimise the SS level during the dredging and sandfilling works	Project Site / During dredging and sandfilling	Contractor		✓			*Annex 6 of the EIAO-TM*
6.6.1 and Figure 6.21	-	Standing type silt curtains will be deployed around the proposed sandfilling extent prior to commencement of sandfilling works.	To further minimise the SS level during the dredging and sandfilling works	Project Site / During dredging and sandfilling	Contractor		✓			*Annex 6 of the EIAO-TM*
6.6.1	-	A hourly dredging rate of a closed grab dredger (with a minimum grab size of 3 m^3) should be less than 31 m^3 hr^{-1}, with reference to the maximum rate for dredging, which was derived in the EIA.	To further minimise the SS level during the dredging works	Project Site / During dredging	Contractor		✓			-
6.6.1	-	A daily filling rate should be less than 1,000 m^3 day^{-1}, which was defined in the EIA.	To further minimise the SS level during the sandfilling works	Project Site / During sandfilling	Contractor		✓			-
6.6.1	-	Mechanical grabs should be designed and maintained to avoid spillage and should seal tightly while being lifted.	To further minimise the SS level during the dredging works	Project Site / During dredging	Contractor		✓			-
6.6.1	-	Barges or hoppers should have tight fitting seals to their bottom openings to prevent leakage of material.	To further minimise the SS level during the dredging and sandfilling works	Project Site / During dredging and sandfilling	Contractor		✓			-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage				Relevant Legislation Guidelines
						Des	C	O	Dec	
6.6.1	-	Loading of barges or hoppers shall be controlled to prevent splashing of dredged material to the surrounding water.	To further minimise the SS level during the dredging works	Project Site / During dredging	Contractor		✓			-
6.6.1	-	Barges or hoppers should not be filled to a level which will cause overflow of materials or pollution of water during loading or transportation.	To further minimise the SS level during the dredging and sandfilling works	Project Site / During dredging and sandfilling	Contractor		✓			-
6.6.1	-	Excess material should be cleaned from the decks and exposed fittings of barges or hoppers before the vessel is moved.	To further minimise the SS level during the dredging and sandfilling works	Project Site / During dredging and sandfilling	Contractor		✓			-
6.6.1	-	Adequate freeboard should be maintained on barges to reduce the likelihood of decks being washed by wave action.	To further minimise the SS level during the dredging and sandfilling works	Project Site / During dredging and sandfilling	Contractor		✓			-
6.6.1	-	All vessels should be sized such that adequate clearance is maintained between vessels and the seabed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash.	To further minimise the SS level during the dredging and sandfilling works	Project Site / During dredging and sandfilling	Contractor		✓			-
6.6.1	-	The works should not cause foam, oil, grease, litter or other objectionable matter to be present in the water within and adjacent to the Project Site.	To further minimise the SS level during the dredging and sandfilling works	Project Site / During dredging and sandfilling	Contractor		✓			*ProPECC PN 1/94*

EIA Ref.	**EM&A Ref**	**Environmental Protection Measures**	**Objectives of the Recommended Measure & Main Concerns to address**	**Location/Duration of Measures/Timing of Completion of Measures**	**Implementation Agent**	**Implementation Stage**				**Relevant Legislation Guidelines**
						Des	C	O	Dec	
6.6.1	-	Construction Site Runoff								
		The excavation works for the drainage diversions should be carried out to minimise any seawater influx entering the works area and hence to keep the works area dry as much as possible.	To ensure the works area will be kept dry as much as possible and hence avoid construction site runoff	Project Site / During excavation for the drainage diversions	Contractor		✓			-
6.6.1 and Figure 6.21	-	Silt curtains at the inshore waters should be deployed to enclose the works area before the commencement of the excavation works for two drainage diversions until the completion of the diversions.	To avoid any adverse water quality impacts resulting from the site runoff due to heavy rainfall	Project Site / During excavation for the drainage diversions	Contractor		✓			-
6.6.1	-	At the start of site establishment, perimeter cut-off drains to direct off-site water around the site should be constructed and internal drainage works and erosion and sedimentation control facilities implemented. Channels, earth bunds or sand bag barriers should be provided on site to direct stormwater to silt removal facilities. The design of efficient silt removal facilities should be based on the guidelines in *Appendix A1* of *ProPECC PN 1/94*.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*
6.6.1	-	All the surface runoff should be collected by the on-site drainage system and diverted through the silt traps prior to discharge into storm drain.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*

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6.6.1	-	All exposed earth areas should be completed as soon as possible after earthworks have been completed, or alternatively, within 14 days of the cessation of earthworks, where practicable. If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by tarpaulin or by other means.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*
6.6.1	-	All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms. Deposited silt and grit should be removed regularly and disposed of by spreading evenly over stable, vegetated areas.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*
6.6.1	-	Measures should be taken to reduce the ingress of site drainage into excavations. If the excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*

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						Des	C	O	Dec	
6.6.1	-	Open stockpiles of construction materials (for example, aggregates, sand and fill material) of more than 50 m^3 should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*
6.6.1	-	Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*
6.6.1	-	Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecasted, and actions to be taken during or after rainstorms are summarised in *Appendix A2* of *ProPECC PN 1/94*. Particular attention should be paid to the control of silty surface runoff during storm events, especially for areas located near steep slopes.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*
6.6.1	-	Oil interceptors should be provided in the drainage system and regularly emptied to prevent the release of oil and grease into the storm water drainage system after accidental spillages. The interceptor should have a bypass to prevent flushing during periods of heavy rain.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage				Relevant Legislation Guidelines
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6.6.1	-	All temporary and permanent drainage pipes and culverts provided to facilitate runoff discharge should be adequately designed for the controlled release of storm flows. All sediment traps should be regularly cleaned and maintained. The temporary diverted drainage should be reinstated to the original condition when the construction work has finished or the temporary diversion is no longer required.	To minimise the construction site runoff	Project Site / During land based construction works	Contractor		✓			*ProPECC PN 1/94*
6.6.1	-	<u>Sewage Generated by Workforce</u>								
		Sewage from toilets should be collected by a licensed waste collector.	To prevent contamination to nearby environment	Project Site / During land based construction works	Contractor		✓			*Water Pollution Control Ordinance*
6.6.1	-	<u>Storage and Handling of Oil, Other Petroleum Products and Chemicals</u>								
		Waste streams classifiable as chemical wastes should be properly stored, collected and treated for compliance with *Waste Disposal Ordinance or Disposal (Chemical Waste) (General) Regulation* requirements.	To prevent contamination to nearby environment	Project Site / During land based construction works	Contractor		✓			*Waste Disposal Ordinance*
6.6.1	-	All fuel tanks and chemical storage areas should be provided with locks and be sited on paved areas.	To prevent contamination to nearby environment	Project Site / During land based construction works	Contractor		✓			*Waste Disposal Ordinance*

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6.6.1	-	The storage areas should be surrounded by bunds with a capacity equal to 110% of the storage capacity of the largest tank to prevent spilled oil, fuel and chemicals from reaching the receiving waters.	To prevent contamination to nearby environment	Project Site / During land based construction works	Contractor		✓			*Waste Disposal Ordinance*
6.6.1	-	Oil leakage or spillage should be contained and cleaned up immediately. Waste oil should be collected and stored for recycling or disposal, in accordance with the *Waste Disposal Ordinance*. The Contractors should prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals.	To prevent contamination to nearby environment	Project Site / During land based construction works	Contractor		✓			*Waste Disposal Ordinance*
6.6.1	-	Vehicle and plant servicing areas, vehicle wash bays and lubrication bays should, as far as possible, be located within roofed areas. The drainage in these covered areas should be connected to foul sewers via a petrol interceptor.	To prevent contamination to nearby environment	Project Site / During land based construction works	Contractor		✓			*Waste Disposal Ordinance*
6.9.1 and 11.6.1	5.1	EM&A Requirements								-
		Monitoring of marine water quality during the construction phase is considered necessary to evaluate whether any impacts would be posed by these marine works on the surrounding waters during the operation of dredging and filling works.	To ensure the construction works would not arise any impacts to the surrounding waters	Marine water outside the Project Site / During dredging and filling works	ET and Contractor		✓			

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Water Quality – Post-Construction Phase (After the completion of the construction and before the operation of the beach)										
6.9.2 and 11.6.2	5.2	EM&A Requirements *E. coli* monitoring should be conducted at the outlet of two diverted drains and at EPD's beach water monitoring stations for the identification of pollution loading and to establish relationship between the loading and EPD's beach monitoring programme.	To investigate the pollution loading of *E. coli* and to establish relationship with EPD's beach monitoring data	Two diverted drains and the Bathing Beach/ Within six weeks after the completion of the construction works	ET	Post-Construction Phase (After the completion of the construction and before the operation of the beach)				-
Water Quality – Operational Phase										
6.6.2	-	Surface Runoff from Project Site A petrol interceptor should be provided in the drainage system and regularly emptied to prevent the release of oil and grease into the storm water drainage system after accidental spillages. The interceptor should have a bypass to prevent flushing during periods of heavy rain. Where appropriate, the design should follow or of similar functions as stated in the *ProPECC PN 1/94*.	To prevent contamination to nearby environment	Beach Park area / During operation	Operator	✓		✓		*Water Pollution Control Ordinance and ProPECC PN 1/94*
6.6.2	-	Oil leakage or spillage should be contained and cleaned up immediately. Waste oil should be collected and stored for recycling or disposal in accordance with the *Waste Disposal Ordinance*.	To prevent contamination to nearby environment	Beach Building Facility / During operation	Operator	✓		✓		*Waste Disposal Ordinance*

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Waste Management – Construction Phase										
7.6	-	The Contractor should submit the plan to Project Proponent's Engineer Representative for endorsement prior to the commencement of the construction works. The plan should incorporate site-specific factors, such as the designation of areas for the segregation and temporary storage of reusable and recyclable materials.	To ensure that adverse environmental impacts are prevented	Project Site / Contract mobilisation and during construction	Contractor	✓	✓			-
7.6	-	It will be the Contractor's responsibility to ensure that only reputable licensed waste collectors are used and that appropriate measures to reduce adverse impacts, including windblown litter and dust from the transportation of these wastes, are employed.	To ensure that adverse environmental impacts are prevented	Project Site / Contract mobilisation and during construction	Contractor	✓	✓			-
7.6	-	The Contractor must ensure that all the necessary permits or licences required under the Waste Disposal Ordinance are obtained for the construction phase.	To ensure compliance with relevant statutory requirements	Project Site / Contract mobilisation and during construction	Contractor	✓	✓			-
7.6	-	<u>Waste Management Hierarchy</u> • Nomination of approved personnel to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility of all wastes generated at the site;	To ensure that adverse environmental impacts are prevented	Project Site / Contract mobilisation and during construction	Contractor	✓	✓			*Waste Disposal (Charges for Disposal of Construction Waste) Regulation;* *Works Bureau Technical Circular No.31/2004; and*

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		• Training of site personnel in proper waste management and chemical handling procedures; • Provision of sufficient waste disposal points and regular collection for disposal; • Appropriate measures to reduce windblown litter and dust transportation of waste by either covering trucks or by transporting wastes in enclosed containers; • Separation of chemical wastes for special handling and appropriate treatment at the Chemical Waste Treatment Centre; • Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors; and • A recording system for the amount of wastes generated/recycled and disposal sites.								*Annex 5 and Annex 6 of Appendix G of ETWBTC No. 19/2005*
	-	Waste Reduction Measures • Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of material and their proper disposal;	To reduce construction waste generation	Project Site / During construction	Contractor		✓			-

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		• Encourage collection of aluminium cans and waste paper by individual collectors during construction with separate labelled bins being provided to allow the segregation of these wastes from other general refuse generated by the workforce; • Any unused chemicals and those with remaining functional capacity be recycled as far as possible; • Use of reusable non-timber formwork to reduce the amount of C&D materials; • Prior to disposal of construction waste, wood, steel and other metals should be separated, to the extent practical for re-use and/or recycling to reduce the quantity of waste to be disposed at landfills; • Proper storage and site practices to reduce the potential for damage or contamination of construction materials; and • Plan and stock construction materials carefully to reduce amount of waste generated and avoid unnecessary generation of waste.								

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7.6.1	-	<u>Dredging Materials</u> The final disposal site for the dredged sediments should be determined by the MFC and a dumping licence should be obtained from EPD prior to the commencement of the dredging works. Uncontaminated sediments should be disposed of at open sea disposal sites designated by the MFC. For contaminated sediments requiring Type 2 confined marine disposal, relevant contract documents should specify the allocation conditions of the MFC and EPD.	To ensure adverse environmental impacts are prevented	Dredging area / During construction	Contractor		✓			*Dumping at Sea Ordinance*
7.6.2	-	<u>Excavated Materials and C&D Waste</u> *Management of Waste Disposal* The contractor should open a billing account with EPD in accordance with the Waste Disposal (Charges for Disposal of Construction Waste) Regulation for the payment of disposal charges. Every waste load transferred to Government waste disposal facilities such as public fill, sorting facilities, or landfills should require a valid "chit" which contains the information of the account holder to facilitate waste transaction recording and billing to the waste producer. A trip-ticket system should be established in accordance with ETWBTC No. 31/2004 to monitor the reuse of surplus excavated materials off-site and disposal of construction waste and	To properly handle the excavated materials and C&D waste and thus avoid any adverse impacts	Project Site / During construction	Contractor		✓			*Waste Disposal (Charges for Disposal of Construction Waste) Regulation*

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		general refuse at transfer stations/landfills, and to control fly-tipping. The billing “chit” and trip-ticket system should be included as one of the contractual requirements and implemented by the contractor. Regular audits of the waste management measures implemented on-site as described in the Waste Management Plan should be conducted. A recording system (similar to summary table as shown in Annex 5 and Annex 6 of *Appendix G* of ETWBTC No. 19/2005) for the amount of waste generated, recycled and disposed of (including the disposal sites) will be established during the construction phase.								
7.6.2	-	*Reduction of C&D Materials Generation* Public fill and construction waste should be segregated and stored in different containers or skips to facilitate reuse or recycling of the public fill and proper disposal of the construction waste. Specific areas of the work site should be designated for such segregation and storage if immediate use is not practicable. To reduce the potential dust and water quality impacts of site formation works, C&D materials should be wetted as quickly as possible to the extent practicable after excavation/filling.	To reduce the generation of C&D waste	Project Site / During construction	Contractor		✓			-

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7.6.3	-	Chemical Waste The Contractor should register as a chemical waste producer with the EPD. Chemical waste, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes. 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 L unless the specifications 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 will: • Be clearly labelled and used solely for the storage of chemical waste; • Be enclosed on at least 3 sides;	To ensure proper handling of chemical waste	Project Site / During construction	Contractor		✓			*Code of Practice on the Packaging, Handling and Storage of Chemical Wastes*

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		• 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 of as chemical waste, if necessary); and • Be arranged so that incompatible materials are appropriately separated. Chemical waste should be collected by a licensed chemical waste collector to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility.								

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7.6.4	-	<u>Sewage</u> An adequate number of portable toilets should be provided for the on-site construction workforce during construction phase. All portable toilets should be maintained in a state that will not deter the users from using them. Night soil should be regularly collected by a licensed collector for disposal. The sewage generated from the visitors during operation of the Proposed Beach Development should be discharged to the adjacent foul sewer conveying to Tai Po Sewage Treatment Works for treatment.	To ensure proper handling of sewage	Project Site / During construction	Contractor		✓			-
7.6.5	-	<u>General Refuse</u> General refuse should be stored in enclosed bins or compaction units separately from construction and chemical wastes. A reputable waste collector should be employed to remove general refuse from the site, separately from construction and chemical wastes, on a daily basis to reduce odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law. Recycling bins should be provided at strategic locations to facilitate recovery of aluminium cans and waste paper from the Project Site. Materials recovered should be sold for recycling.	To ensure proper handling of general refuse	Project Site / During construction	Contractor		✓			-

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7.6.6	-	Staff Training Training should be provided to workers on the concept of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling at the beginning of the construction works.	To ensure that adverse environmental impacts are prevented	Project Site / Contract mobilisation and during construction	Contractor	✓	✓			-
7.7	6.1	EM&A Requirements Joint site audits by the Environmental Team and the Contractor should be undertaken on a weekly basis. Particular attention should be given to the Contractor's provision of sufficient spaces, adequacy of resources and facilities for on-site sorting and temporary storage of C&D materials. The C&D materials to be disposed of from the Project Site should be visually inspected. The public fill for delivery to the off-site stockpiling area should contain no observable non-inert materials (e.g., general refuse, timber, etc). The waste to be disposed of at refuse transfer stations or landfills should as far as possible contains no observable inert or reusable/recyclable C&D materials (e.g., soil, broken rock, metal, and paper/cardboard packaging, etc). Any irregularities observed during the weekly site audits should be raised promptly to the Contractor for rectification.	To ensure that adverse environmental impacts are prevented	Project Site / During construction	ET and Contractor		✓			-

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Waste Management – Operational Phase										
7.7	-	EM&A Requirements EM&A is not required during the operation phase of the Proposed Beach Development.	-	-	-					-
Ecology – Construction Phase										
8.10.2	7.1	Measures for Common Rat Snake To undertake a search of the Common Rat Snake within the land based Project Site just before the commencement of the construction works. Due to the small size of the Project Site and given that there are no optimal habitats for Common Rat Snake, one day-time search is considered sufficient. The surveyor(s) should actively search the areas within the Project Site and pay special attention to the leaf litters and rocks. All recorded Common Rat Snake should be caught by hand and translocated to the shrubland at the north of the Study Area, immediately after the search. The Common Rat Snake search and translocation works should be undertaken by a qualified ecologist with relevant experience in faunal translocation works.	To ensure that adverse impacts arising from the Project to Common Rat Snake are prevented	Project Site (land based) / prior to commencement of construction works	ET / Qualified Ecologist	✓				-

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8.10.2	-	Dredging and Sand Filling Operations It is predicted that the sediment plume and the sediment deposition will not be large in extent and no unacceptable water impacts including DO depletion, release of contaminants and nutrients are expected. Although no unacceptable water quality impacts would result, the following good construction site practice and proactive precautionary measures are recommended to ensure dredging and sandfilling operations would be undertaken in such a manner as to avoid any uncontrolled or unexpected incidents during the marine works: • A movable cage type / metal frame type silt curtain should be deployed around the dredging area next to the grab dredger prior to commencement of dredging works; • Standing type silt curtains should be deployed around the proposed sandfilling extent prior to commencement of sandfilling works; and • Proper equipment, dredging rate, filling rate and good construction practices should be implemented, details refer to *Section 6.6.1*.	To minimise ecological impacts arising from dredging and sand filling works	Project Site / During dredging and sand filling works	Contractor		✓			-

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8.10.2	-	Measures for Controlling Construction Runoff • Storm water run-off from the construction site should be directed into existing drainage channel via adequately designed sand/silt removal facilities such as sand/silt traps and oil interceptors. Channels, earth bunds or sand bag barriers should be provided on site to properly direct storm water to such silt removal facilities.	To minimise ecological impacts of construction runoff	Project Site / During dredging and filling works	Contractor		✓			-
8.10.2	-	Planting along the Western Drainage Diversion • Provide tree/ shrub/ climber planting along the gabion wall of the new drainage channel. Regular monitoring and removal of the weed plant Mikania micrantha during the establishment and maintenance period.	To provide an ecological habitat	Along gabion wall of the new western drainage channel/ After completion of the gabion	Contractor		✓	✓		-
8.10.2	-	Good Construction Practices • Erect fences along the boundary of the Extension Site before the commencement of works to prevent vehicle movements, and encroachment of personnel, onto adjacent areas; and • Regularly check the work site boundaries to ensure that they are not breached and that damage does not occur to surrounding areas.	To avoid any adverse ecological impacts	Project Site / During construction works	Contractor		✓			-

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Ecology – Operational Phase										
8.10.3	-	A total of approximately 382 mangrove seedlings will be provided. Detailed mangrove seedling planting proposal providing information of planting methodology, recipient sites, planting species and mix, implementation programme, post-planting monitoring and personal involved shall be submitted to and approved by EPD and AFCD. Mangrove seedling planting should be undertaken and supervised by a suitably qualified botanist/ horticulturist. After planting, one year monitoring should be undertaken to check the performance and health conditions of the planted individuals on a monthly basis. Remedial actions should be discussed with AFCD in the event of unsuccessful mangrove seedling planting and follow an approved Event and Action Plan as indicated in Table 8.30 of the EIA Report.	To monitoring the conditions of mangroves after re -planting	Next to Eastern Box Culvert / after plantation works	ET/ Qualified Ecologist			✓		-

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8.10.3 and 8.12.2	7.2	Mangrove seedling planting location is proposed along the outer sides of the groynes and western drainage channel at a level of about 1.2 to 1.6 mPD with a total size of 300 m^2. After planting, one year monitoring will be undertaken to check the performance and health conditions of the planted individuals on a monthly basis. Regular monitoring and removal of the weed plant *Mikania micrantha* during the establishment and maintenance period.	To monitoring the conditions of mangroves after re -planting	Next to Eastern Box Culvert / after plantation works	ET/ Qualified Ecologist/Contractor			✓		-
Fisheries – Construction Phase										
9.10.1	-	<u>EM&A Requirements</u> EM&A is not required during the construction phase of the Project. However, water quality monitoring will be conducted at the Yim Tin Tsai Fish Culture Zone. Details should be referred to the Water Quality Section.	To ensure that no water quality deterioration in the Fish Culture Zone as a result of the dredging and sandfilling works	Details refer to Section 12.6 of the EM&A Manual.	ET and Contractor		✓			*Environmental Impact Assessment Ordinance, Annex 21* of the *EIAO-TM*
Fisheries – Operational Phase										
9.10.2	-	<u>EM&A Requirements</u> EM&A is not required during the operation phase of the Proposed Beach Development.								-

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Landscape and Visual Impact – Construction Phase										
10.5.1	-	<u>Landscape Mitigation</u> A Landscape Plan will be submitted before the commencement of Works.	To provide landscaping work.	Before commencement of construction phase	ET and Contractor	✓				-
10.6.10	-	*Cultivation of areas impacted during construction*. Areas impacted during the construction phase that are not required during the operation phase, are to be cultivated to a depth of 300mm in accordance with accepted Hong Kong practice and guidelines. The cultivation shall involve ripping of compacted soil by mechanical means and the addition gypsum and/or organic fertiliser if required.	To improve the soil allowing plants to thrive	Project Site / During construction	Contractor		✓			-
10.6.10	-	*Car Park Tree Planting*. Advanced trees are to be planted in the car park	To provide shade to the carpark areas and to reduce the mass of the paved areas	Project Site / During construction	Contractor		✓			-
10.6.10	-	*Tree and shrub planting*. All planting of trees and shrubs is to be carried out in accordance with the relevant best practice guidelines. Plant densities are to be provided in future detailed design documents and are to be selected so as to achieve a finished landscape that matches the surrounding, undisturbed, equivalent landscape types. Regular monitoring and removal of the weed plant *Mikania micrantha* during the establishment and maintenance period.	To improve the appearance of the development	Project Site / During construction	Contractor			✓		-

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10.6.10	-	*Roof Terrace Planting.* Trees, shrubs and climbers shall be established in planters on the roof terraces of the new structures where possible.	To improve the appearance of the development by softening the building element	Project Site / During construction	Contractor		✓			-
10.6.10	-	*Natural Rock Groynes* New rock groynes are needed to contain the sand of the new beach. Natural stones will be used for construction of the Groynes.	To improve the appearance of the development to make the man-made feature be more compatible with the surroundings	Project Site / During construction	Contractor		✓			-
10.6.10	-	*Inter-Tidal Re-generation*. It is likely that a build up of sediment and sand will occur at the outer edges of the rock groyne. This is a natural process and the development proponent has no control over the implementation of this mitigation measure.	To improve the appearance of the development	Adjacent areas	Nil			✓		-
10.6.10	-	*Mangrove Re-generation*. Mangroves of similar species to existing to be manually established by planting of droppings.	To improve the ecological value of the project	Project Site / During post-construction	Contractor		✓			-
10.6.10	-	*Buffer Planting.* Trees and shrubs are to be planted along Ting Kok road to screen the development from the nearby Village/Developed Areas.	To improve the appearance of the development	Project Site / During post-construction	Contractor		✓			-
10.6.10	-	*Early Planting Works* Where technically feasible, new plantings are to be installed during the construction works to reduce landscape impacts.	To improve the appearance of the development	Project Site / During construction	Contractor		✓			-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage				Relevant Legislation Guidelines
						Des	C	O	Dec	
10.6.10	-	*Tree Protection/Transplantation.* Where technically feasible, existing trees in the Trees/Backshore Vegetation LR are to be retained. Those trees that cannot be retained that are of value are to be transplanted.	To improve the appearance of the development	Project Site / Before commencement of construction	Contractor	✓				-
10.7.9	-	<u>Visual Mitigation</u>								-
		Design of Structures. The structure shown in the photomontages are to illustrate the mass of the structures only. During the design phase of the development, features such as the location of doors, windows, eaves etc. will be detailed. All of these elements will greatly improve the appearance of the structures. Where possible, built structures will utilise appropriate designs to complement the surrounding landscape. Materials and finishes will also be considered during detailed design.	To reduce visual impacts and improve the appearance of the development	Project Site / During construction	Architect	✓				
10.7.9	-	*Colour Scheme.* Colours for the structures can be used to complement the surrounding area. Lighter colours such as shades of light grey, off-white and light brown may be utilised where technically feasible to reduce the visibility of the structures.	To reduce visual impacts and improve the appearance of the development	Project Site / During construction	Architect	✓				-
10.7.9	-	*Plantings.* In addition to the landscape mitigation plantings proposed in Section 10.5.9 of the EIA report, appropriate new plantings will be installed as appropriate to help integrate the new structures into the surrounding landscape.	To help integrate the new structures into the surrounding landscape	Project Site / During post-construction	Contractor		✓			-

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage				Relevant Legislation Guidelines
						Des	C	O	Dec	
10.7.9	-	*Colour of Site Hoardings*. In order to mitigate the visual impact of these temporary hoardings, it is recommended that the hoardings be erected at a uniform height, with a uniform colour that complements the existing surrounding landscape.	To mitigate the visual impact of temporary hoardings	Project Site / During construction	Contractor		✓			-
-	9.2	EM&A Requirements								-
		A specialist Landscape Sub-Contractor should be employed for the implementation of landscape construction works and subsequent maintenance operations during a 12-month establishment period. A Registered Landscape Architect should be employed to supervise the specialist Landscape Sub-contractor for the implementation of landscape works, both hard and soft, involved. Measures undertaken by both the Contractor(s) and the specialist Landscape Sub-Contractor during the construction phase and first year post-construction will be audited by the Registered Landscape Architect of the ET. Site inspections should be undertaken at least once every two weeks throughout the landscaping plants establishment period when planting works are being undertaken.	To check the implementation and maintenance of landscape mitigation measures and ensure that they are fully realised and that potential conflicts between the proposed landscape measures and any other project works and operational requirements are resolved at the earliest practical date and without compromise to the intention of the mitigation measures	Project Site / During construction and post-construction phase	Specialist Landscape Sub-contractor,Registered Landscape Architect and ET		✓			

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage Des	C	O	Dec	Relevant Legislation Guidelines
		A tree survey should be prepared, for DLO submission, and for the purpose of existing trees protection. Removal of existing trees to be minimized. The Contractor should consider to employ a certified arborist when sizable and valuable existing tree(s) protection of transplant is required. Post-construction phase auditing will be restricted to the 12-month establishment works of the landscaping proposals. Advance planting- monitoring of implementation and maintenance of planting, and against potential incursion, physical damage, fire, pollution, surface erosion, etc. Protection of trees to be retained-identification and demarcation of trees / vegetation to be retained, erection of physical protection (e.g. fencing), monitoring against potential incursion, physical damage, fire, pollution, surface erosion, etc. Clearance of existing vegetation-identification and demarcation of trees / vegetation to be cleared, checking of extent of works to reduce damage, monitoring of adjacent areas against potential incursion, physical damage, fire, pollution, surface erosion, etc.								

EIA Ref.	EM&A Ref	Environmental Protection Measures	Objectives of the Recommended Measure & Main Concerns to address	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage Des	C	O	Dec	Relevant Legislation Guidelines
		Transplanting of trees-identification and demarcation of trees / vegetation to be transplanted, monitoring of extent of pruning / lifting works to reduce damage, timing of operations, implementation of the stages of preparatory and translocation works, and maintenance of transplanted vegetation, etc.								
		Plant supply-monitoring of operations relating to the supply of specialist plant material (including the collecting, germination and growth of plants from seed) to ensure that plants will be available in time to be used within the construction works.								
		Soiling, planting, etc-monitoring of implementation and maintenance of soiling and planting works and against potential incursion, physical damage, fire, pollution, surface erosion, etc.								
		Architectural design and treatment of all structures (where practicable), retaining walls, elevated road structures and other engineering works-implementation and maintenance of mitigation measures, to ensure conformity with agreed designs.								
		Erection of Site Hoardings/Fences - Erection of site hoardings/fences during the construction phase to reduce visual impacts.								

EIA Ref.	**EM&A Ref**	**Environmental Protection Measures**	**Objectives of the Recommended Measure & Main Concerns to address**	**Location/Duration of Measures/Timing of Completion of Measures**	**Implementation Agent**	**Implementation Stage**				**Relevant Legislation Guidelines**
						Des	C	O	Dec	
		Establishment Works - monitoring of implementation of maintenance operations during Establishment Period.								
Landscape and Visual Impact – Operational Phase										
11.10.2	-	*Plant Maintenance*. All installed plant material to be maintained to the relevant Hong Kong standard for the life of the Proposed Beach Development	To improve the appearance of the development.	Proposed Beach Development / During operation	Operator			✓		-

12 SUMMARY OF ENVIRONMENTAL OUTCOMES AND CONCLUSIONS

12.1 Introduction

This *Section* summarises the environmental outcomes associated with the construction and operation of the Proposed Beach Development.

12.2 Construction Phase Air Quality

Dust generating activities and gaseous emissions from construction plant for the Proposed Beach Development may potentially cause air quality impacts to adjacent ASRs. The construction of the Proposed Beach Development involves site formation, localised widening of Ting Kok Road, building works, construction of gabion, groynes and culverts and sand filling for the beach. Excavation, dredging, filling, truck movements, materials handling and wind erosion of open stockpiles of dusty materials have been identified to be the key dust generating activities. In view of the small scale of the Proposed Beach Development and the small size of the worksite, no adverse fugitive dust impact is envisaged with the implementation of dust control measures and adoption of good site practices.

Potential air quality impacts associated with gaseous emissions of diesel-powered construction vehicles and equipment are expected to be relatively small as only a small number of diesel construction vehicles and plant will be operated in the limited works areas at any one time. The requirement for all construction plant to use ultra-low-sulphur diesel (ULSD) will further reduce the potential air quality impacts. The potential cumulative dust impacts from the contemporary occurrence of the Phase IIC works have been assessed, the cumulative dust impacts will expect to be minor.

12.3 Noise Impact

Construction Phase

Owing to the proximity of the NSRs to the Proposed Beach Development, mitigation measures are required to be implemented to mitigate the construction noise impacts. Practicable mitigation measures, including use of quiet construction plant and movable noise barriers, have been recommended to be implemented for different work stages. With the implementation of mitigation measures, the mitigated construction noise levels at the representative NSRs are anticipated to comply with the construction noise criterion of 75 dB(A) throughout the construction period. Construction noise monitoring has been recommended to ensure compliance with the construction noise criterion. The potential cumulative noise impacts from the contemporary occurrence of the Phase IIC works have been considered, and the assessment result indicates that the cumulative construction noise level at the NSRs complies with the construction noise criterion of 75 dB(A).

Operational Phase

The predicted operational noise levels at the representative NSRs are expected to comply with the daytime criteria based on the assessment using a set of specified maximum SWLs for the fixed plant to be installed at the Proposed Beach Development. Attenuation measures, if required, will be provided to the fixed plant for achieving the guaranteed noise levels during the detailed design stage, and therefore operational phase noise monitoring is not required.

12.4 Water Quality Impact

Construction Phase

The water quality modelling works have indicated that for both the dry and wet seasons, no exceedances of the WQO and the evaluation criterion are predicted to occur during the dredging and sandfilling operations. The impact assessment has also shown that other land-based construction works, if properly controlled, are not expected to cause any adverse impacts to the surrounding waters and the sensitive receivers. With the implantation of the proposed mitigation measures and good site management practices, water quality impacts will be further minimised.

Operational Phase

No operational impacts to water quality are expected to occur if mitigation measures are fully implemented. Considering that the improvement works, including the diversion of drains, the provision of groynes and with DSD's new sewerage system to be in place, the beach water quality is expected to be significantly improved. The proposed site is suitable to operate as a bathing beach with regard to the compliance with the WQO for *E. coli* and high likelihood of achieving Beach Grade 2 (Fair) standard during its operation phase. In addition to the improvement works, the operator will pay best effort to provide the greatest protection for the bathers. It is also noted that the Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94) including Lung Mei area, as part of the Sewerage Master Plan (SMP) Works, is expected to be gazetted prior to the operation of the Proposed Beach Development. This will further improve the water quality in the Lung Mei region since it is mandatory for new developments to connect to the public sewer. CEDD and LCSD will closely monitor the implementation programme of the village sewerage projects to achieve the target sewerage connection rate to communal sewers before the beach is put into operation. In addition to the compliance with water quality standards, Lung Mei is considered to be the best location for the proposed beach development in view of the community demand and accessibility.

12.5 Waste Management Implications

Construction Phase

A total of approximate 10,500 m^3 of marine sediment will be dredged. About 6,380 m^3 of the sediments are uncontaminated and can be disposed of at the open sea disposal sites and about 2,620 m^3 of the Category M sediment (which passed the biological screening) will be disposed of at dedicated open sea disposal sites. The remaining 1,500 m^3 of the Category M (which failed the biological screening) will have to be disposed of at the confined marine disposal site at East Sha Chau. The final disposal site for the dredging sediments will be determined by the Marine Fill Committee (MFC) and a dumping licence will be obtained from EPD prior to the commencement of the dredging works.

About 13,800 m^3 of excavated materials will be generated during construction phase and 8,280 m^3 (about 60%) of which will be reuse on-site. The surplus excavated soil will be reused in other concurrent construction projects in Hong Kong or disposed of at public fill reception facilities.

The anticipated quantities of demolition waste (470 m^3), construction waste (225 m^3), chemical wastes (a few hundred litres, mainly are used lube oils), sewage (6 m^3 per day) and general refuse (65 kg per day) to be generated during the construction phase of the Project will be small. With the implementation of the general good construction site practices, the construction of the Proposed Beach Development will not cause adverse waste management or environmental impacts with respect to the criteria specified in the *EIAO-TM*.

Operational Phase

During the operational phase, it is estimated that a maximum of 10 m^3 of sewage and 1,520 kg of general refuse will be produced each day by visitors during peak season. In view of the small quantity of sewage and general refuse to be generated and their proper disposal to foul sewer or transfer station/landfill, no adverse environmental impact associated with the management of these wastes is anticipated during the operation of the Proposed Beach Development.

12.6 Ecological Impact

The ecological resources recorded within the Study Area include secondary woodland, shrubland, stream, pond, sandy shore with backshore vegetation, village/modified area, mangrove, sandy shore and artificial/ disturbed shoreline, as well as subtidal soft and hard bottom and associated wildlife. Of these habitats, mangrove has high ecological value, secondary woodland has moderate to high ecological value and shrubland has moderate ecological value. The remaining habitats are of low to low to moderate ecological value.

A total of 3 coral species (including *Oulastrea crispate*, *Cyphastrea serailia* and *Psammocora superficialis*, which considered as common species in Hong Kong) and 20 terrestrial species of conservation interest were recorded within the Study Area, including 2 plant species (Red Azalea and Incense Tree), 4 bird species (Black Kite, White-bellied Sea Eagle, Osprey and Created Goshawk), 13 uncommon butterfly species (Brown Pansy, Common Nawab, Danaid Egg-fly, Dark Evening Brown, Great Swift, Indian Palm Bob, Painted Jezebel, Plain Tiger, Silver Streak Blue, South China Bush Brown, Tailed Sulphur, White-edged Blue Baron and Yellow Orange Tip) and one reptile species (Common Rat Snake).

The Proposed Beach Development will be located mainly in low quality habitats including village/modified area, sandy shore with backshore vegetation, and channel. The potential impacts on the natural habitats are considered to be low. The corals in the Study Area and area in the vicinity would not subject to any direct loss (due to construction works) or indirect impact (due to change of water quality). No adverse residual impacts are expected after the implementation of the recommended mitigation measures. The measures include the adoption of good construction practices and provision of mangrove seedling planting. These measures will reduce potential disturbance to the surrounding environment.

12.7 Fisheries Impact

Construction Phase

Information from a study on fishing operations in Hong Kong and the AFCD Port Survey 2001/2002 indicate that fisheries production values in the vicinity of the assessment area are generally medium. Fish culture zones are generally too remote to be affected by the construction and operation of the Proposed Beach Development. Significant construction phase impacts to fisheries resources and fishing operations are not expected to occur. Impacts arising from the proposed dredging or sandfilling works are predicted to be largely confined to the specific works areas and the predicted elevations in suspended sediment concentrations at the sensitive receivers are not predicted to cause exceedances of the assessment criterion.

Silt curtain will be provided during the dredging and sandfilling works in the marine water as precautionary measure. Adverse impacts to water quality are not predicted. Water quality monitoring will be conducted at Yim Tin Tsai Fish Culture Zone during the dredging and sandfilling works.

Operational Phase

Significant operational phase impacts to fisheries resources and fishing operations are not expected to occur. Approximately 4.7 ha of coastal waters will be restricted for fishing operation during the operation of the beach. Adverse impacts to fisheries are not predicted to be significant given the small size of the affected area. Impact from sewage and wastewater discharge is not anticipated to occur as the sewage and wastewater generated from the beach building facilities will be discharged into the public sewer. No additional fisheries-specific mitigation measures are required during operation.

12.8 Landscape and Visual Impact

Three Landscape Character Areas (LCAs) were identified and the residual impacts on the LCA1 (Foreshore Landscape) will be *moderate*. For LCA2 (Inshore Waters Landscape), the residual impact will be *slight* and for LCA3 (Coastal Rural/Suburban Landscape) the residual impact will be *negligible*. Two new LCAs will also be created 'Recreational Beach Landscape' and 'Coastal Urban Recreational Landscape' as a consequence of the project.

Of the seven Landscape Resources (LRs) identified, there will be no *significant* residual impacts on any of the LRs after the implementation of mitigation measures. There will be *moderate* residual impacts on Trees/Backshore Shrubland and the Sandy/Rocky Beach LRs. There will be *slight* residual impacts on the Water LR and for the Shrubland, River, Road and Village, the residual impacts will be negligible. One new LR will also be created 'Sandy Beach' as a consequence of the project.

Four visually sensitive receivers (VSRs) including VSR 1 (Tai Mei Tuk), VSR 2 (Lung Mei Residents), VSR 3 (BBQ site) and VSR 4 (Lo Tsz Tin residents) were identified. The un-mitigated visual impacts for VSR 1 (Tai Mei Tuk), VSR 2 (Lung Mei Residents) and VSR 4 (Lo Tsz Tin residents) in operation stage will be *significant*. However, with the implementation of the mitigation measures, the impact will be more acceptable resulting in *moderate/significant* in Operation Day 1 and *moderate* in Operation Year 10. For VSR 3 (BBQ Site - West of the site), the unmitigated visual impacts will be *moderate/significant.* However, with the implementation of the mitigation measures, the impact will be reduced to *moderate* in Operation Day 1 and *slight* in Operation Year 10. In sum, the proposed beach development will inevitably change the existing waterfront view of the area. However, there will be no significant residual impacts for any VSRs. With the adoption of the mitigation measures, the residual impact will be reduced to a large extent and is considered acceptable.

There will be various lighting fixtures associated with the project, with the most visible light source being the carpark lighting. Whilst these lights will contribute to the general ambient light levels of the area, the impacts are not expected to be significant.

According to *Annex 10* of the *Technical Memorandum on the Environmental Impact Assessment Process* (EIAO-TM) the Landscape and Visual Impacts are considered *acceptable with mitigation.*

12.9 Environmental Outcomes

The environmental impact assessment (covering air quality, noise, waste management, water quality, ecology, fisheries and landscape and visual) has concluded that no unacceptable environmental impacts are envisaged due to the construction and operation of the Proposed Beach Development.

12.10 Environmental Benefits

The location of the Proposed Beach Development is situated at Lung Mei avoiding environmentally and conservation sensitive areas including mangroves, Ting Kok SSSI, Coastal Protection Area and Conservation. The site is also remote from the Fish Culture Zone at Yim Tin Tsai East thereby avoiding potential conflicts with fishermen. With incorporation of well designed beach dimension and groyne structures, there will be no significant problem with cross-shore sediment movement under storm wave conditions and the annual net sand drift rate is expected to be low. Therefore the associated impacts due to the change in sedimentation pattern are not expected.

The Proposed Beach Development at Lung Mei is currently occupied by low quality habitats. The potential impacts on the environments are considered to be low, and no adverse residual impacts are expected after the implementation of the recommended mitigation measures. In addition to meet the community demand serving swimmers during the bathing season, the beach at Lung Mei can also provide all year round recreational ground for non-swimmers, ie playing in the sand, sunbathing and other beach activities. Consequently, the Proposed Beach Development at Lung Mei would complement the existing amenity facilities and further diversify the recreational activities in the Tai Mei Tuk area.

Considering that the proposed improvement works of this Project, including the diverted drains and the provision of groynes, the beach water quality is expected to be significantly improved.

12.11 Suitability of Site be a Gazetted Bathing Beach

Lung Mei is considered to be the best location for the proposed beach development in view of the following:

- Community Demand: There is no beach facility in the east region of the New Territories, except in the Sai Kung District, which is very far from Tai Po District. Moreover, the existing and future swimming facilities in the Tai Po areas could not satisfy the demand for a bathing beach. Therefore, the public has been requesting repeatedly to the LCSD for a beach development in the Tai Po District. Consequently, the Feasibility Study was carried out and identified in 2001 that the current project site as a feasible location for developing a bathing beach.

  In light of the above, the Tai Po District Council (TPDC) strongly requested the development of a bathing beach at Lung Mei and members of the TPDC urged for early implementation of the Project. In a Legislative Council case conference on 20 April 2004, Members requested the Government to accord priority to this Assignment. This project was one of the 25 projects identified for priority implementation in the Chief Executive’s 2005 Policy Address and has the support of Home Affairs Bureau. It is considered that this Proposed Beach Development at Lung Mei will meet the increasing demand for swimming facilities. Moreover, the beach can serve a recreational function even during non-bathing season, ie playing in the sand, sunbathing and other beach activities.

- Accessibility: Lung Mei is located next to the existing road (Ting Kok Road) and at the sea front. The proposed Lung Mei beach facilities and carpark area will be highly accessible.

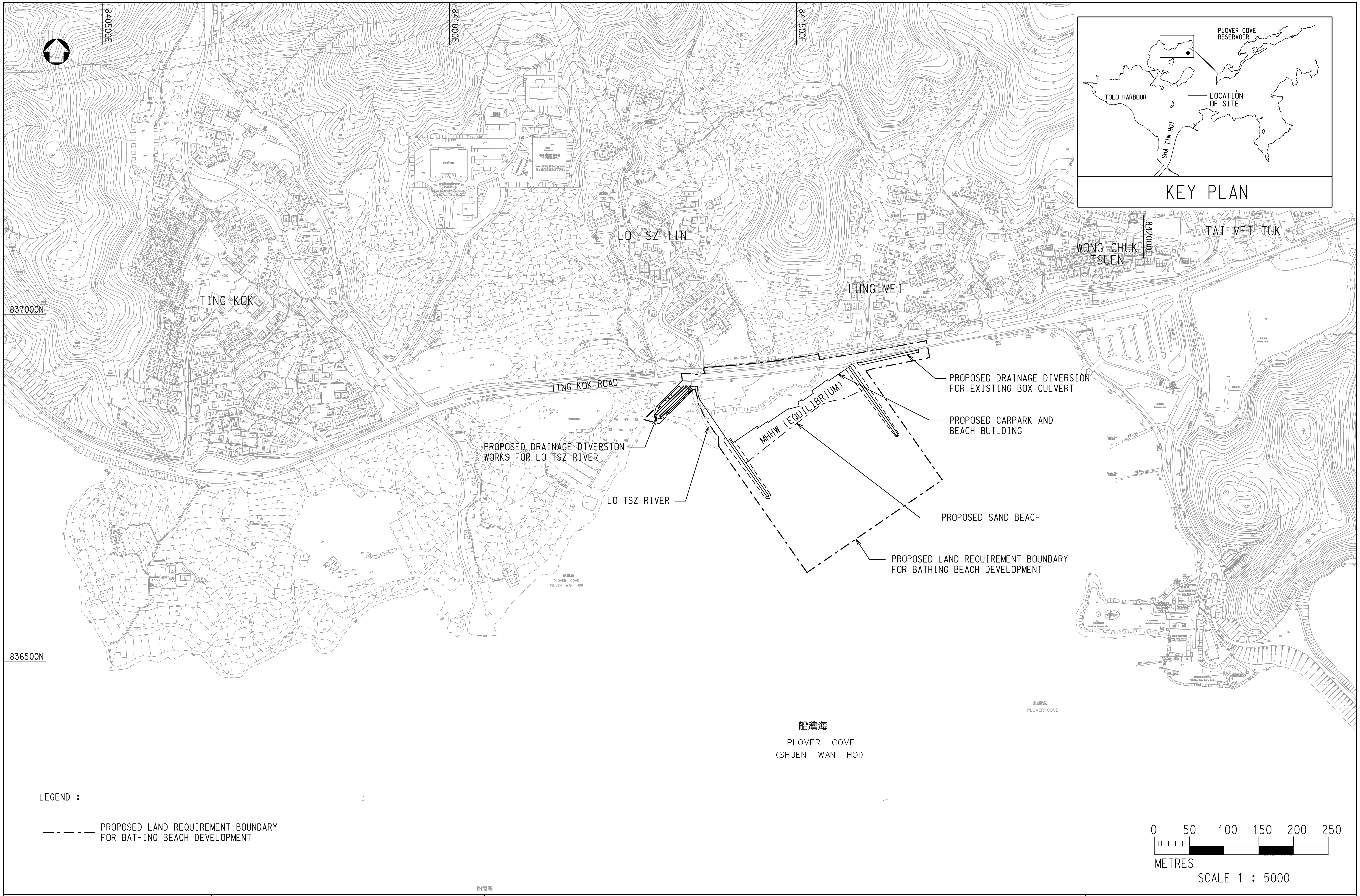
- Compliance with Water Quality Standards: The proposed improvement works of this Project involve the diverted drains and the provision of groynes. Based on the results of the Water Quality Impact Assessment (refer to *Section 6*), these improvement works will significantly improve the water quality (ie with most of the time (over 86%) during bathing beach in operation phase, the weekly beach gradings of Lung Mei Beach will be of Grade 2 or Grade 3 which LCSD considers to be acceptable) of the Lung Mei beach area. The proposed site is hence considered to be suitable to operate as a bathing beach with regard to the compliance with the WQO for *E. coli.*

  In addition, it is noted that the Tolo Harbour Sewerage of Unsewered Areas Stage I Phase IIC (Agreement No. CE 18/94) including Lung Mei area, as part of the Sewerage Master Plan (SMP) Works, is expected to be gazetted under Road (Works, Use and Compensation) Ordinances as applied by Water Pollution Control (Sewerage) Regulation prior to the operation of the Proposed Beach Development. This will further improve the water quality in the Lung Mei region since it is mandatory for new developments to connect to the public sewer. CEDD and LCSD will closely monitor the implementation programme of the village sewerage projects to achieve the target sewerage connection rate to communal sewers before the beach is put into operation.

  Within six weeks after the completion of the construction of the Proposed Beach Development, *E. coli* monitoring will be carried out twice per week at two diverted drains and EPD routine monitoring stations to examine the correlation of the pollution loading and the beach water quality (details refer to *Section 11.6* and the *EM&A Manual*). This information will be reviewed by LCSD to ensure the beach water quality is suitable for recreational purpose before the beach is put into operation.

  EPD has well established a comprehensive water quality monitoring programme for all gazetted beaches to detect any deterioration of beach water quality, which will also be implemented for this Lung Mei bathing beach. In case the beach water quality at Lung Mei tends to be deteriorated and becomes not desirable for swimming, LCSD will close the beach temporarily until the beach water quality becomes suitable for swimming. EPD will continue monitoring the beach water quality and provide LCSD the monitoring results.

Figures



LEGEND :

— · — · — PROPOSED LAND REQUIREMENT BOUNDARY FOR BATHING BEACH DEVELOPMENT

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Enviromental Resources Management as sub-consultant	Agreement No. : CE 59/2005 (EP)	ENVIRONMENTAL IMPACT ASSESSMENT REPORT	FIGURE 1.1	
		Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: SITE LOCATION PLAN AND GENERAL LAYOUT	Checked PS Designed YC	Scale 1:5000 @ A3 Drawn PF	Rev. 2 Date 14/03/2007

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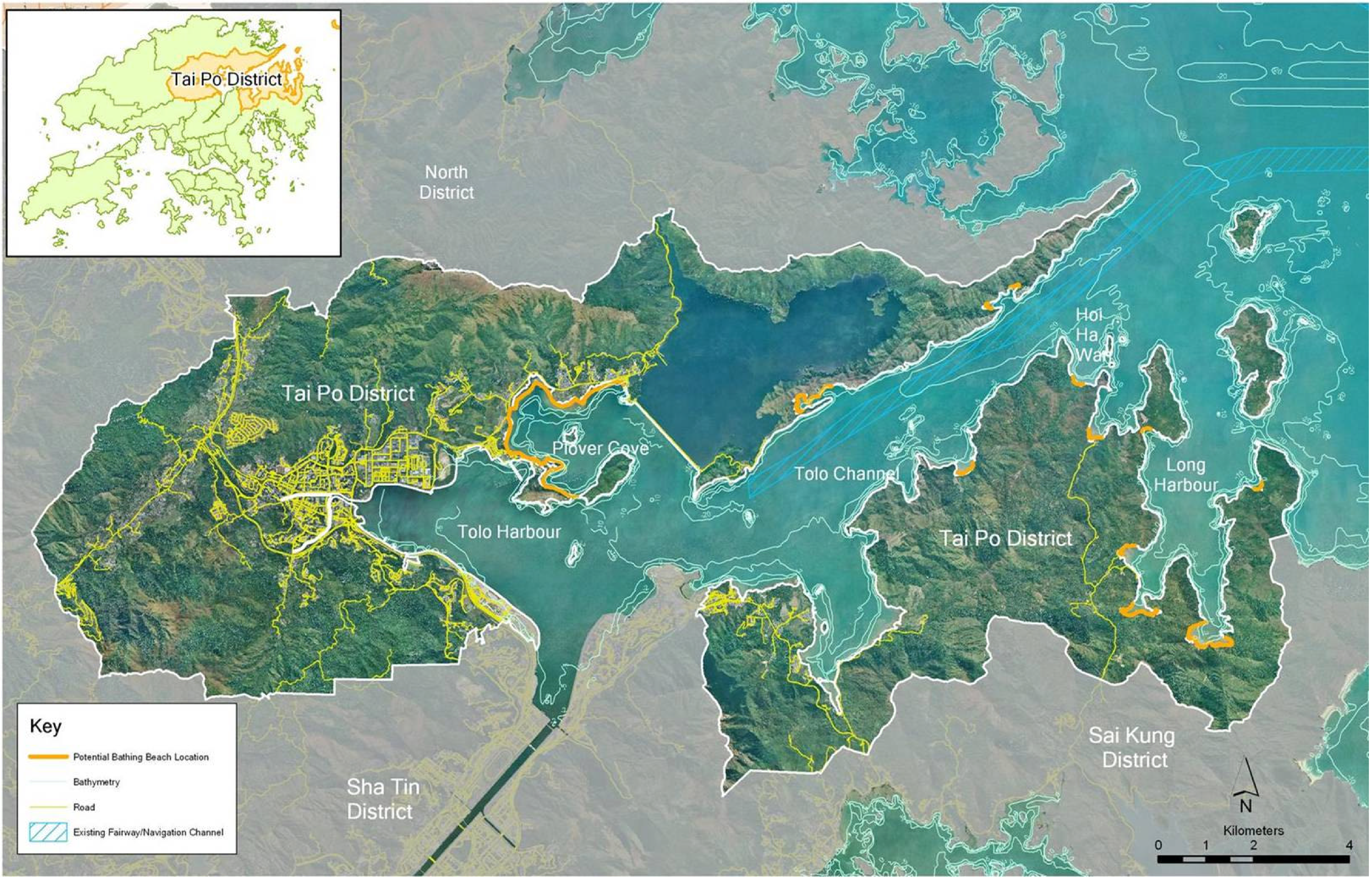

Client

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Consulting Engineer

Halcrow
Halcrow China Ltd.

ERM Environmental Resources Management as sub-consultant

Agreement No.: CE 59/2005(EP)

Project Title:

DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:

POTENTIAL BATHING BEACH LOCATIONS WITHIN TAI PO DISTRICT

FIGURE 2.1

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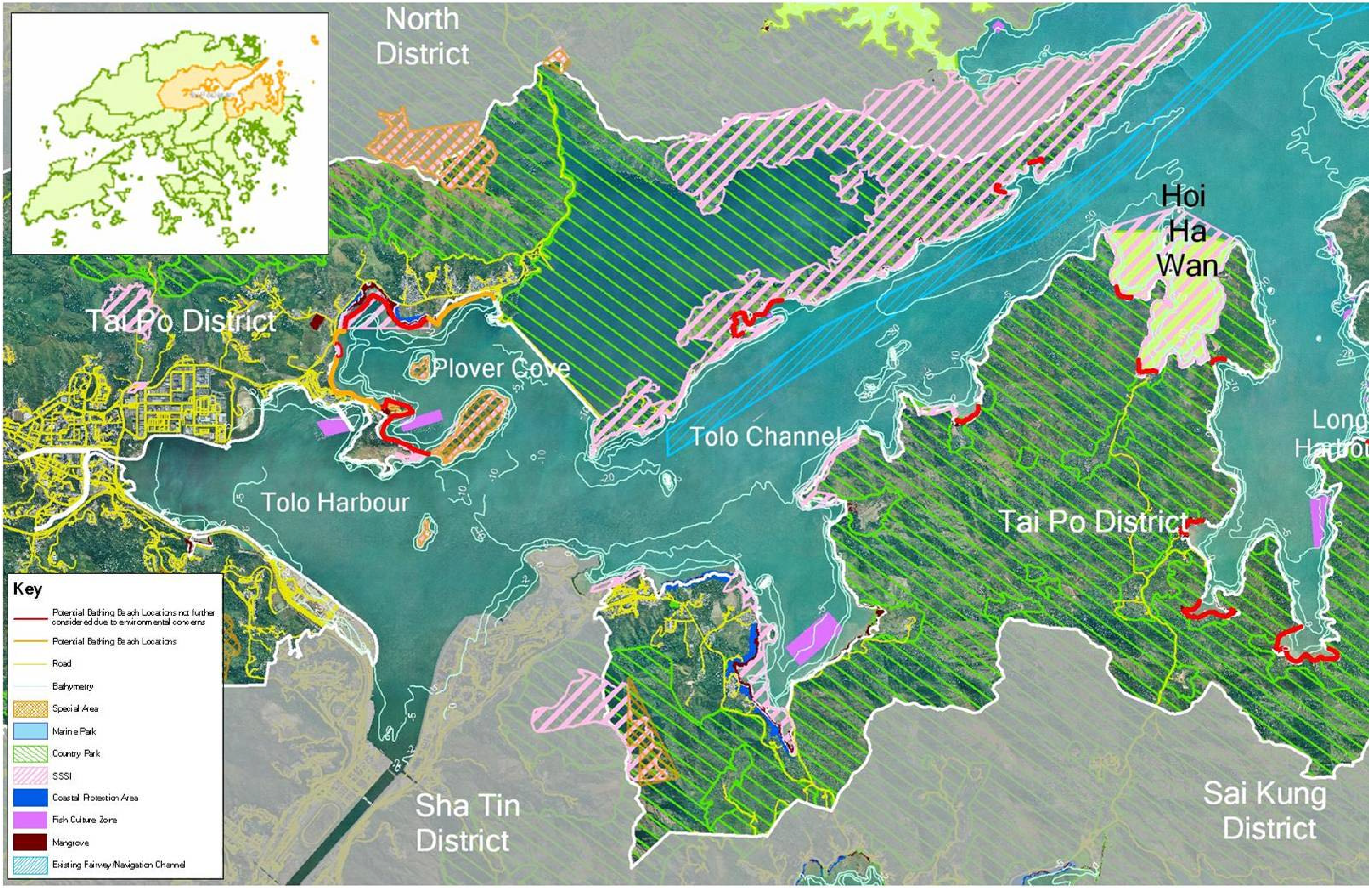

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Project Title:

DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:

ENVIRONMENTAL CONSIDERATION OF THE POTENTIAL BATHING BEACH LOCATIONS WITHIN TAI PO DISTRICT

FIGURE 2.2

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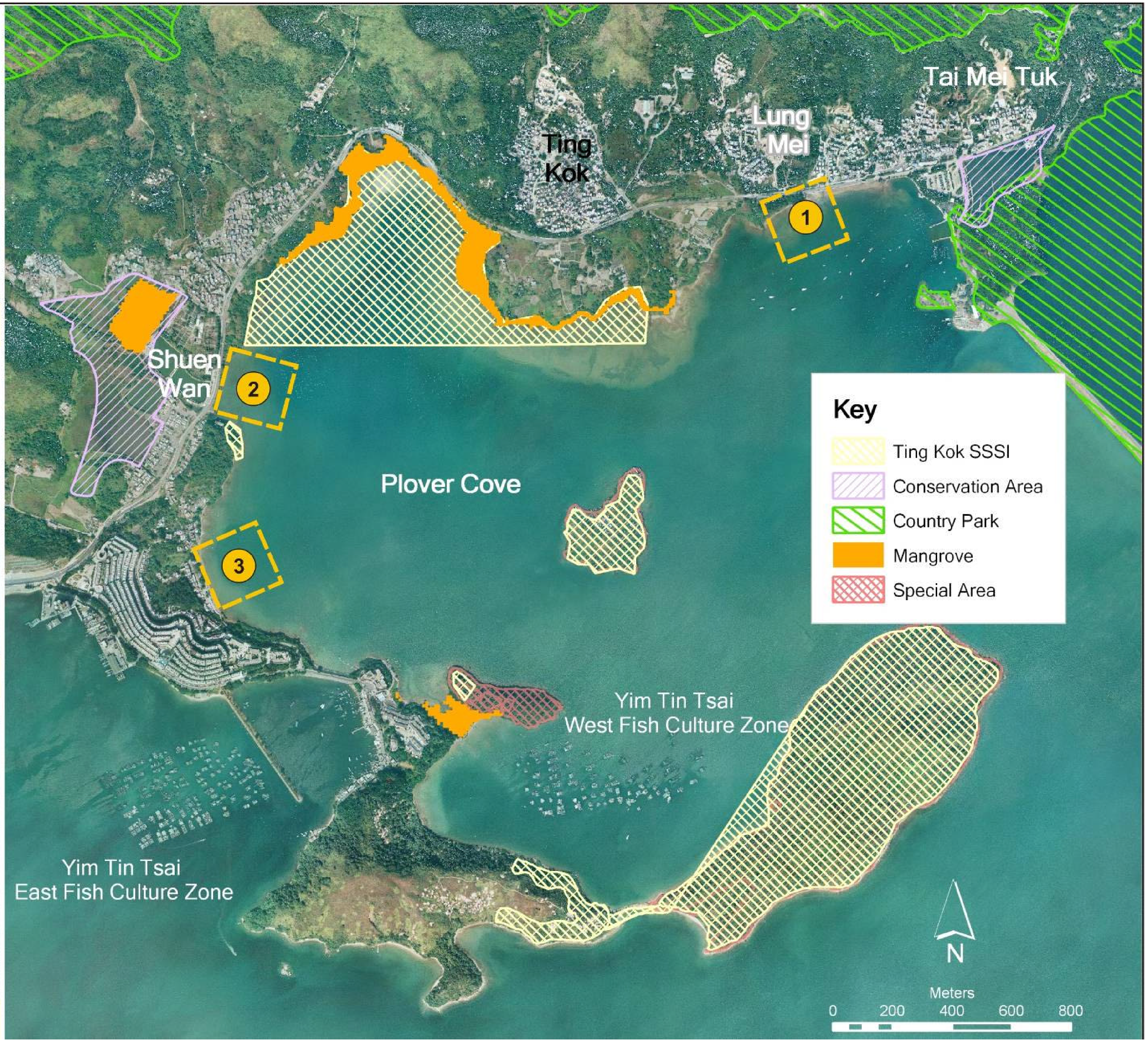
Designed -	Drawn AM	Date 29/08/2007


① Lung Mei


② Shuen Wan


③ Sha Lan



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AND DEVELOPMENT
DEPARTMENT

Consulting Engineer

Halcrow China Ltd.

Environmental
Resources
Management
as sub-consultant

Agreement No.: CE 59/2005(EP)

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FIGURE 2.3

Project Title:

DEVELOPMENT OF A BATHING
BEACH AT LUNG MEI, TAI PO

Figure Title:

ALTERNATIVE PROJECT LOCATIONS

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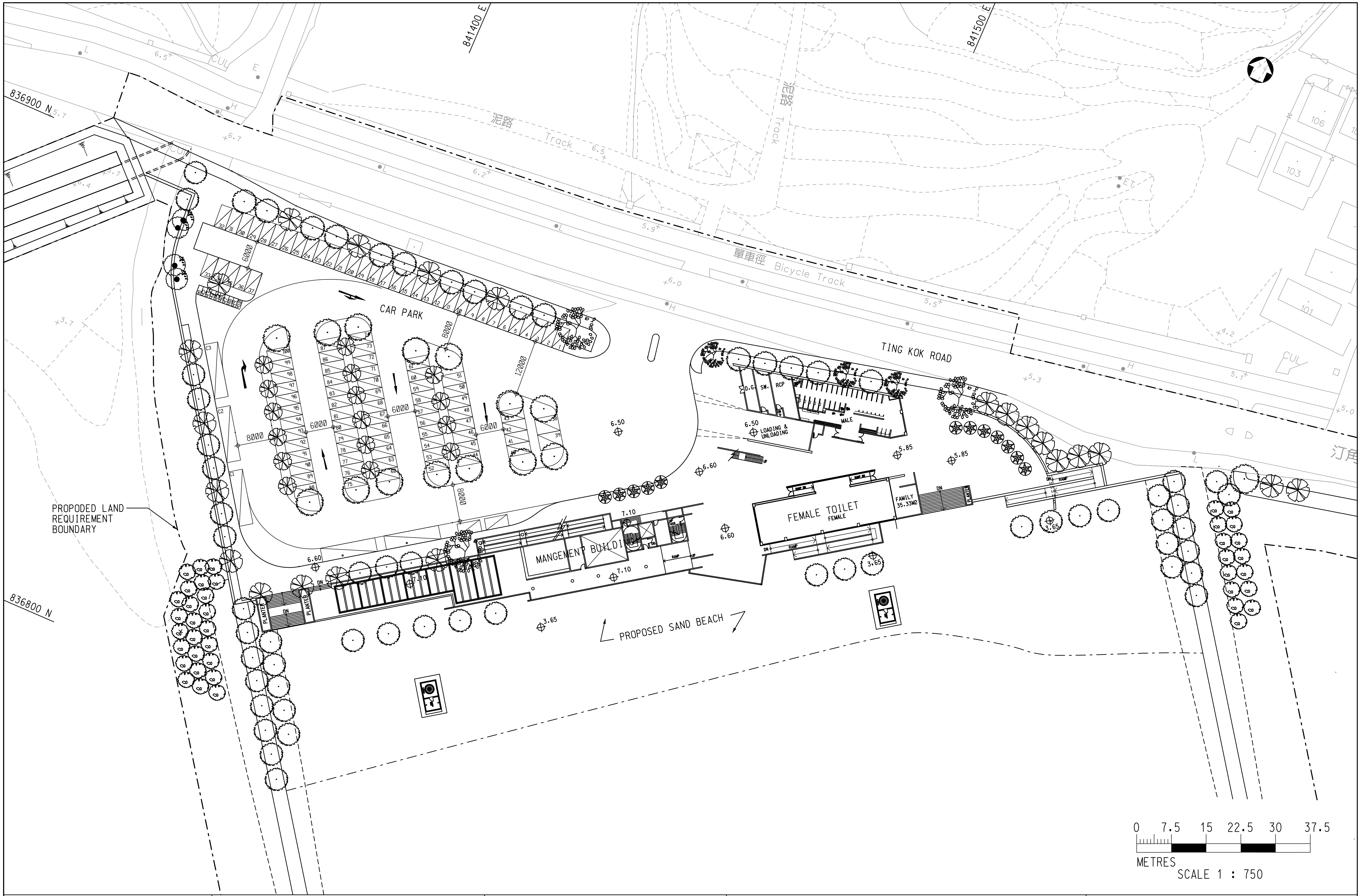
Designed -	Drawn -	Date 25/05/2007



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Agreement No. :
CE 59/2005 (EP)

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
PRELIMINARY CARPARK AND BEACH BUILDING LAYOUT

FIGURE 2.4

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YC	PF	14/03/2007

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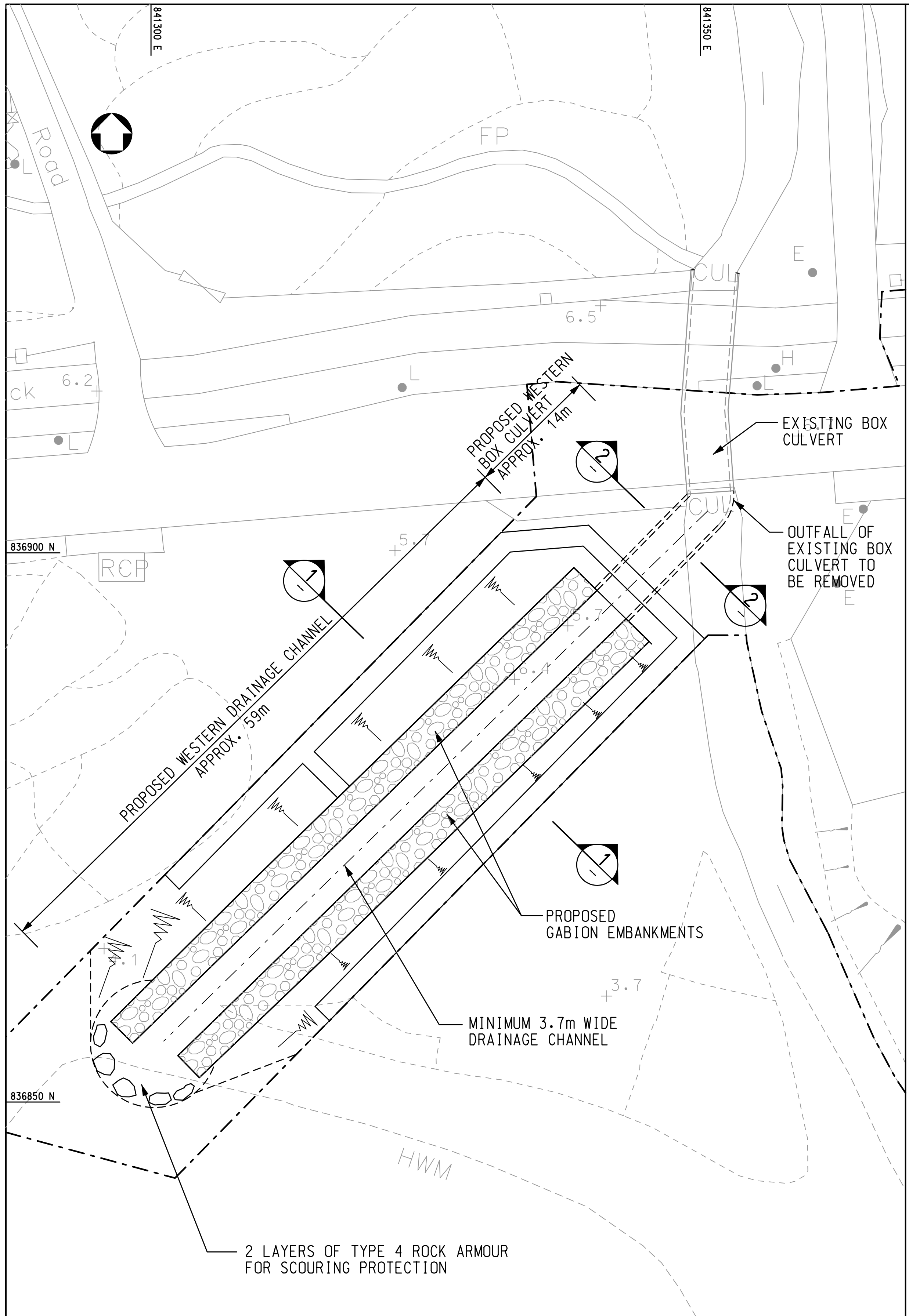

PLAN
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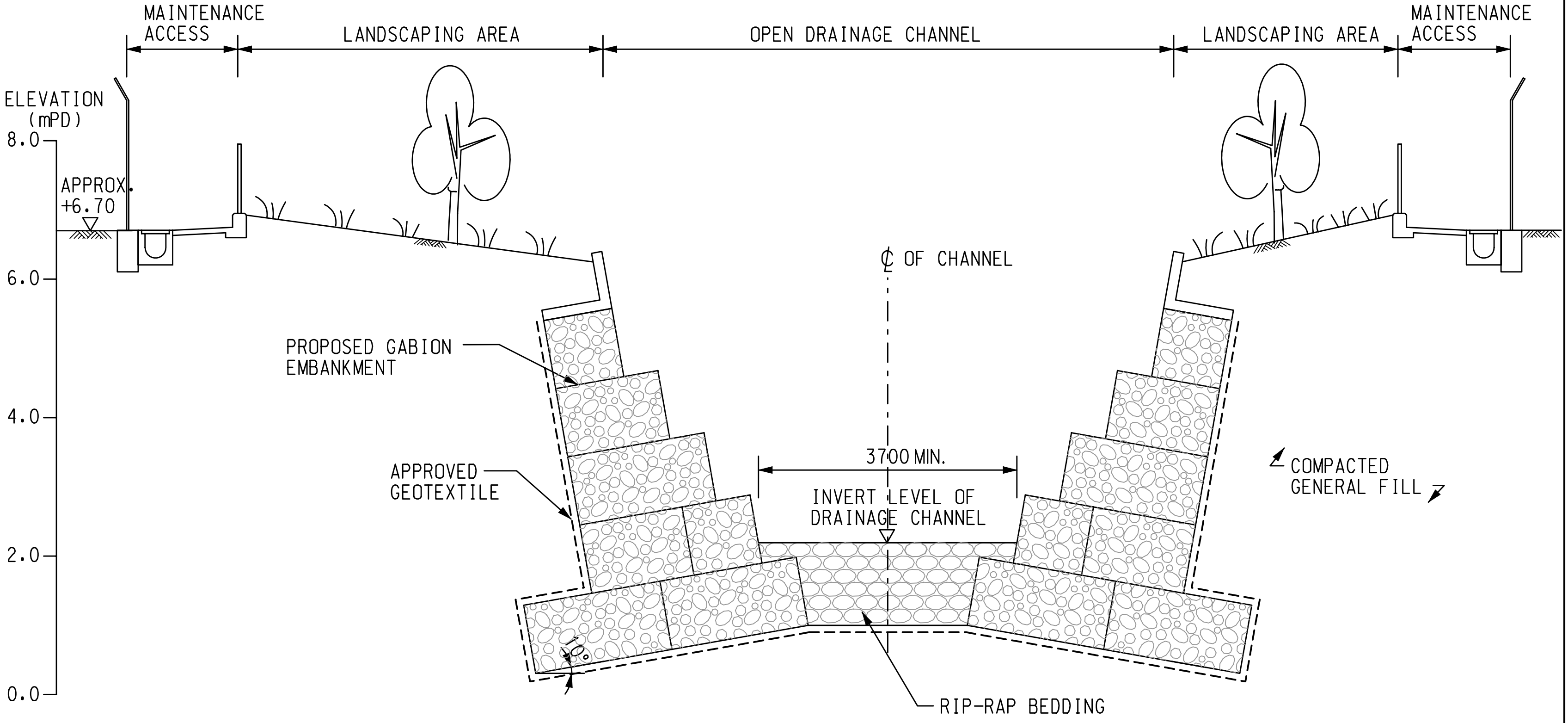
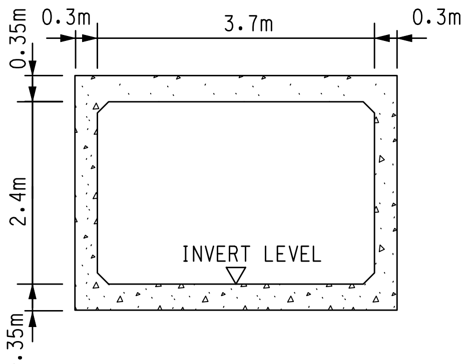


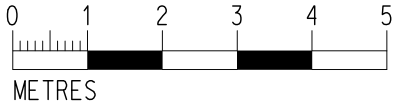
SECTION 1
SCALE 1:100

TYPICAL CROSS-SECTION OF WESTERN DRAINAGE CHANNEL



SECTION 2
SCALE 1:100

TYPICAL CROSS-SECTION OF WESTERN BOX CULVERT



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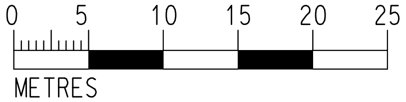

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Consulting Engineer
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ERM Enviromental Resources Management as sub-consultant

Agreement No. : CE 59/2005 (EP)

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
PROPOSED DRAINAGE DIVERSION
WORKS FOR LO TSZ RIVER

FIGURE 2.5

Checked	Scale	Rev.
PS	1: 500 @ A3	2

Designed	Drawn	Date
YC	PF	05/01/2007

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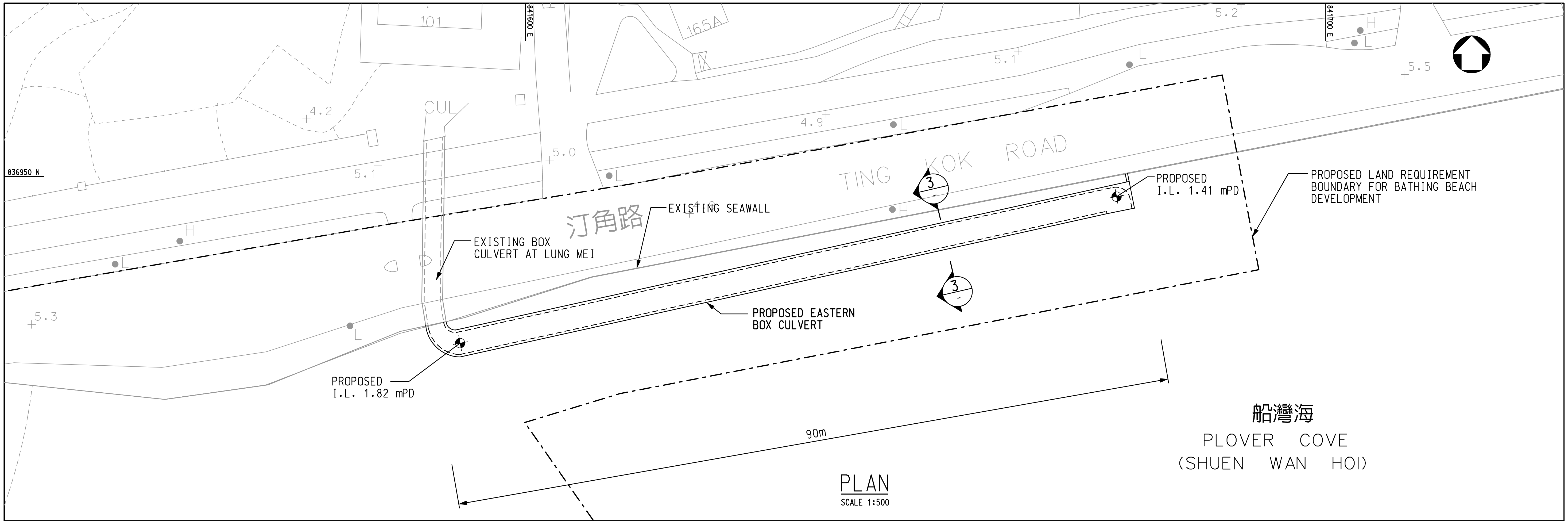
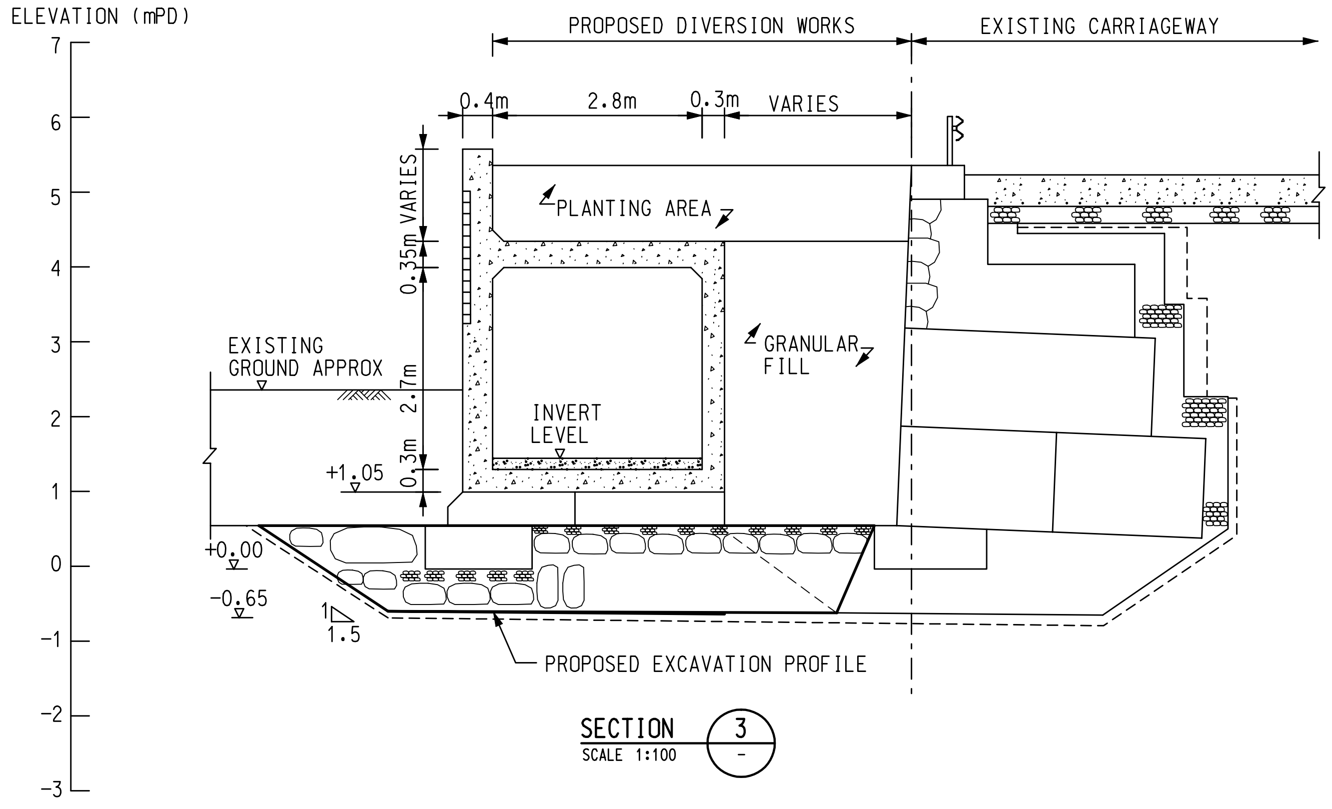
13/11/2007



PLAN
SCALE 1:500



SECTION 3
SCALE 1:100

TYPICAL CROSS-SECTION OF PROPOSED EASTERN BOX CULVERT

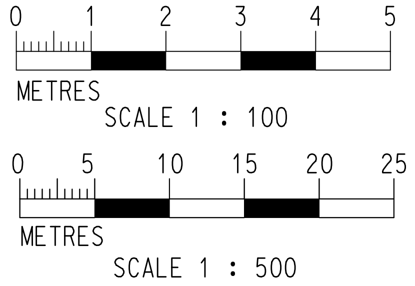


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FIGURE 2.6

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

Figure Title:
PROPOSED DRAINAGE DIVERSION WORKS
FOR EXISTING EASTERN BOX CULVERT

Checked	Scale	Rev.
PS	1: 500 @ A3	1
Designed	Drawn	Date
YC	PF	14/03/2007

philipF 13/11/2007
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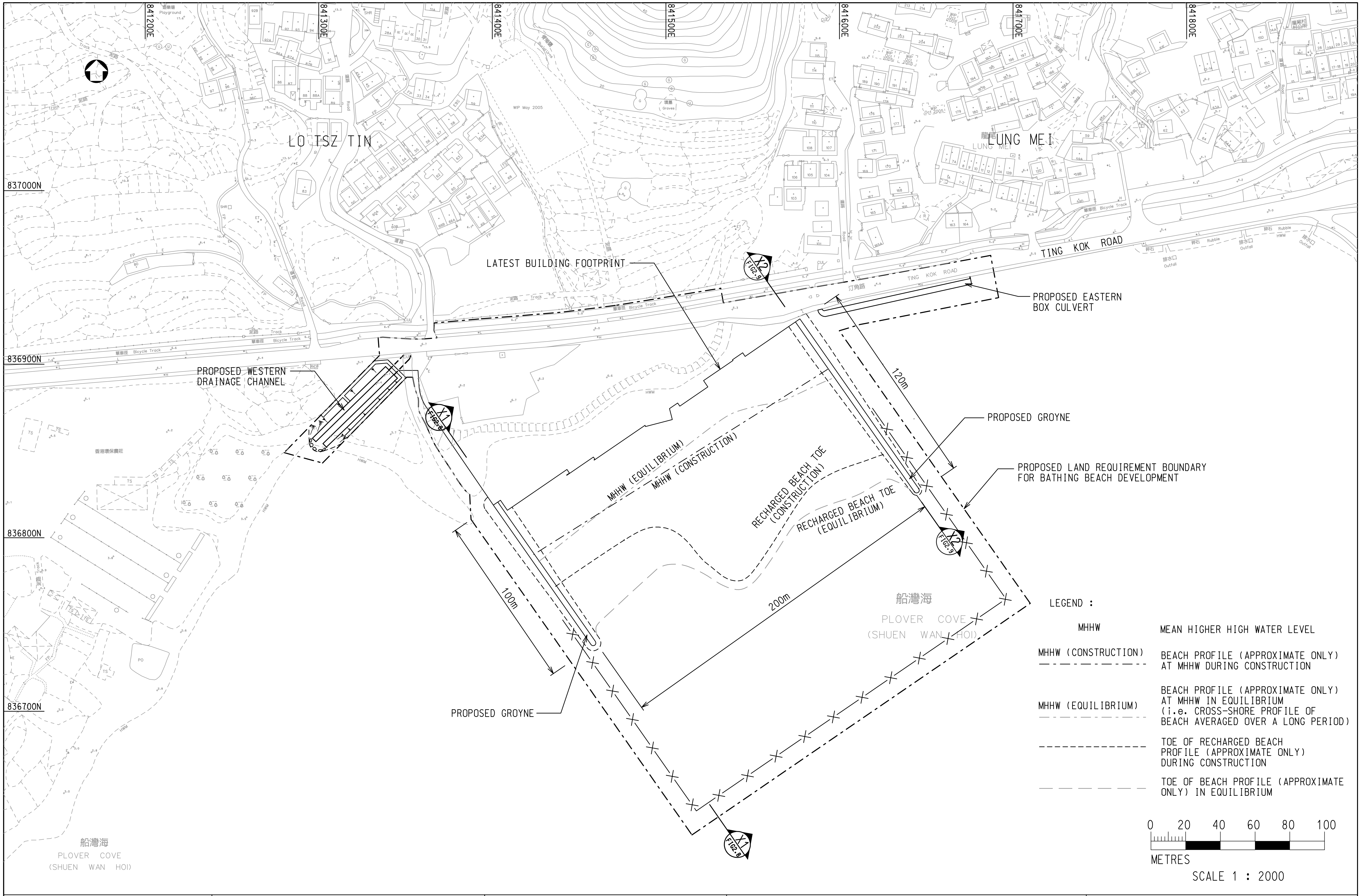

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Figure Title:
PREFERRED GROYNE LAYOUT OPTION - LAYOUT PLAN

FIGURE 2.7

Checked	Scale	Rev.
PS	1: 2000 @ A3	3

Designed	Drawn	Date
YC	MJY	14/03/2007

philipF 13/11/2007
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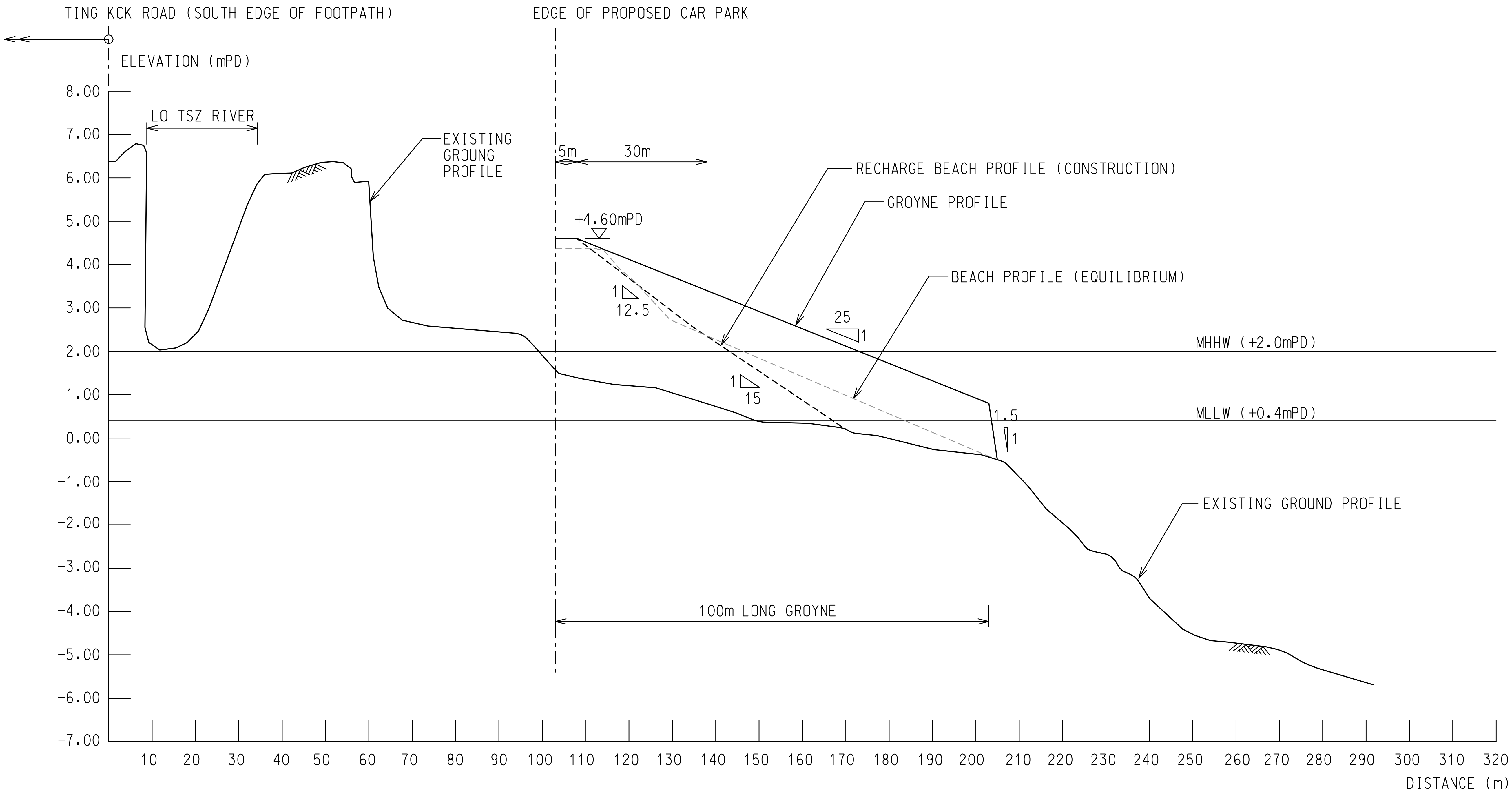
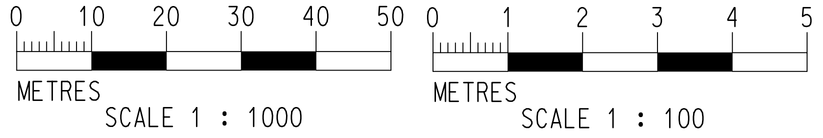


PROFILE X1

(PLANTER NOT SHOWN FOR CLARITY)
VERTICAL SCALE 1:100 HORIZONTAL SCALE 1:1000



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		Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: PROFILE OF WESTERN GROYNE (PROFILE X1) - PREFERRED OPTION	Checked PS Scale AS SHOWN Rev. 0 Designed YC Drawn MH Date 24/09/2007

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13/11/2007
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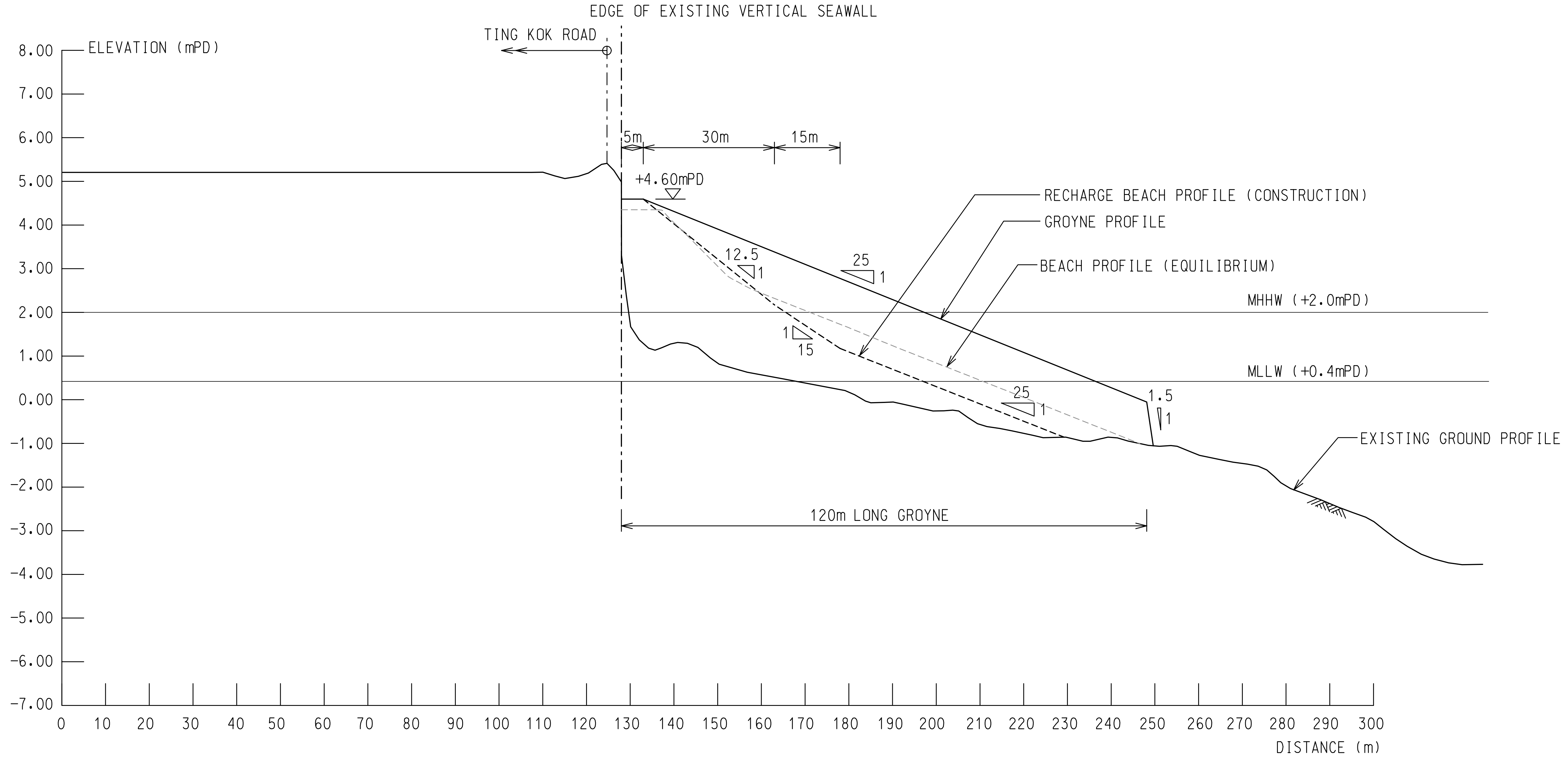

PROFILE X2

(PLANTER NOT SHOWN FOR CLARITY)
VERTICAL SCALE 1:100 HORIZONTAL SCALE 1:1000

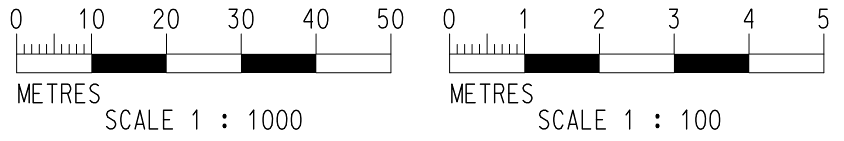

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Figure Title:
PROFILE OF EASTERN GROYNE
(PROFILE X2) - PREFERRED OPTION

FIGURE 2.9

Checked PS	Scale AS SHOWN	Rev. 0
Designed YC	Drawn MH	Date 24/09/2007

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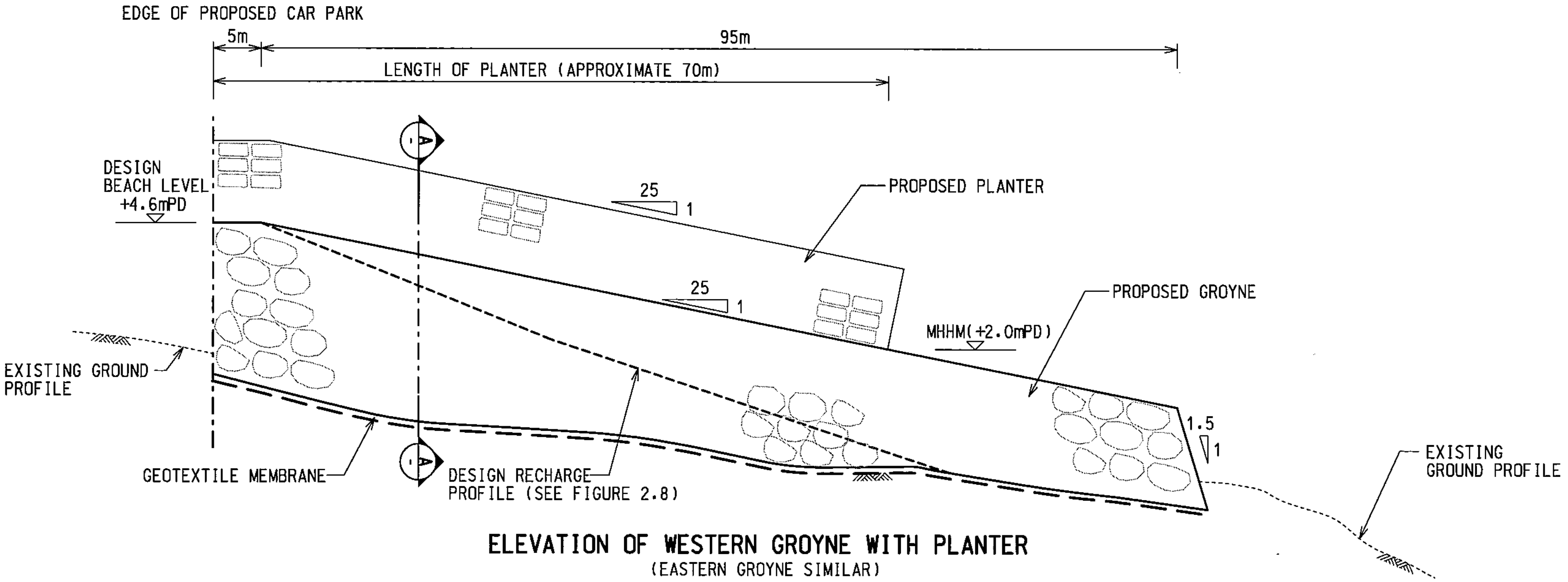
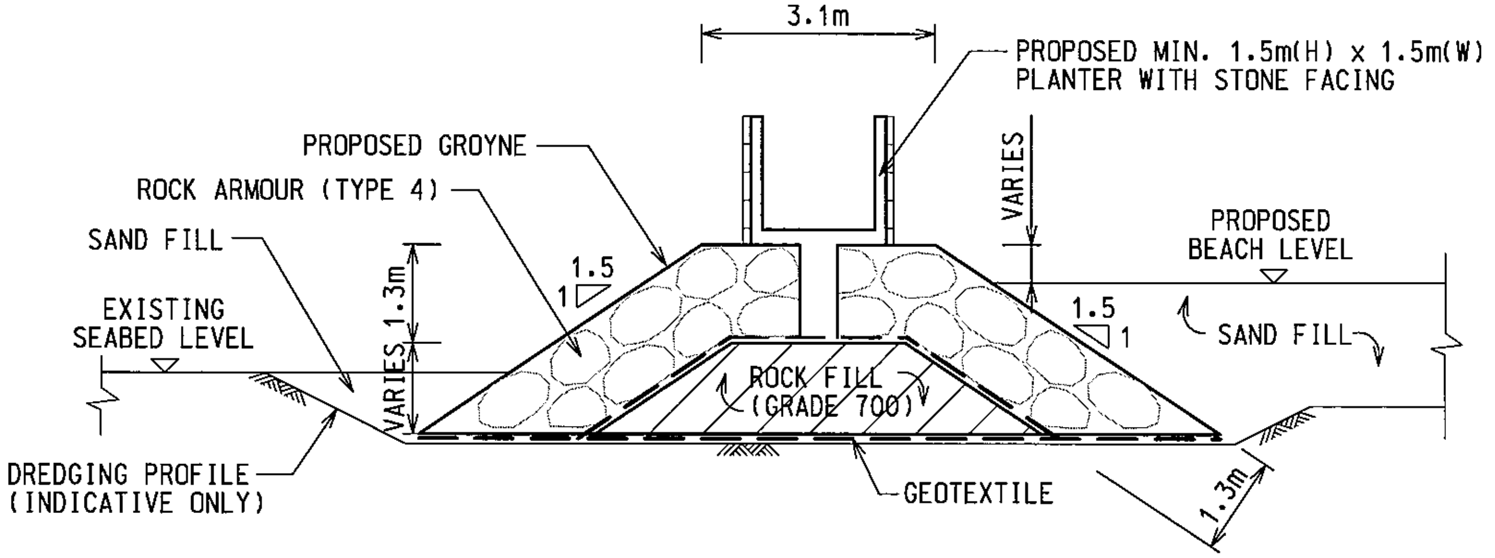
e:¥proj¥CALBDS¥Figure¥E_IA_Rpt¥Fig2_9_0_EIA_RPT.dgn



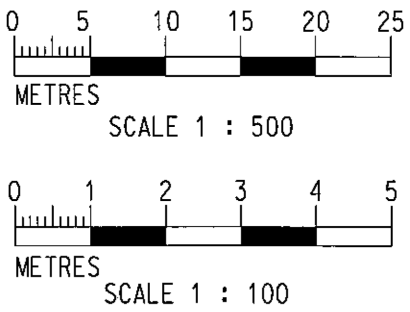
ELEVATION OF WESTERN GROYNE WITH PLANTER

(EASTERN GROYNE SIMILAR)
VERTICAL SCALE 1:100 HORIZONTAL SCALE 1:500



TYPICAL CROSS SECTION OF PLANTER
SECTION A-A

SCALE 1: 100



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AT LUNG MEI, TAI PO

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Figure Title:
PROPOSED ARRANGEMENT FOR
PROPOSED GROYNE AND PLANTER

FIGURE 2.10

Checked PS	Scale AS SHOWN	Rev. 1
Designed YC	Drawn MJY	Date 26/09/2007

Caddraft 24/10/2007
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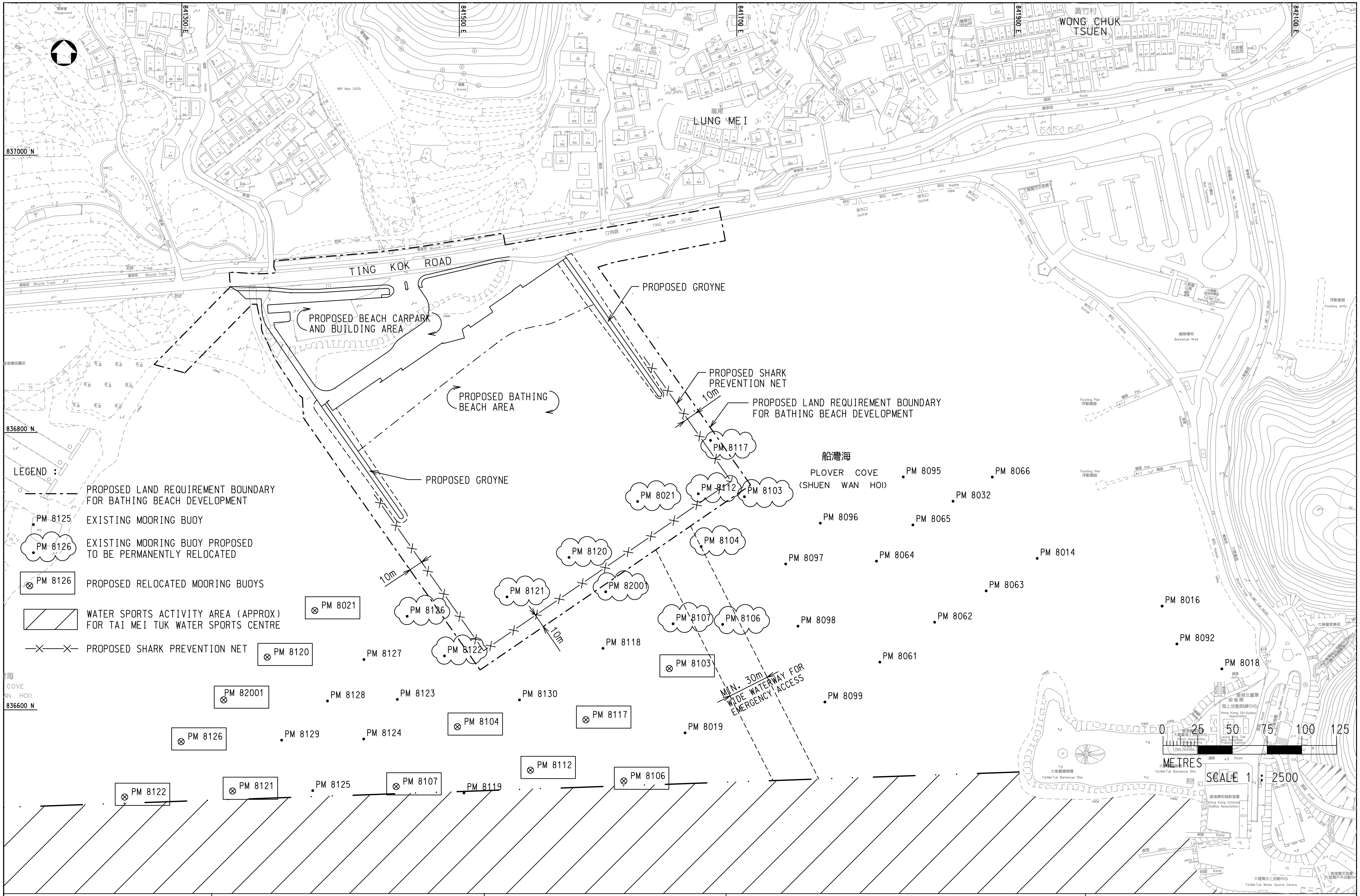

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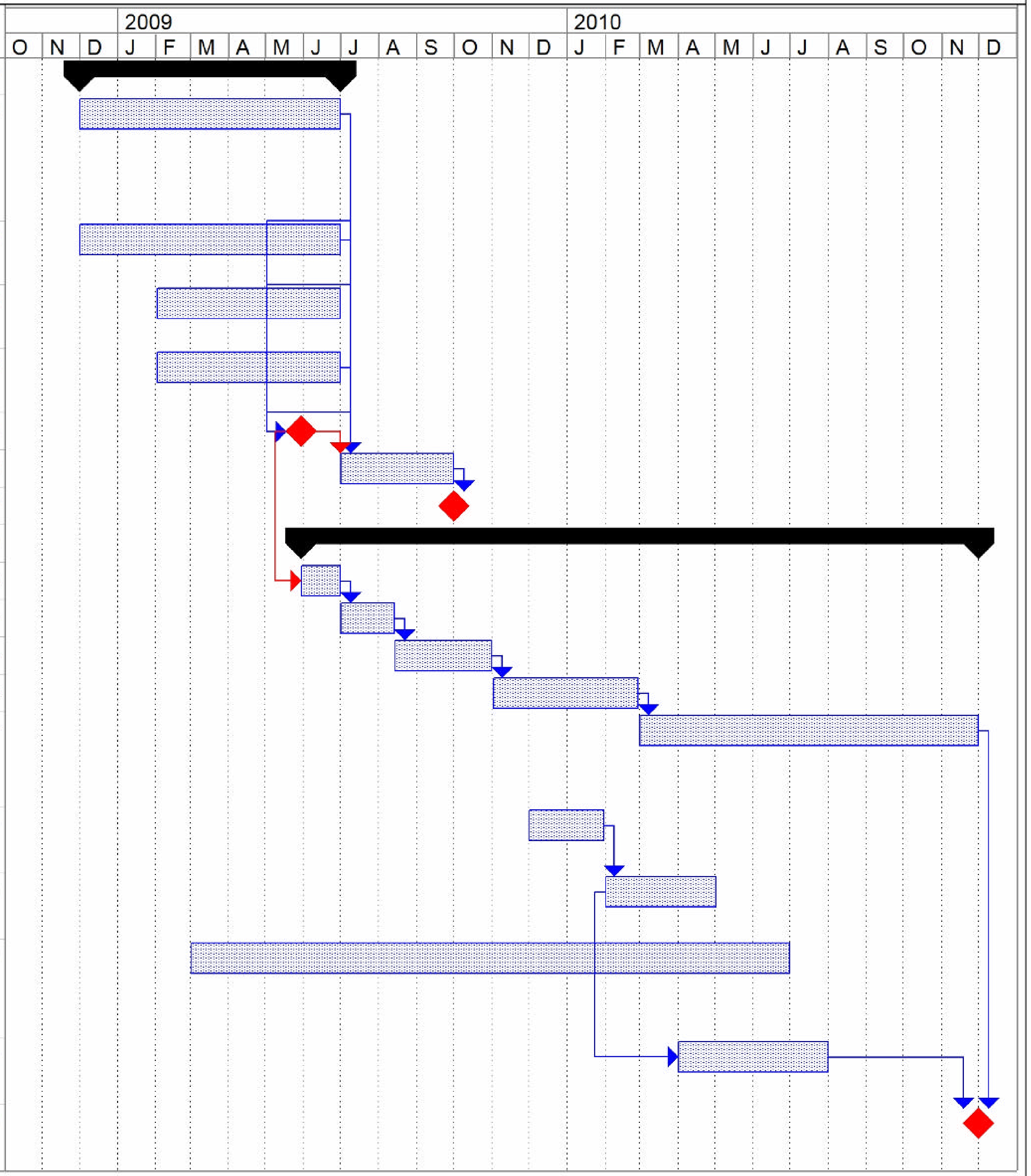
Figure Title: PRELIMINARY PROPOSED PERMANENT MARINE FACILITIES ARRANGEMENT

FIGURE 3.1

Checked	Scale	Rev.
PS	1: 2500 @ A3	1
Designed	Drawn	Date
YC	PF	22/02/2007

philipF 13/11/2007
e:*proj*CALBDS*Figure*E_IA_Rpt*Fig3_1_1_EIA_Rpt.dgn

ID	Task Name	Duration	Start	Finish
1	**Construction Works on Land**	**7 months**	**12/08**	**06/09**
2	Site Formation, including Seawall/Retaining Wall (with dredging of foundation), Tree Transplant and Backfilling	7 months	12/08	07/09
3	Road Widening and roadworks construction at Ting Kok Road	7 months	12/08	07/09
4	Drainage Works and connection to existing main drainage	5 months	02/09	07/09
5	Sewerage works and sewerage Connection to Existing Trunk Sewer	5 months	02/09	07/09
6	**Handover Building Site Area to ArchSD**	**-**	**06/09**	**06/09**
7	**Car Park Paving**	**3 months**	**07/09**	**10/09**
8	**Handover Car Park to ArchSD**	**-**	**10/09**	**10/09**
9	**Building Works by ArchSD**	**18 months**	**06/09**	**12/10**
10	Mobilization	1 month	-	-
11	Sheet Piling	1.5 months	-	-
12	Foundation and Tanking	2.5 months	-	-
13	Superstructure	4 months	-	-
14	Landscape Works, Building Finishes & Internal Fitting-out (including slippage due to inclement weather)	9 months	-	-
15	**Dredging for Beach and Groyne Construction**	**2 months**	**12/09**	**1/10**
16	**Rock Filling of Groynes**	**3 months**	**02/10**	**04/10**
17	**Box Culvert Construction and River Diversion with Tree Transplant & Landscaping Works**	**16 months**	**03/09**	**07/10**
18	**Sand Filling for Beach Construction**	**4 months**	**04/10**	**7/10**
19	**Overall Completion**	**-**	**12/10**	**12/10**



File: Bathing Beach (20070511)_PS
Date: Thu 5/31/07

Key Date ◆ Task ▨ Summary ▬

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FIGURE 3.2

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title:
TENTATIVE CONSTRUCTION PROGRAMME

Checked	Scale	Rev.
PS	-	1
Designed	Drawn	Date
-	-	08/03/2007

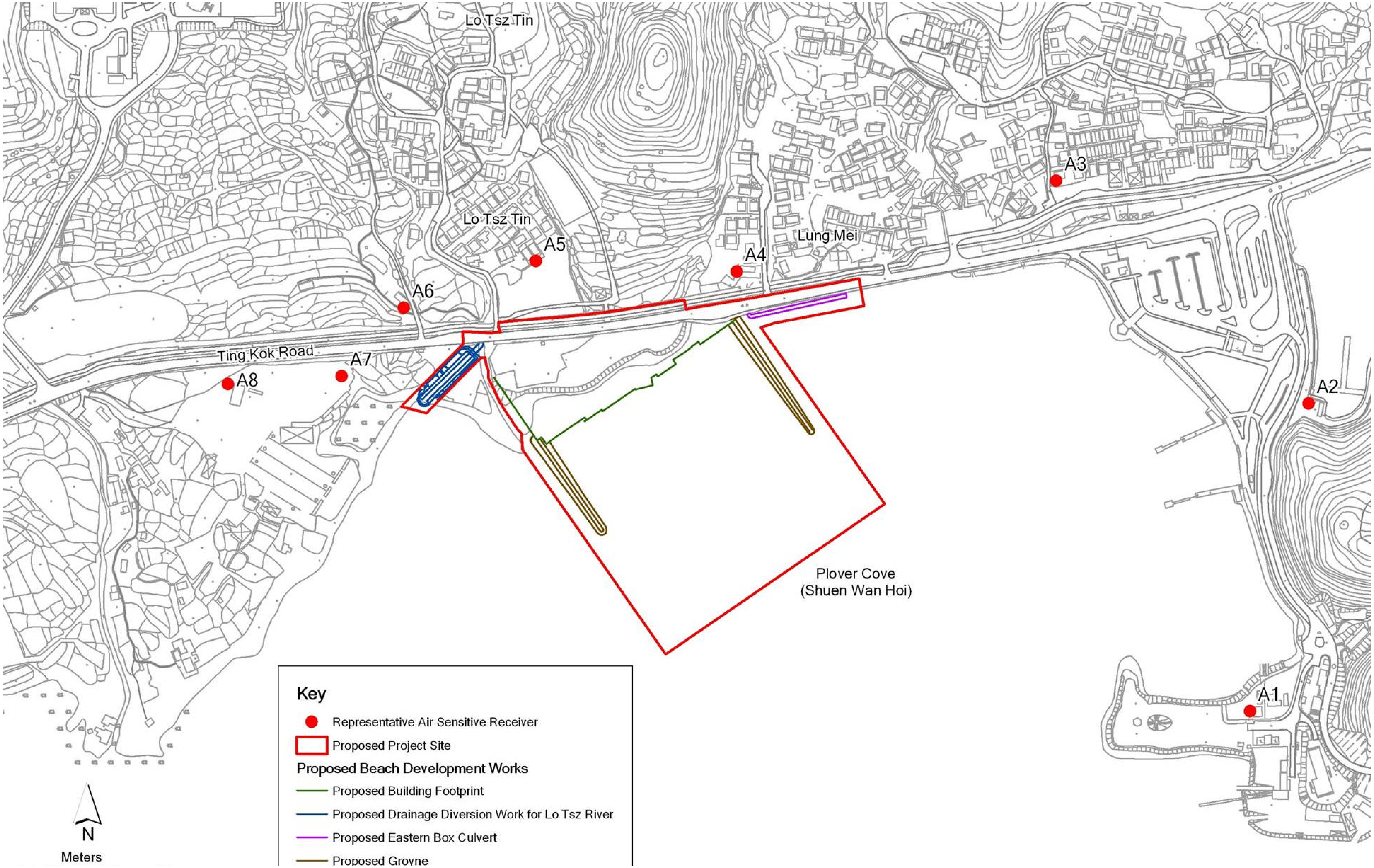

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FIGURE 4.1

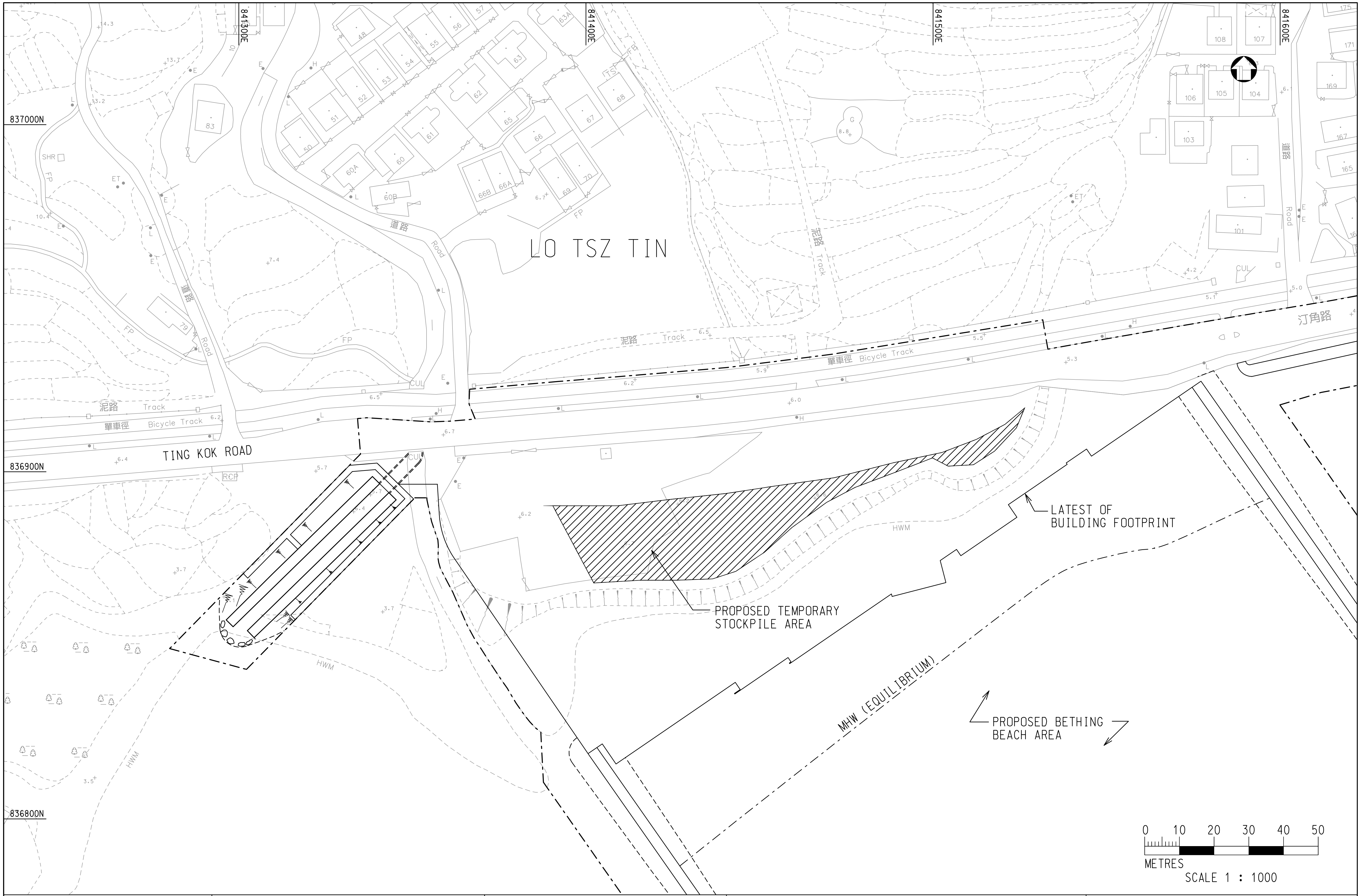
Project Title:

DEVELOPMENT OF A BATHING
BEACH AT LUNG MEI, TAI PO

Figure Title:

REPRESENTATIVE AIR SENSITIVE RECEIVER

Checked	Scale	Rev.
WK	AS SHOWN	2
Designed	**Drawn**	**Date**
-	-	08/03/2007



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Agreement No. : CE 59/2005 (EP)	Figure Title: ENVIRONMENTAL IMPACT ASSESSMENT REPORT	FIGURE 4.2	
Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: TEMPORARY STOCKPILE AREA	Checked PS	Scale 1:1000 @ A3
		Rev. 2	Designed YC
		Drawn PF	Date 14/03/2007

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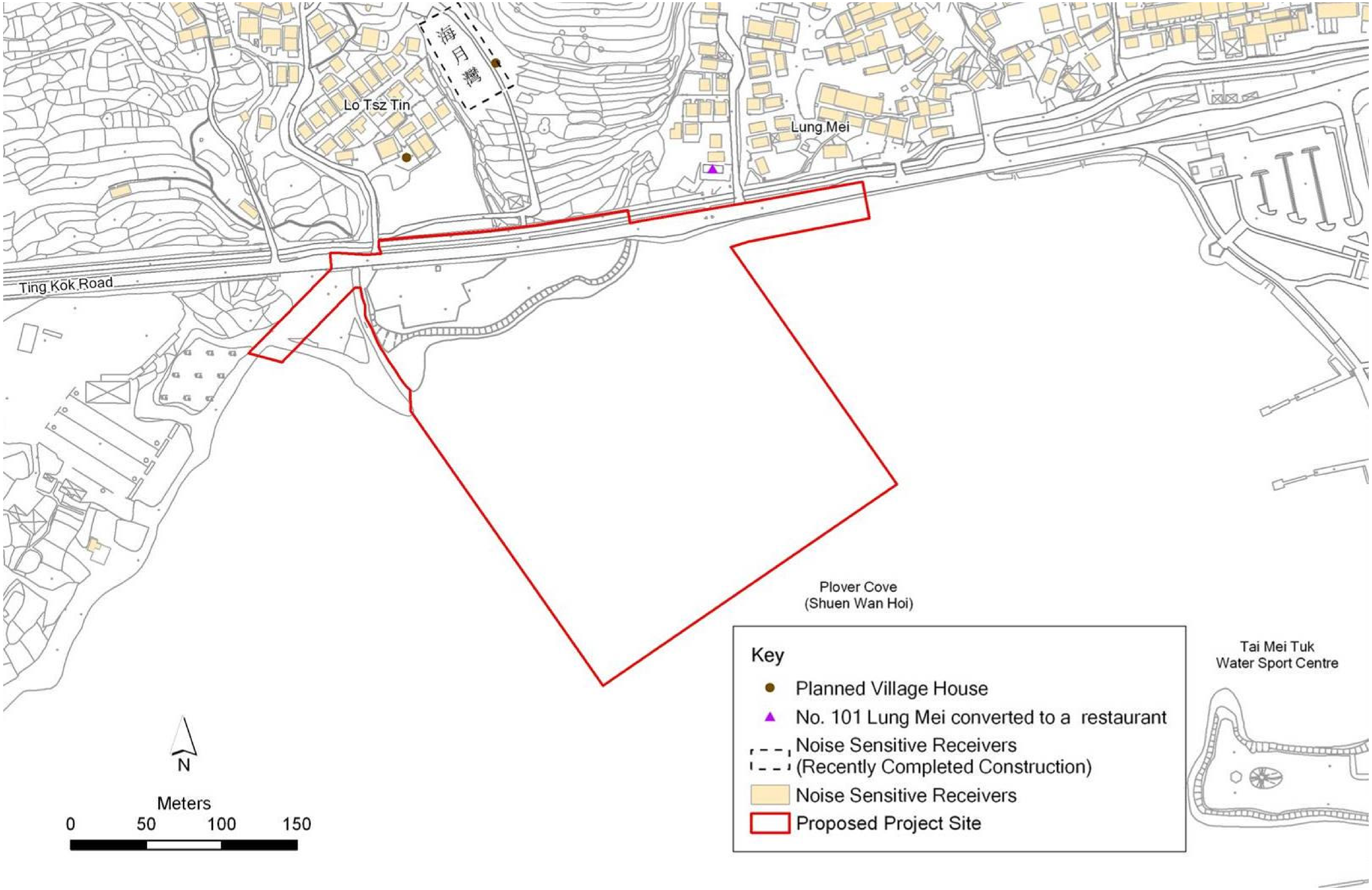
13/11/2007
e:*proj*CALBDS*Figure*E_IA_Rpt*FIG4_2_2_EIA_RPT.dgn



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DEVELOPMENT OF A BATHING
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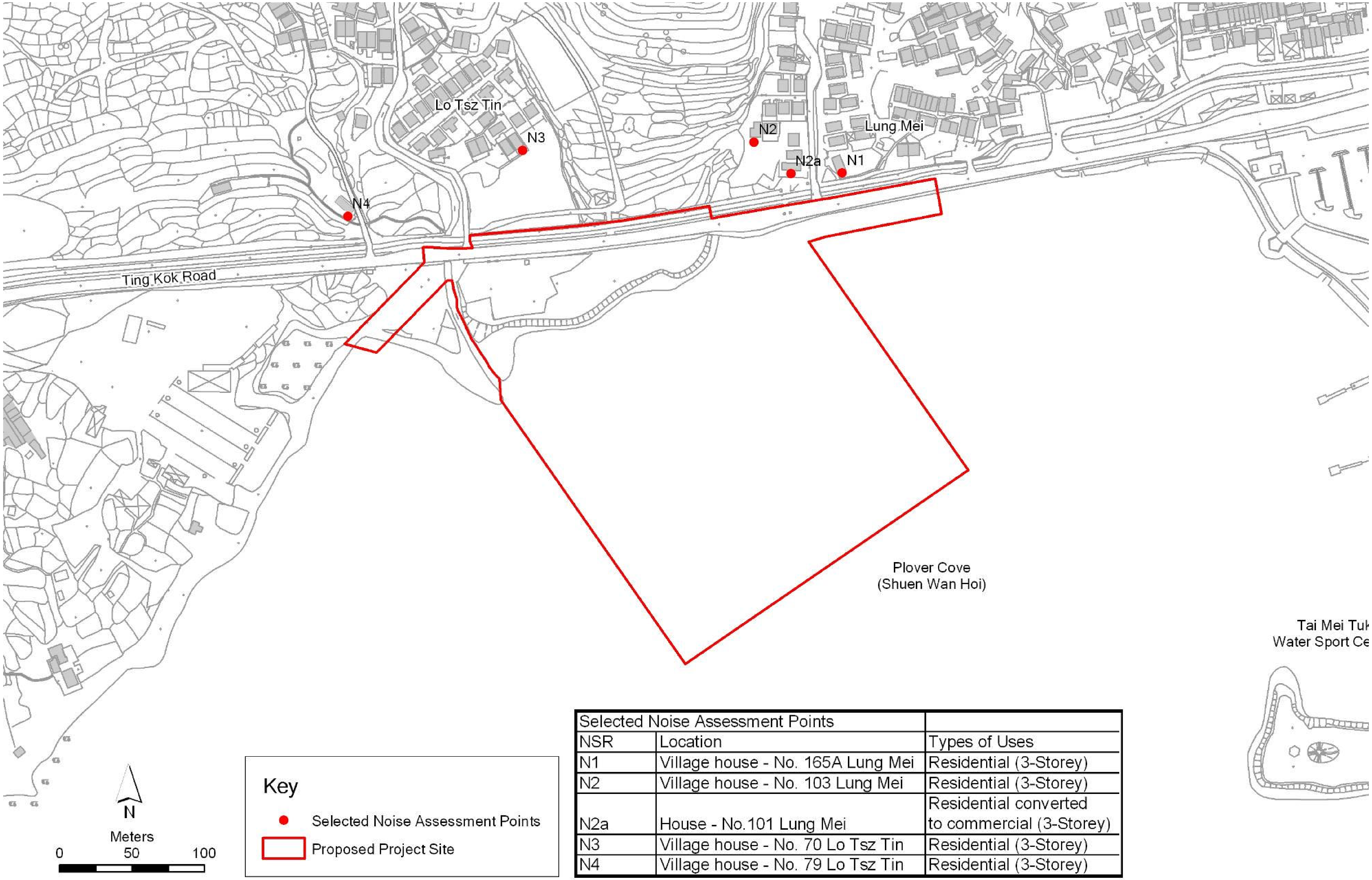
Figure Title:
NOISE SENSITIVE RECEIVERS

FIGURE 5.1

Checked	Scale	Rev.
PS	AS SHOWN	2
Designed	Drawn	Date
-	SW	14/02/2007



Selected Noise Assessment Points		
NSR	Location	Types of Uses
N1	Village house - No. 165A Lung Mei	Residential (3-Storey)
N2	Village house - No. 103 Lung Mei	Residential (3-Storey)
N2a	House - No.101 Lung Mei	Residential converted to commercial (3-Storey)
N3	Village house - No. 70 Lo Tsz Tin	Residential (3-Storey)
N4	Village house - No. 79 Lo Tsz Tin	Residential (3-Storey)

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FIGURE 5.2

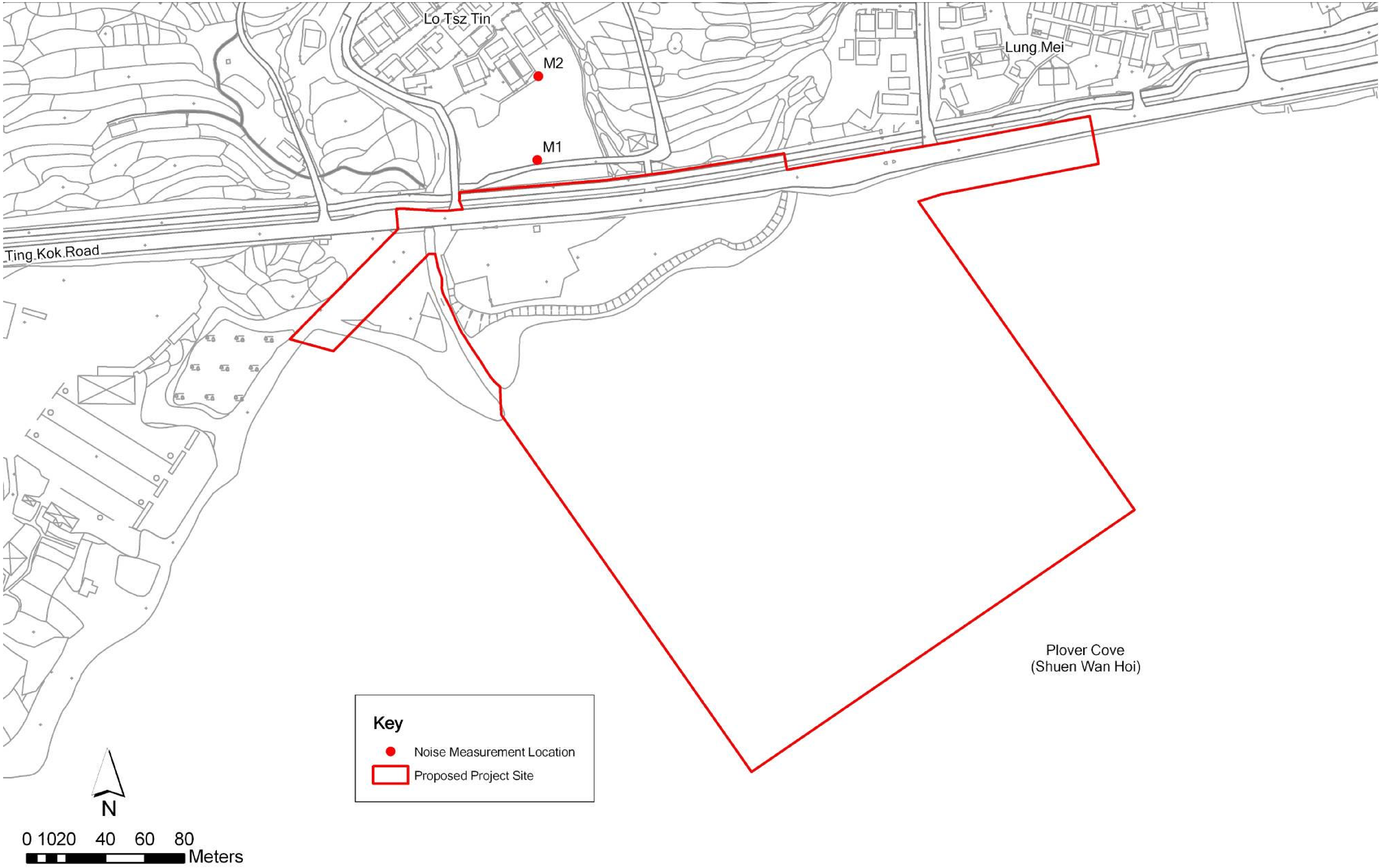
Project Title:

DEVELOPMENT OF A BATHING
BEACH AT LUNG MEI, TAI PO

Figure Title:

SELECTED NOISE ASSESSMENT POINTS

Checked PS	Scale AS SHOWN	Rev. 1
Designed -	Drawn SW	Date 14/02/2007



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Agreement No.: CE 59/2005(EP)	ENVIRONMENTAL IMPACT ASSESSMENT REPORT	**FIGURE 5.3**		
Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: NOISE MEASUREMENT LOCATIONS	Checked PS	Scale AS SHOWN	Rev. 1
		Designed -	Drawn SW	Date 14/02/2007

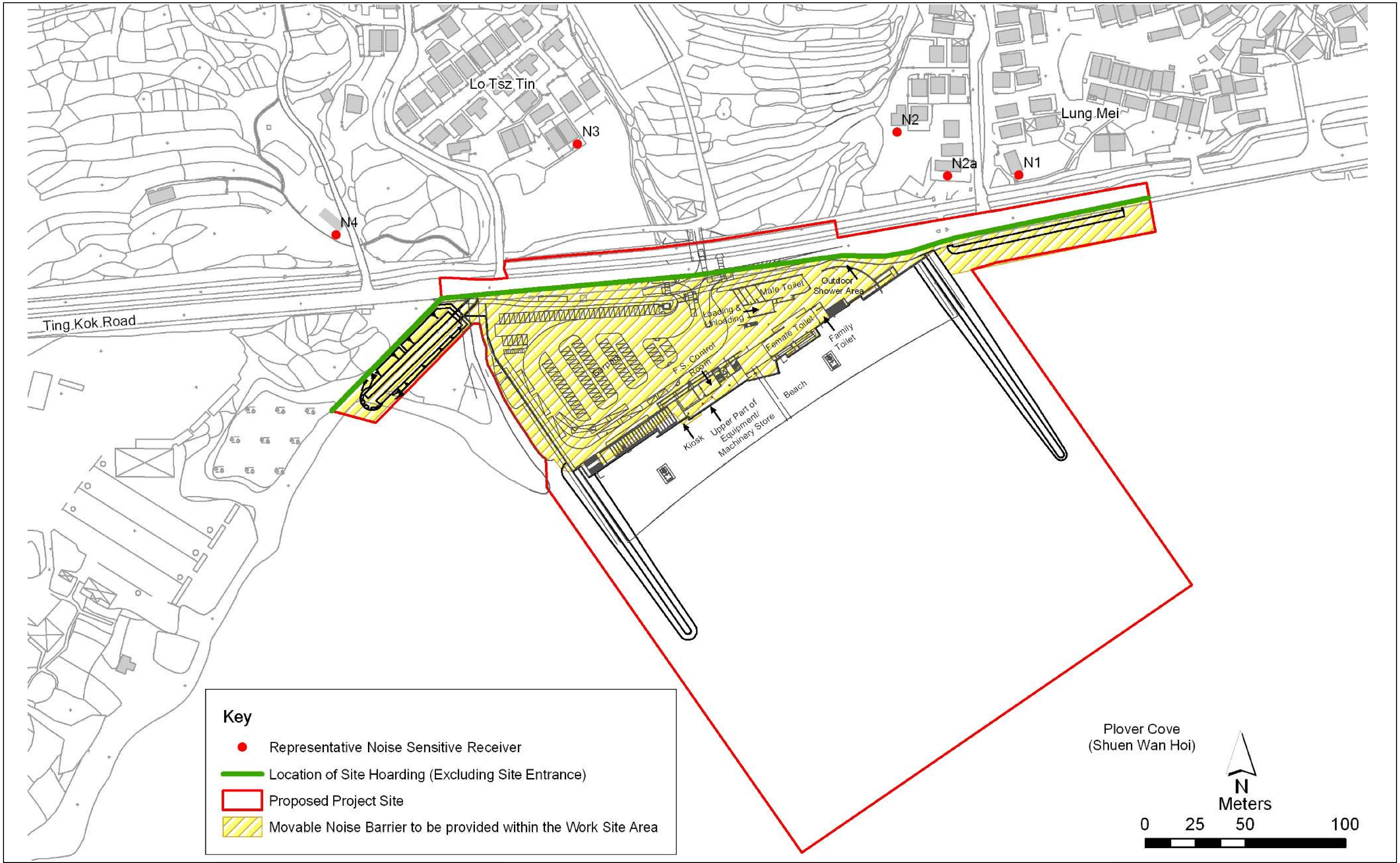

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FIGURE 5.4

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title:
LOCATION OF PROPOSED MOVABLE BARRIERS DURING CONSTRUCTION PHASE

Checked	Scale	Rev.
PS	AS SHOWN	1

Designed	Drawn	Date
-	KK	06/07/2007

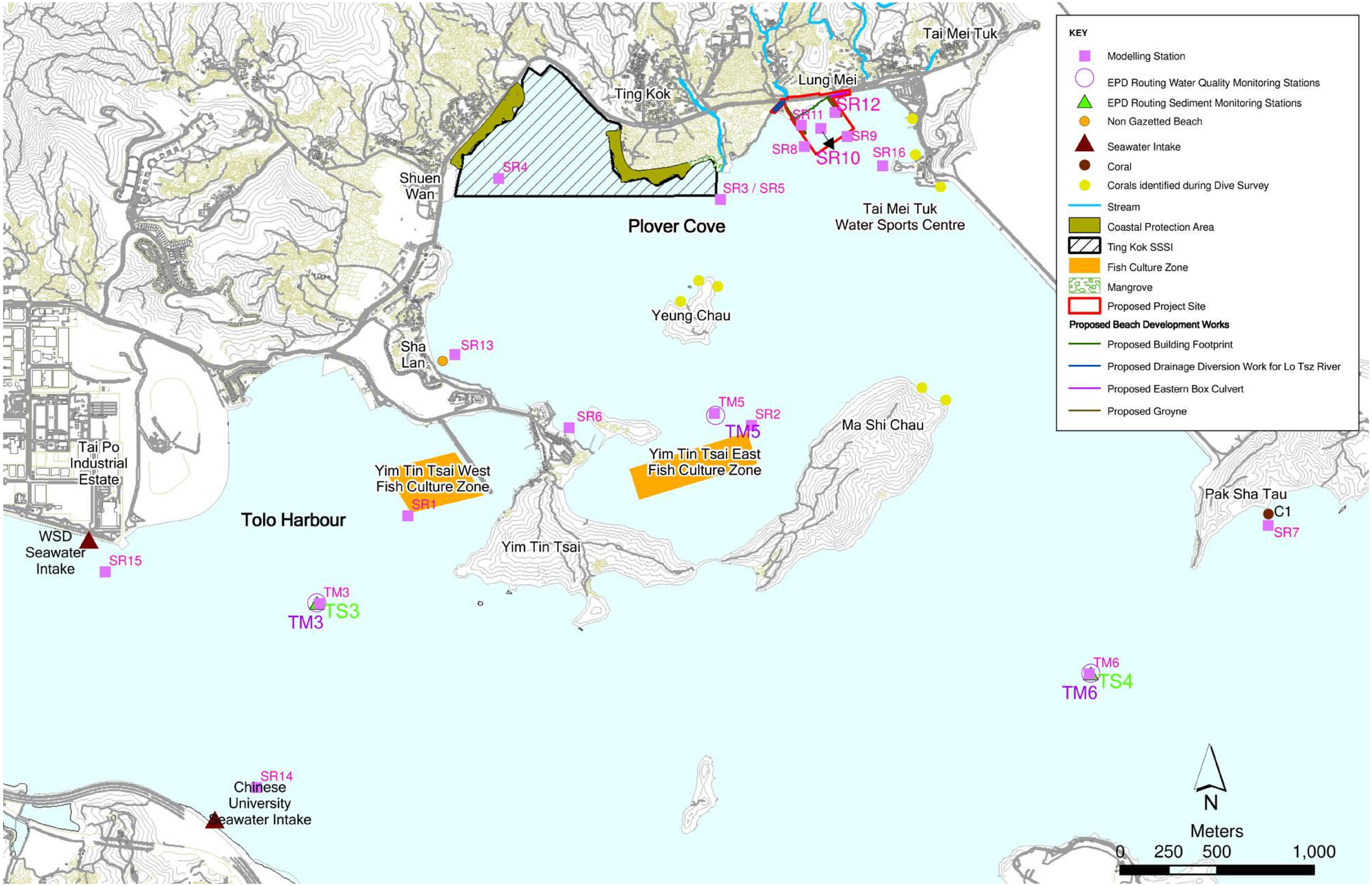

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Figure Title:

MODELLING OUTPUT LOCATIONS IN THE VICINITY OF THE PROPOSED BEACH DEVELOPMENT SITE

FIGURE 6.1

Checked	Scale	Rev.
TF	AS SHOWN	3
Designed	Drawn	Date
-	KK	06/07/2007

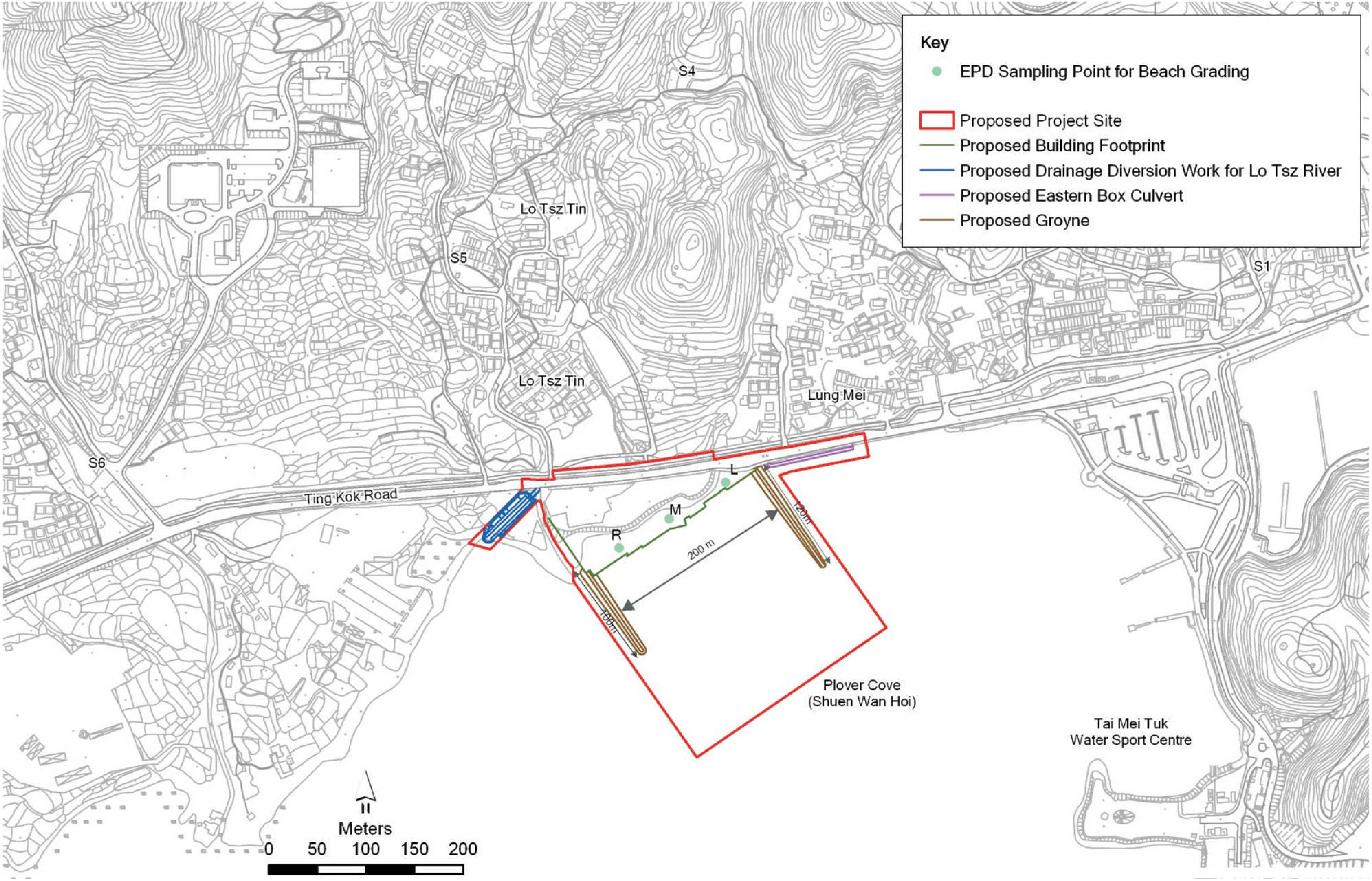

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FIGURE 6.2

Project Title:

DEVELOPMENT OF A BATHING
BEACH AT LUNG MEI, TAI PO

Figure Title:

EPD BEACH WATER QUALITY SAMPLING LOCATIONS

Checked	Scale	Rev.
TF	AS SHOWN	1
Designed	Drawn	Date
-	KK	6/07/2007

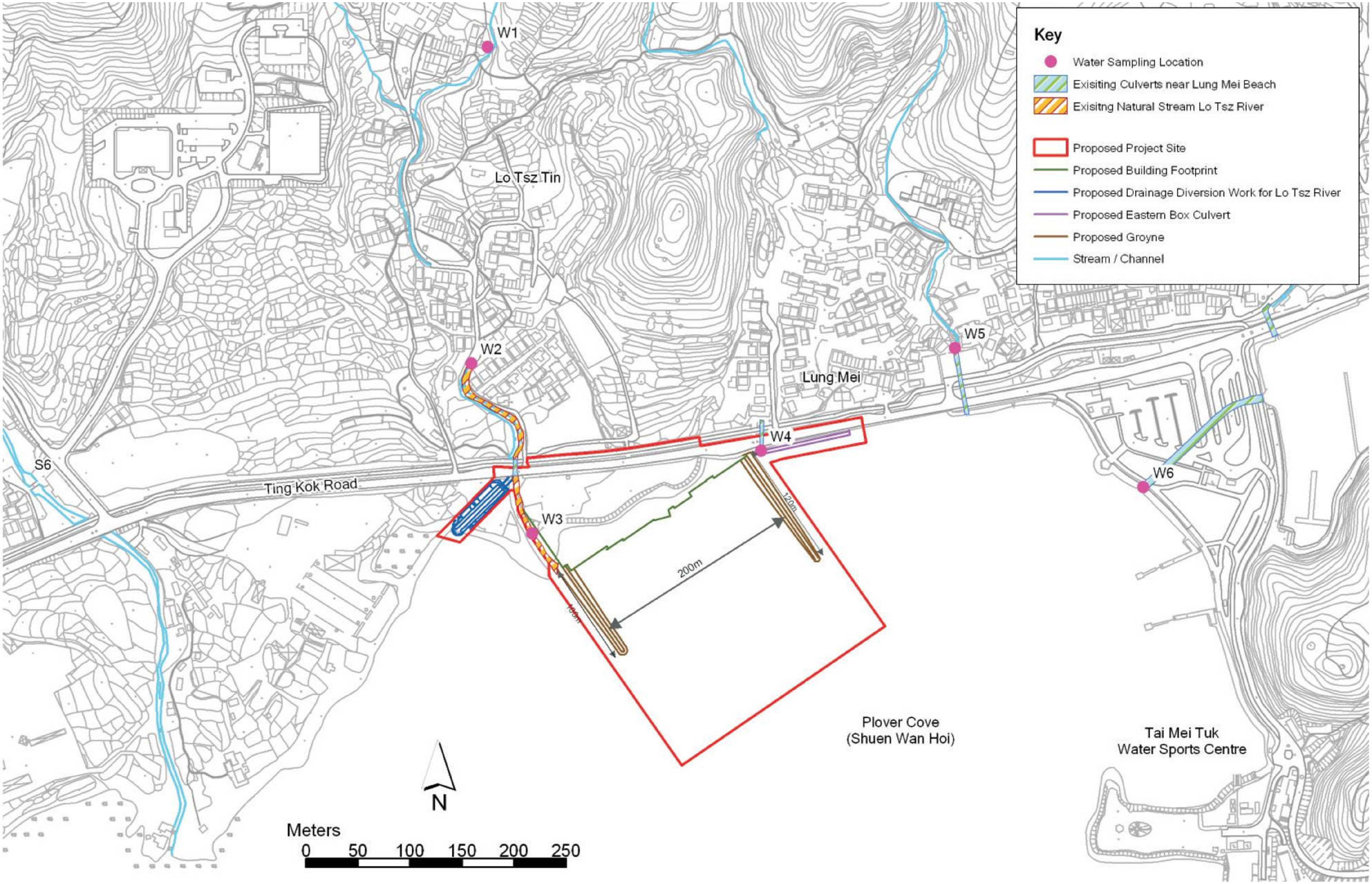

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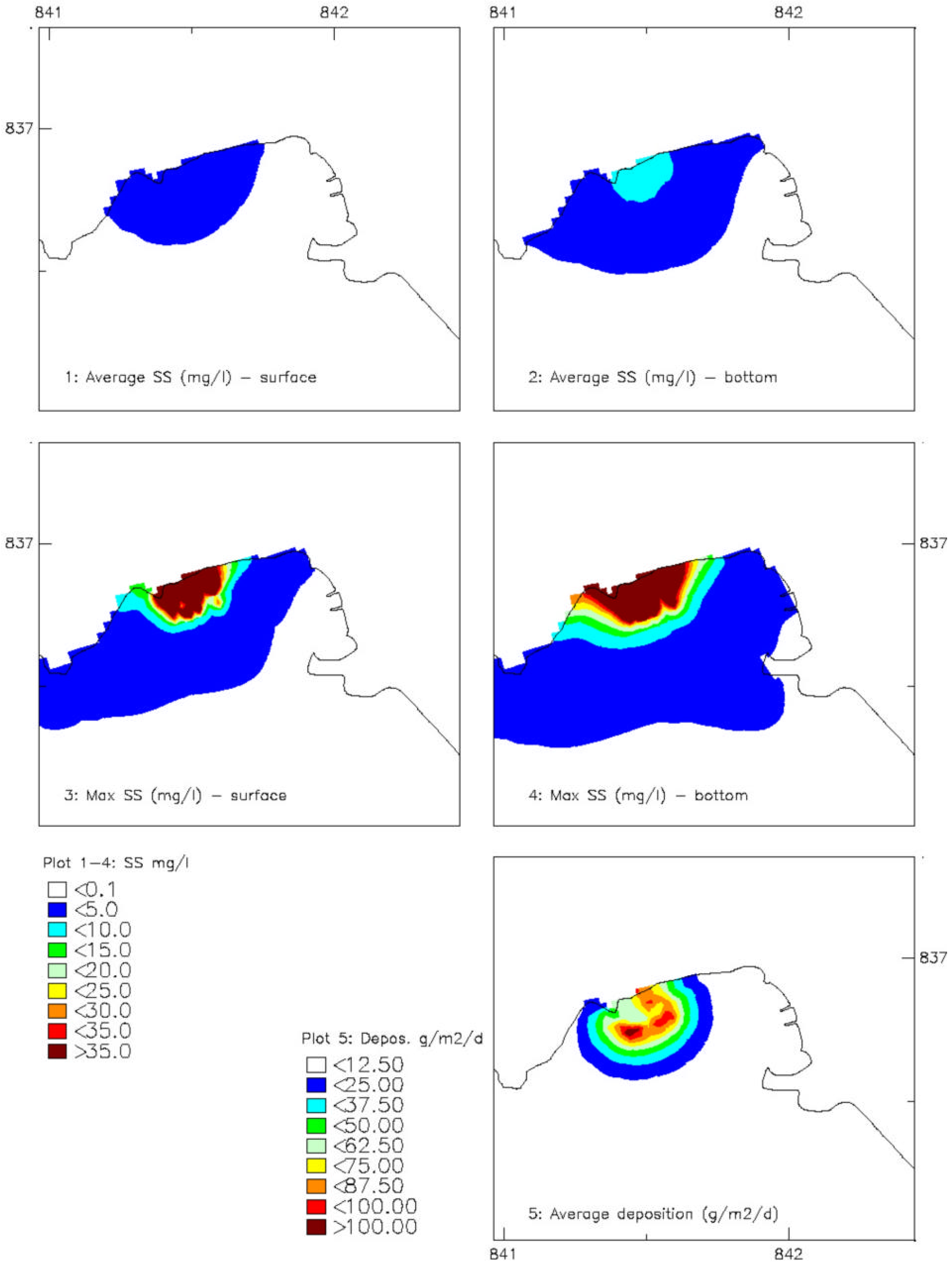
Figure Title:
WATER SAMPLING LOCATIONS AT EXISTING
WATERCOURSE AND DRAINS

FIGURE 6.3

Checked PS	Scale AS SHOWN	Rev. 1
Designed -	Drawn AM	Date 06/07/2007



Plot 1-4: Suspended Sediments (mg/l) - average and maximum
Plot 5: Average deposition (g/m2/d)
Construction Scenarios: Dredging Operations

Figure 6.4: Contour Plots (SS Elevations) for Construction Scenarios (Dredging) (Dry Season)

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FIGURE 6.4

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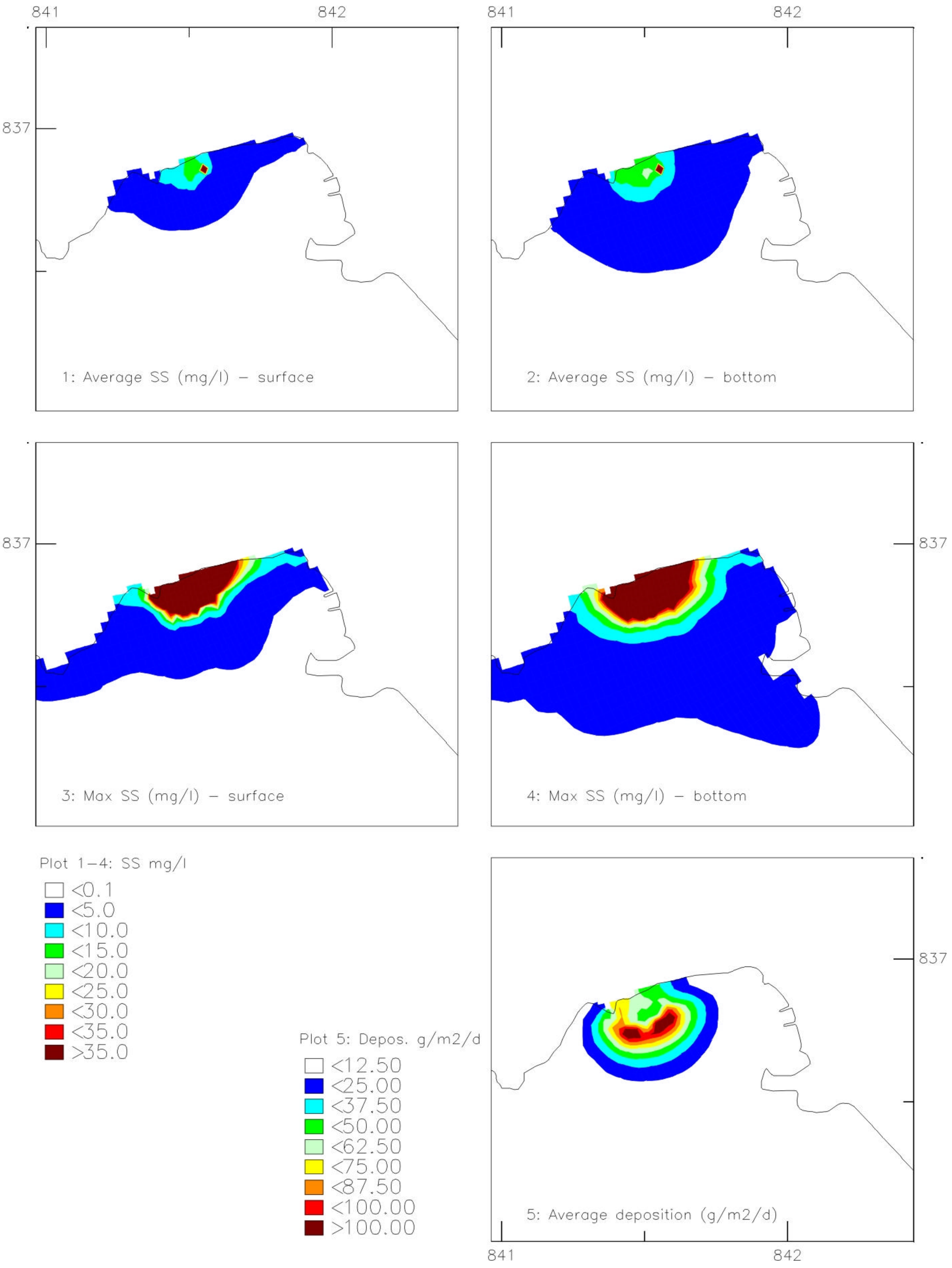

Plot 1-4: Suspended Sediments (mg/l) - average and maximum
Plot 5: Average deposition (g/m2/d)
Construction Scenarios: Dredging Operations

Figure 6.5: Contour Plots (SS Elevations) for Construction Scenarios (Dredging) (Wet Season)

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DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

FIGURE 6.5

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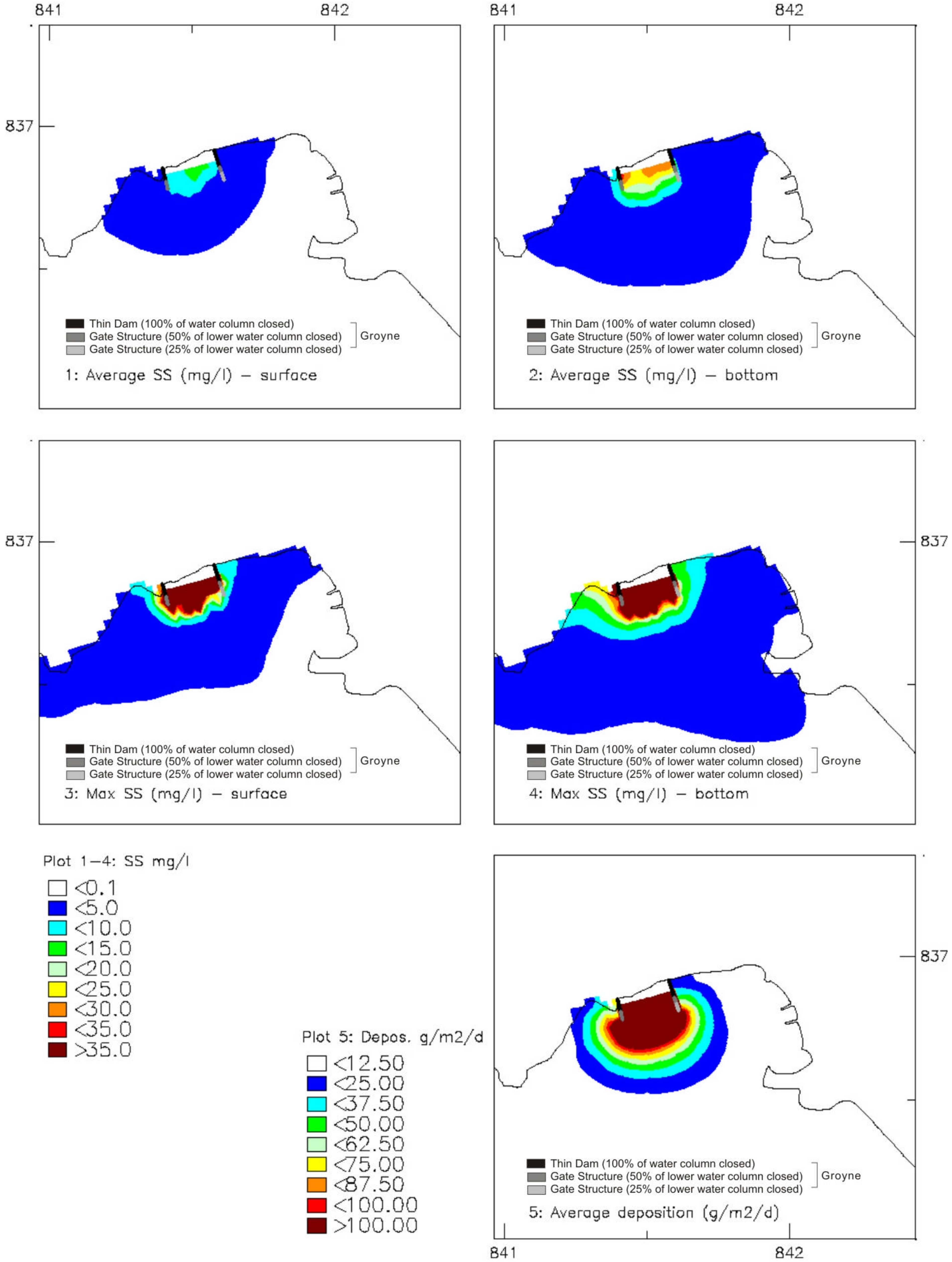
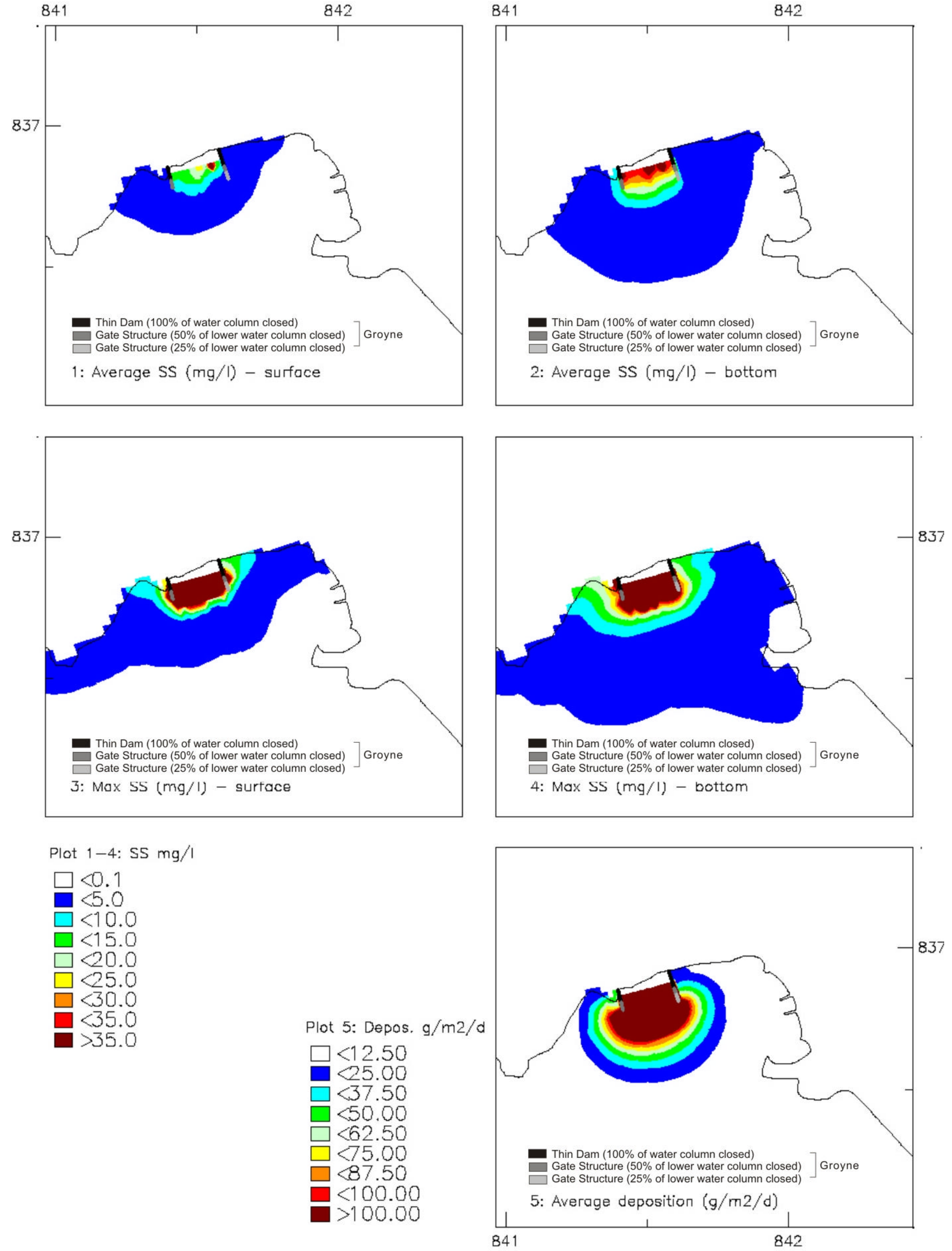


Plot 1-4: Suspended Sediments (mg/l) - average and maximum
Plot 5: Average deposition (g/m2/d)
Construction Scenarios: Sandfilling Operations

Figure 6.6: Contour Plots (SS Elevations) for Construction Scenarios (Sandfilling) (Dry Season)



Plot 1-4: Suspended Sediments (mg/l) - average and maximum
Plot 5: Average deposition (g/m2/d)
Construction Scenarios: Sandfilling Operations

Figure 6.7: Contour Plots (SS Elevations) for Construction Scenarios (Sandfilling) (Wet Season)

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DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

FIGURE 6.7

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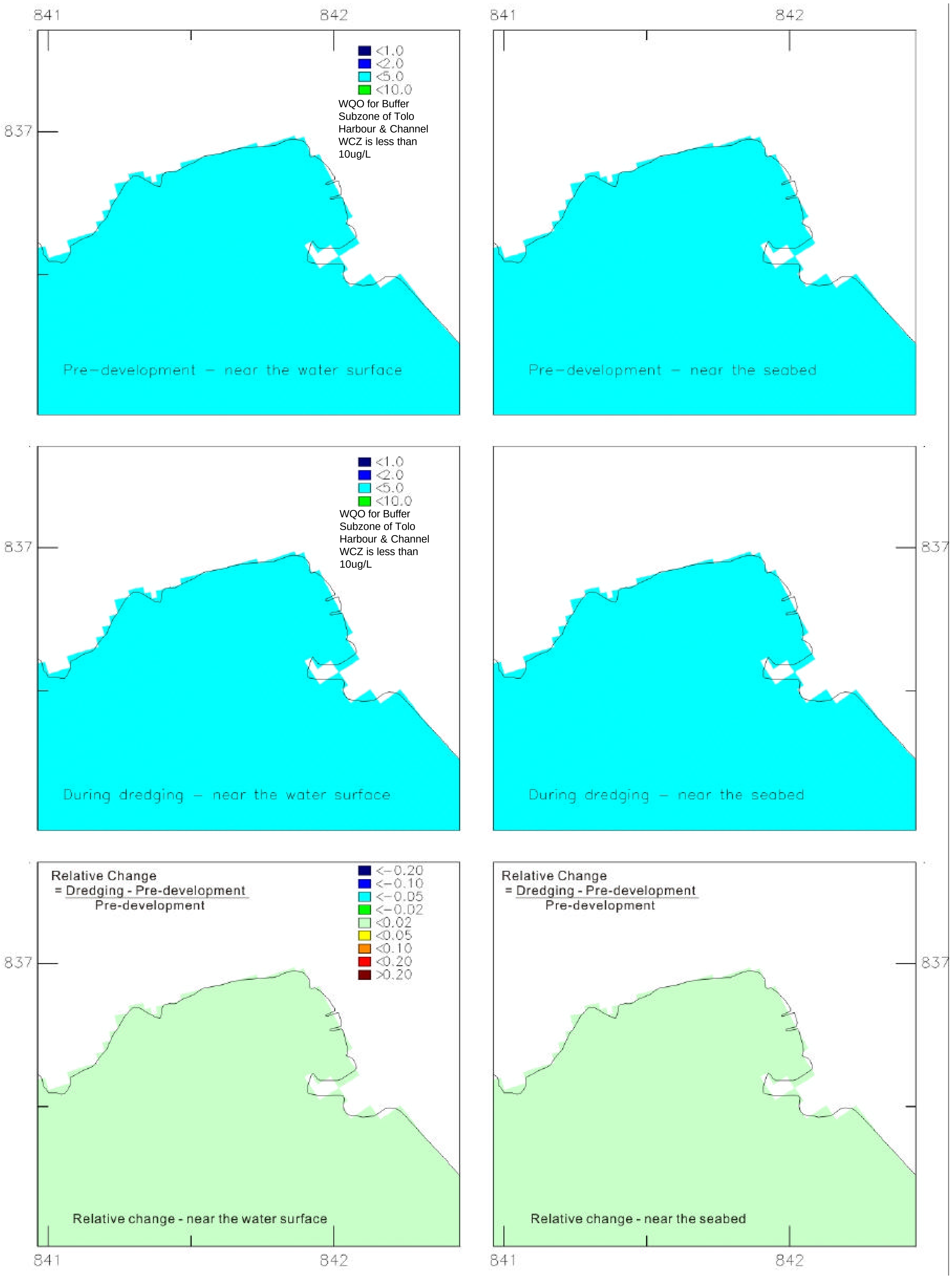
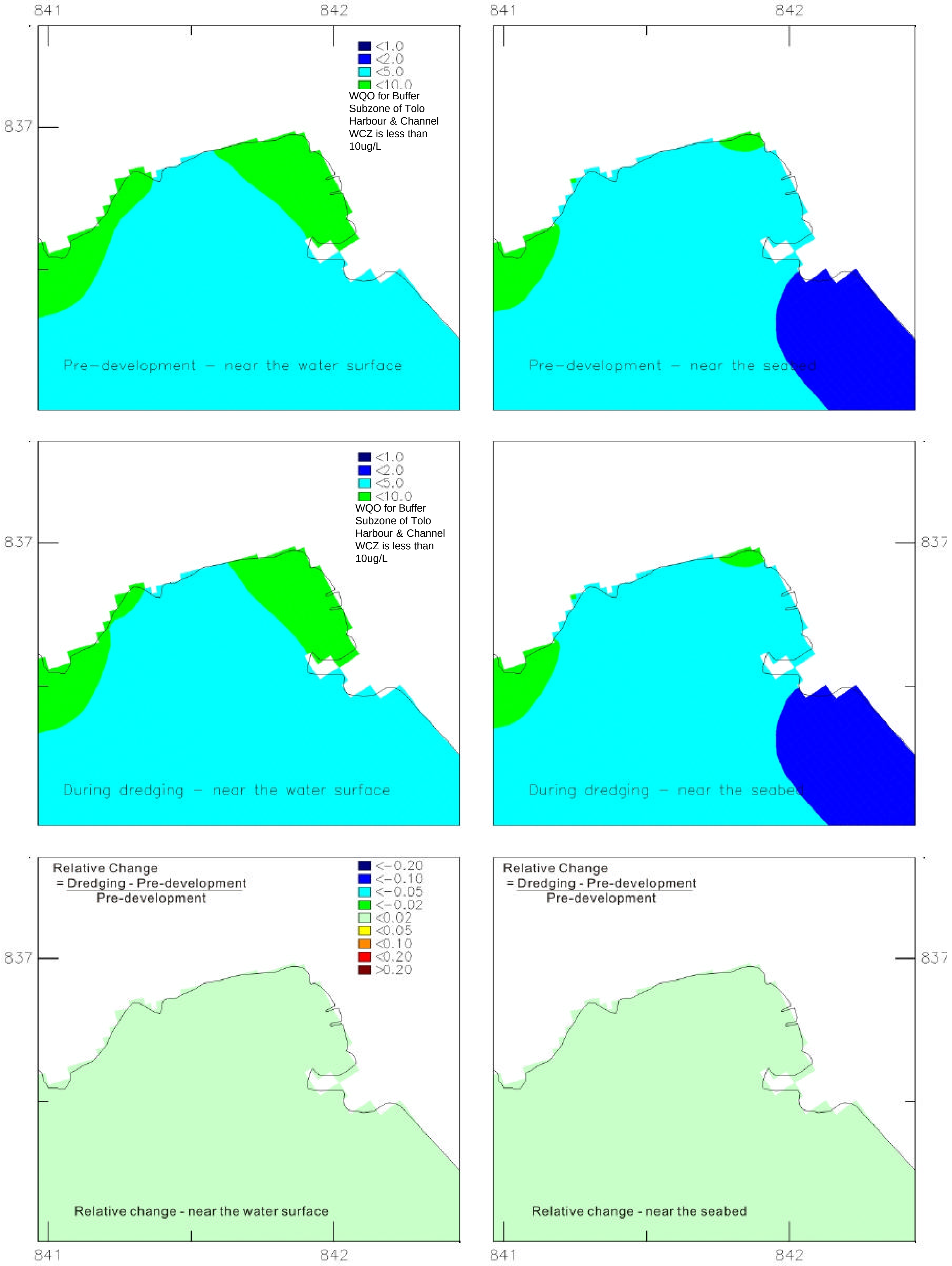


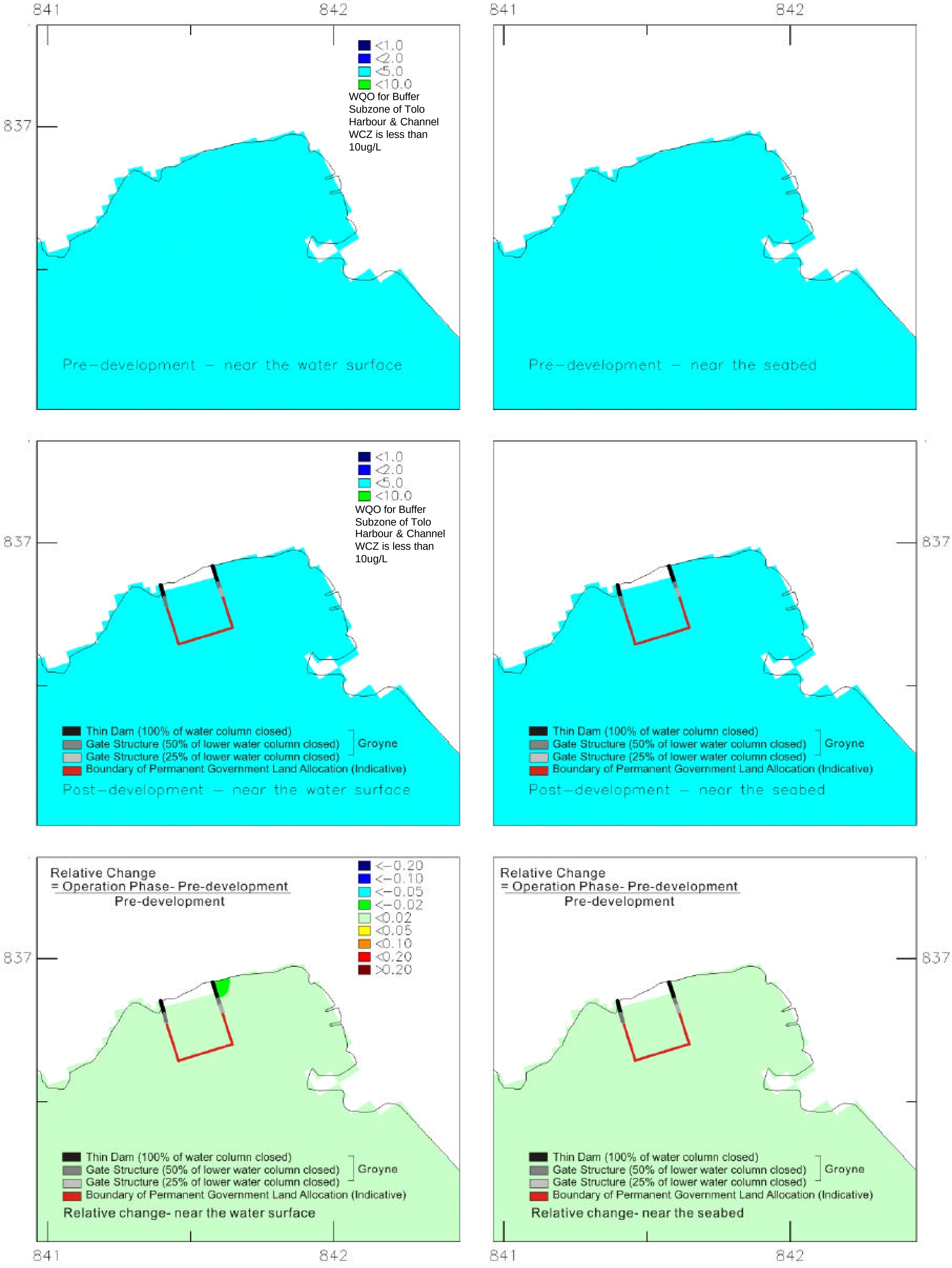
Upper and centre plots: Chlorophyll-a (ug/l), and
Lower plots: Change in Chlorophyll-a due to dredging operations
Dredging Operations

Figure 6.8: Contour Plots (Chlorophyll-a concentrations) for Construction Scenarios (Dredging) (Dry Season)



Upper and centre plots: Chlorophyll-a (ug/l), and
Lower plots: Change in Chlorophyll-a due to dredging operations
Dredging Operations

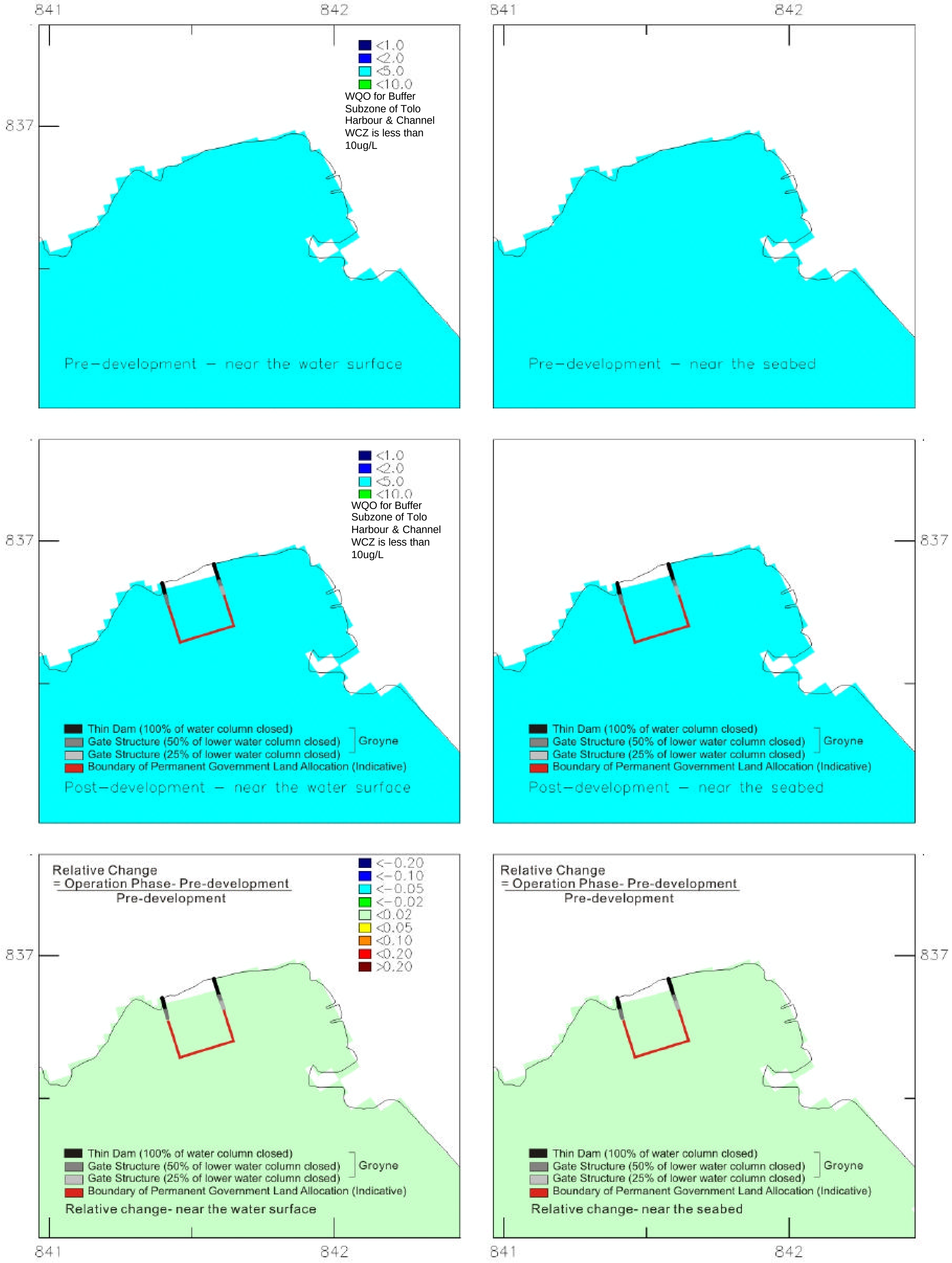
Figure 6.9: Contour Plots (Chlorophyll-a concentrations) for Construction Scenarios (Dredging) (Wet Season)



Upper and centre plots: Chlorophyll-a (ug/l), and
Lower plots: Change in Chlorophyll-a due to Lung Mei Development
Lung Mei development (Operation Phase - 60% Sewerage connection rate)

Figure 6.10 (a): Contour Plots (Chlorophyll-a concentrations) for Operation Phase - 60% Sewerage Connection Rate (Dry Season)

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.10 (a)**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



Upper and centre plots: Chlorophyll-a (ug/l), and
Lower plots: Change in Chlorophyll-a due to Lung Mei Development
Lung Mei development (Operation Phase - 40% Sewerage connection rate)

Figure 6.10 (b): Contour Plots (Chlorophyll-a concentrations) for Operation Phase - 40% Sewerage Connection Rate (Dry Season)

Agreement No.: CE 59/2005(EP)

DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

FIGURE 6.10 (b)

Client

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer

Halcrow China Ltd.

ERM Environmental Resources Management as sub-consultant

WL | delft hydraulics as sub-consultant

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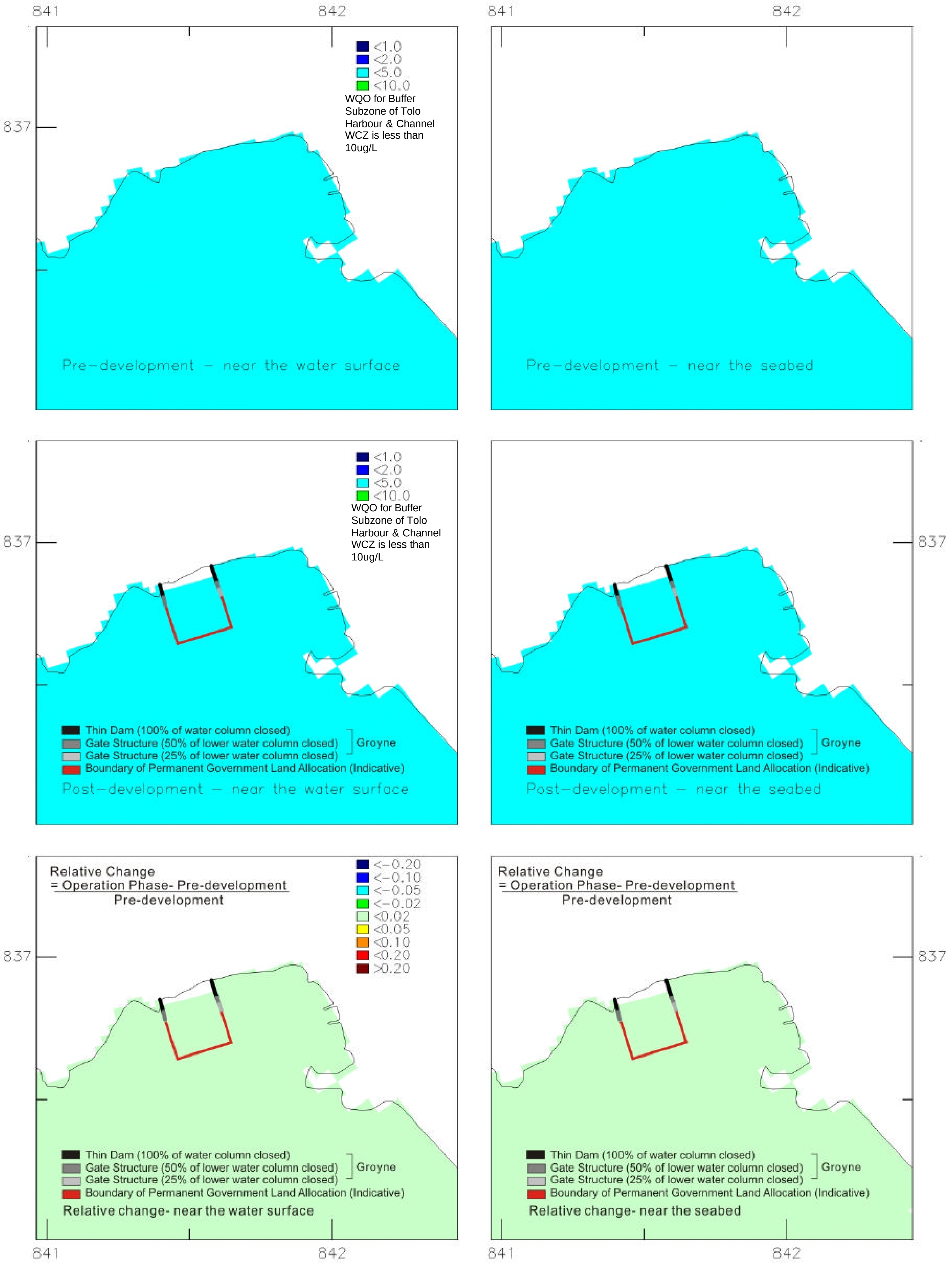
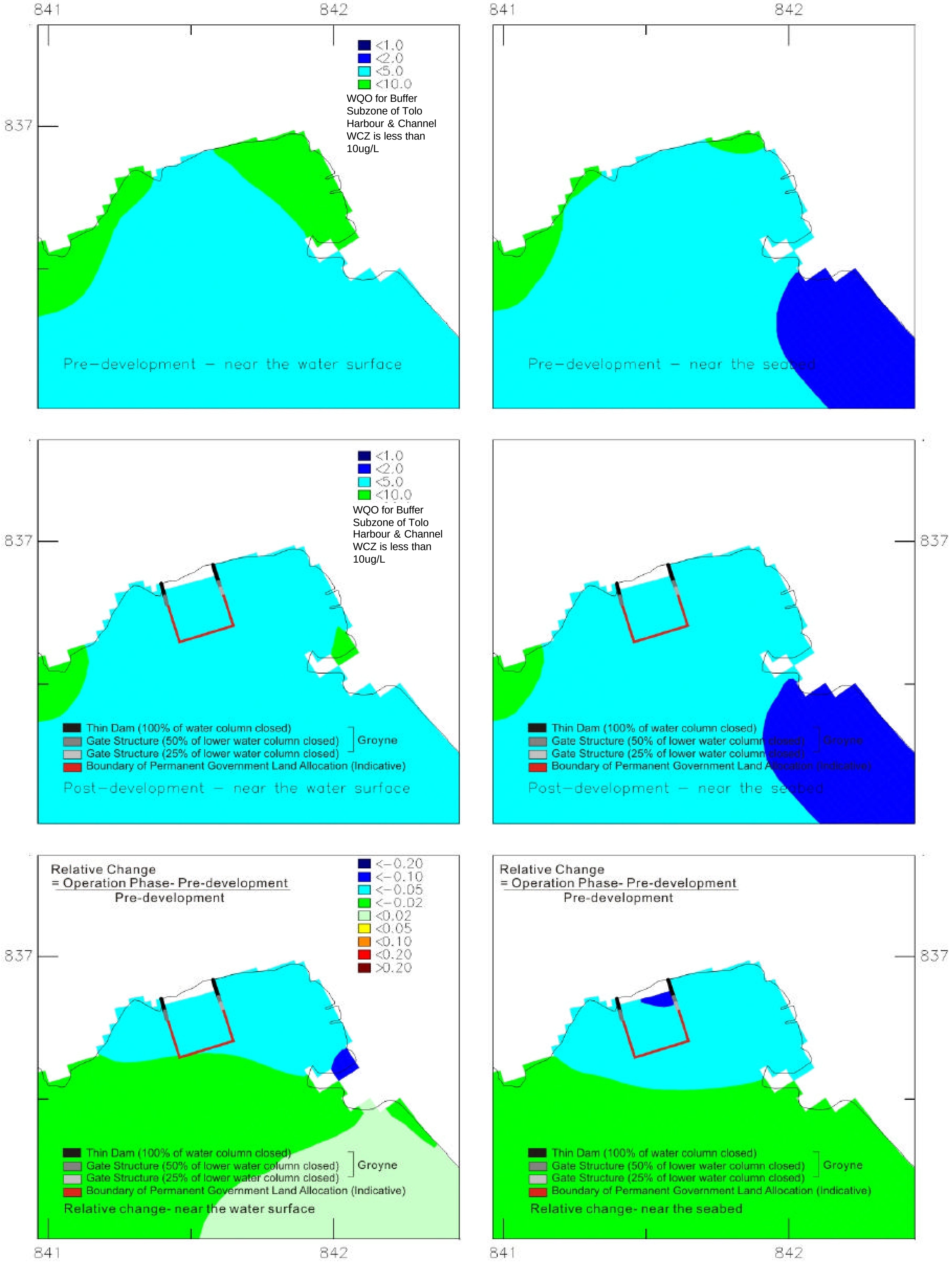


Upper and centre plots: Chlorophyll-a (ug/l), and
Lower plots: Change in Chlorophyll-a due to Lung Mei Development
Lung Mei development (Operation Phase - 20% Sewerage connection rate)

Figure 6.10 (c): Contour Plots (Chlorophyll-a concentrations) for Operation Phase - 20% Sewerage Connection Rate (Dry Season)

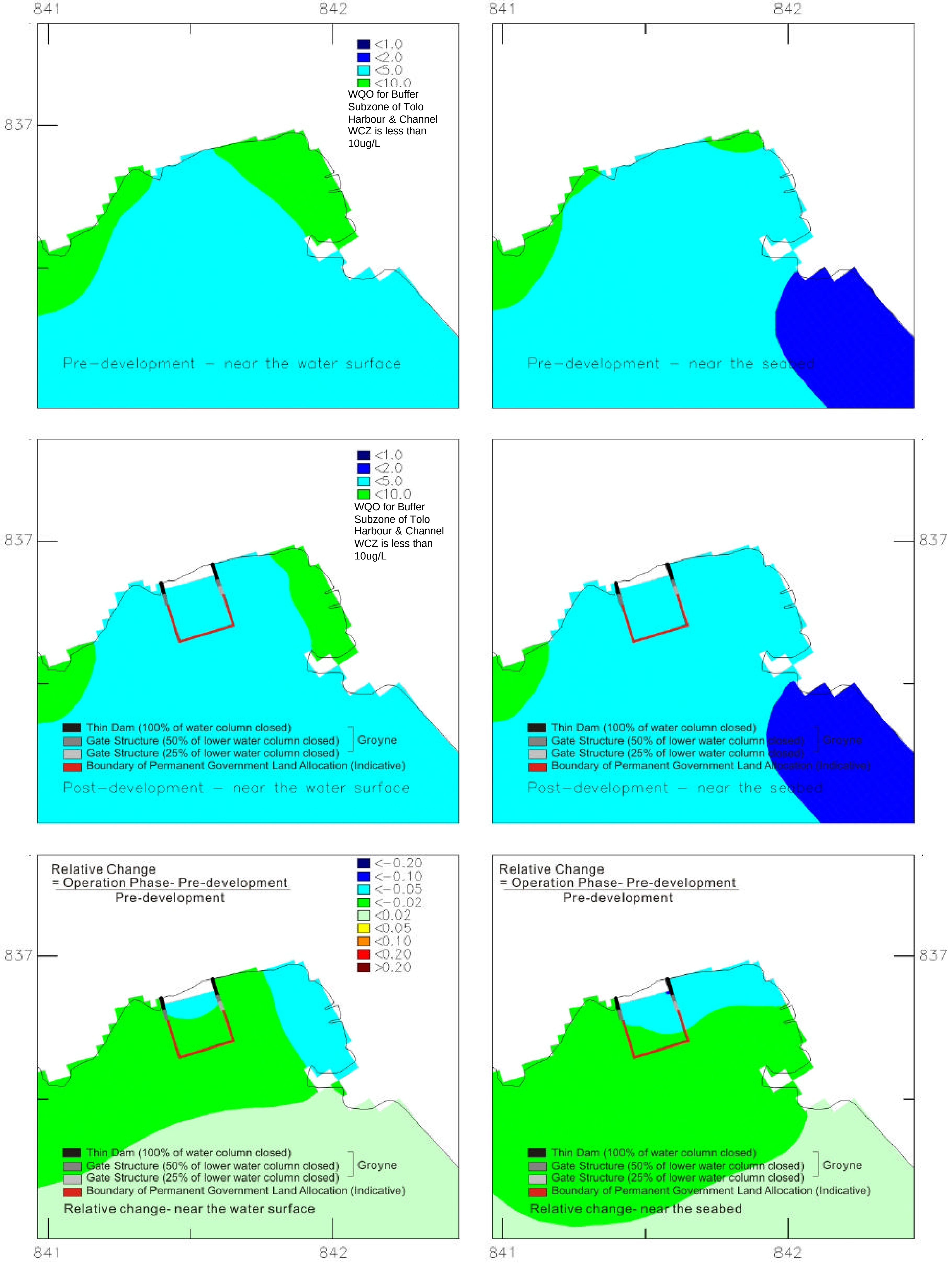
Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.10 (c)**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



Upper and centre plots: Chlorophyll-a (ug/l), and
Lower plots: Change in Chlorophyll-a due to Lung Mei Development
Lung Mei development (Operation Phase - 60% Sewerage connection rate)

Figure 6.11 (a): Contour Plots (Chlorophyll-a concentrations) for Operation Phase - 60% Sewerage Connection Rate (Wet Season)

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.11 (a)**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



Upper and centre plots: Chlorophyll-a (ug/l), and
Lower plots: Change in Chlorophyll-a due to Lung Mei Development
Lung Mei development (Operation Phase - 40% Sewerage connection rate)

Figure 6.11 (b): Contour Plots (Chlorophyll-a concentrations) for Operation Phase - 40% Sewerage Connection Rate (Wet Season)

Agreement No.: CE 59/2005(EP)

DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

FIGURE 6.11 (b)

Client
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AND DEVELOPMENT
DEPARTMENT

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Halcrow
Halcrow China Ltd.

ERM
Environmental
Resources
Management
as sub-consultant

WL | delft hydraulics
as sub-consultant

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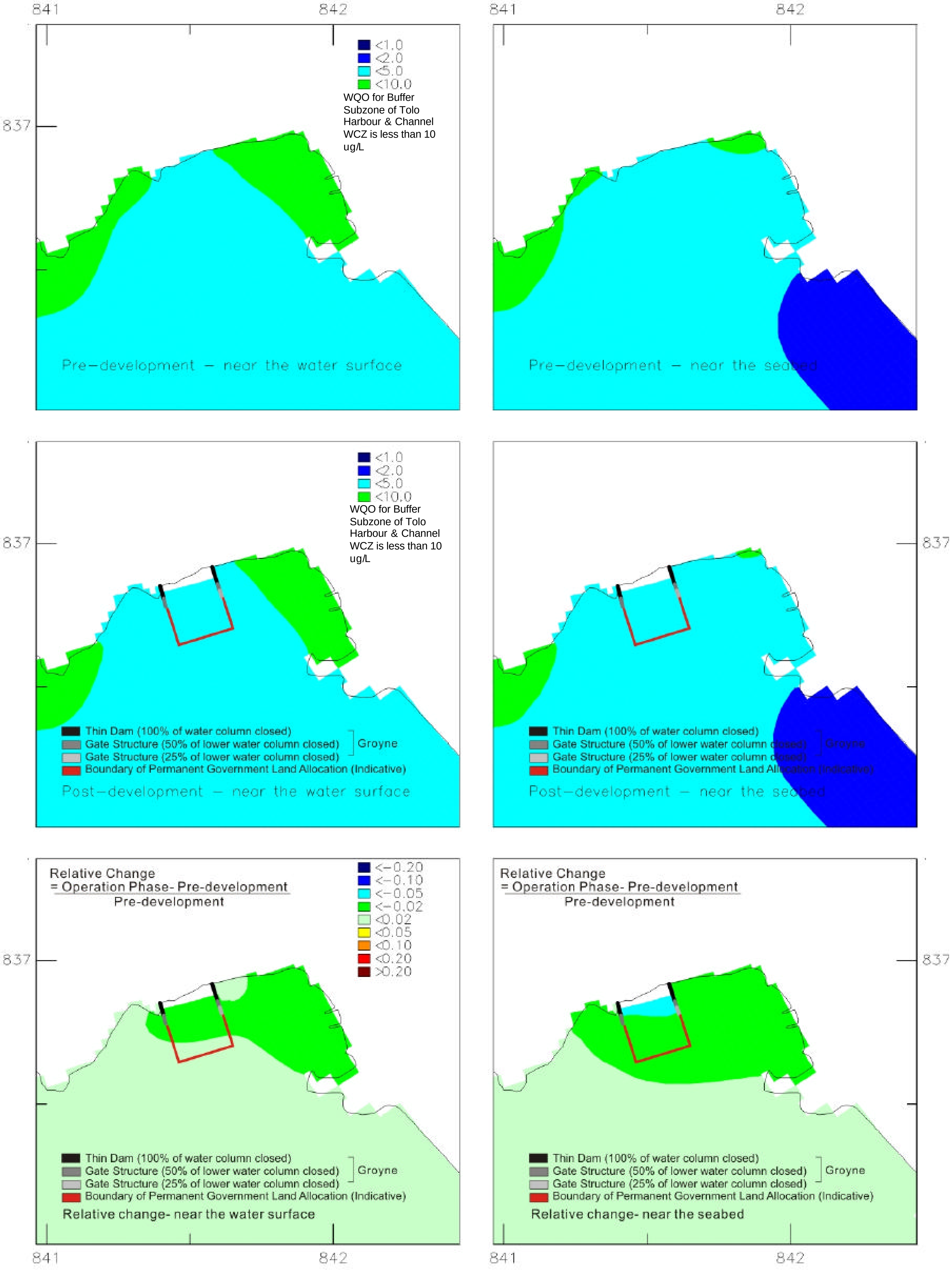


Upper and centre plots: Chlorophyll-a (ug/l), and
Lower plots: Change in Chlorophyll-a due to Lung Mei Development
Lung Mei development (Operation Phase - 20% Sewerage connection rate)

Figure 6.11 (c): Contour Plots (Chlorophyll-a concentrations) for Operation Phase - 20% Sewerage Connection Rate (Wet Season)

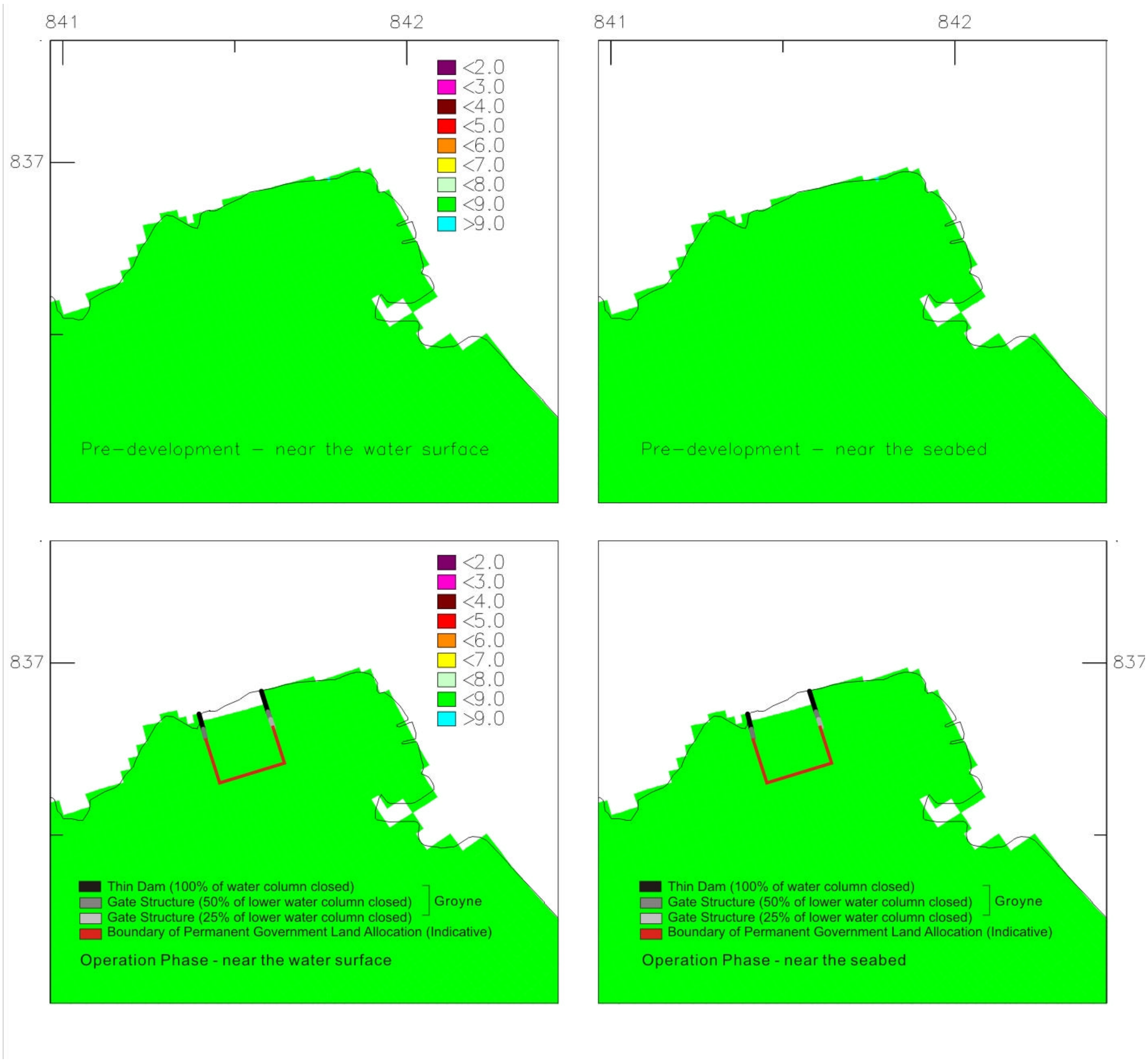


Figure 6.12 (a): Contour Plots (DO concentrations) for Operation Phase - 60% Sewerage Connection Rate (Dry Season)

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.12 (a)**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT

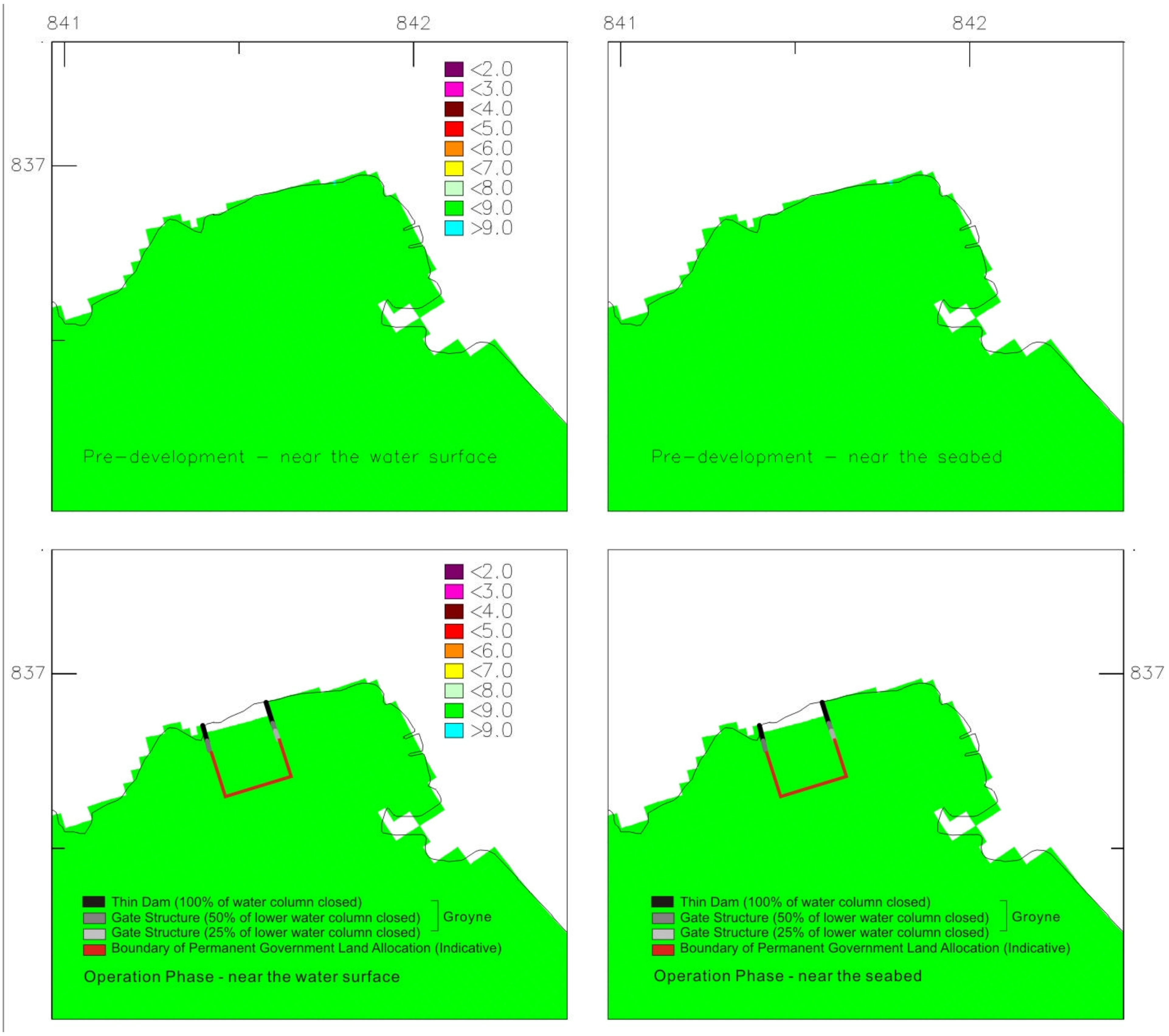


Figure 6.12 (b): Contour Plots (DO concentrations) for Operation Phase - 40% Sewerage Connection Rate (Dry Season)

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.12 (b)**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT

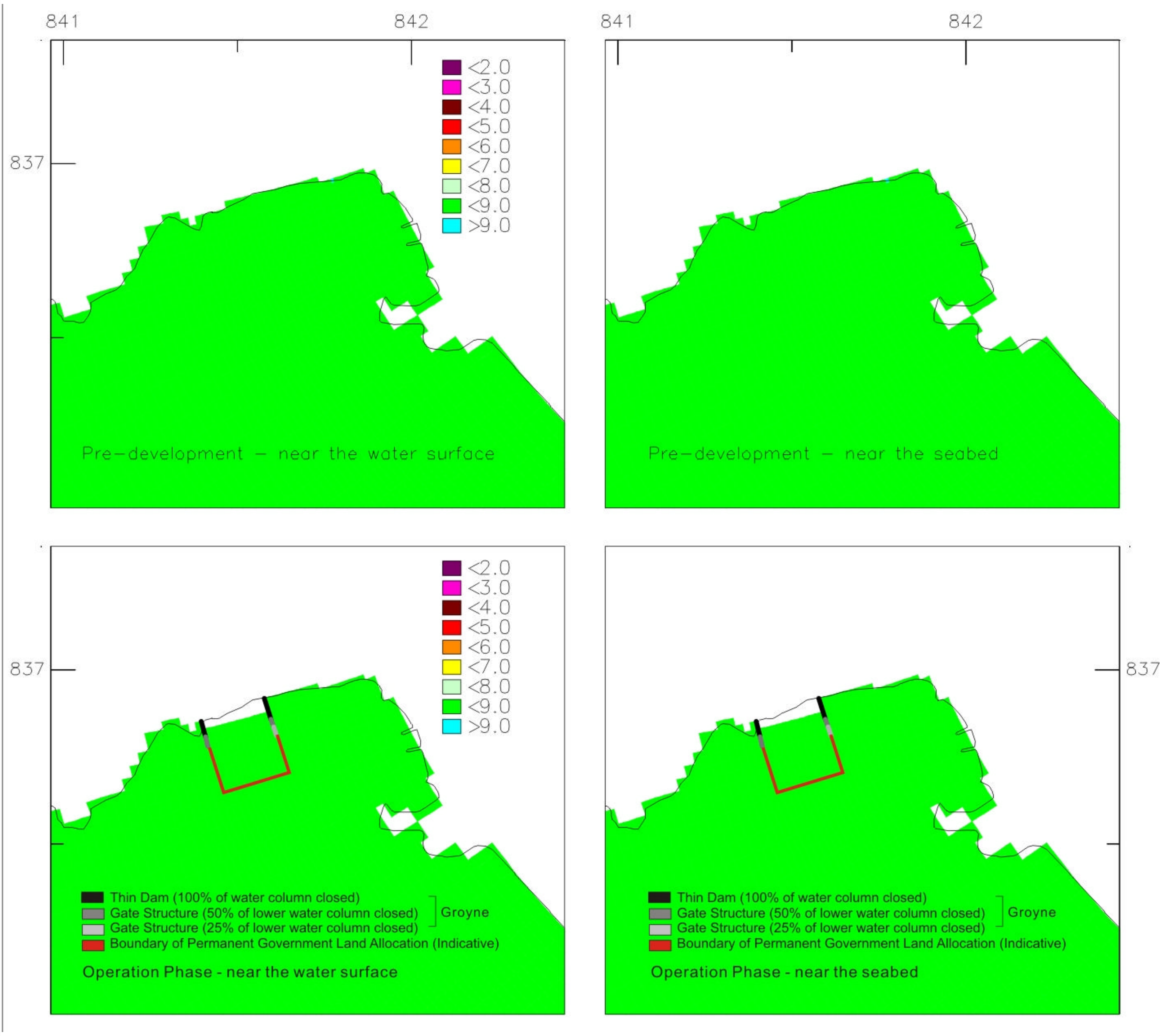
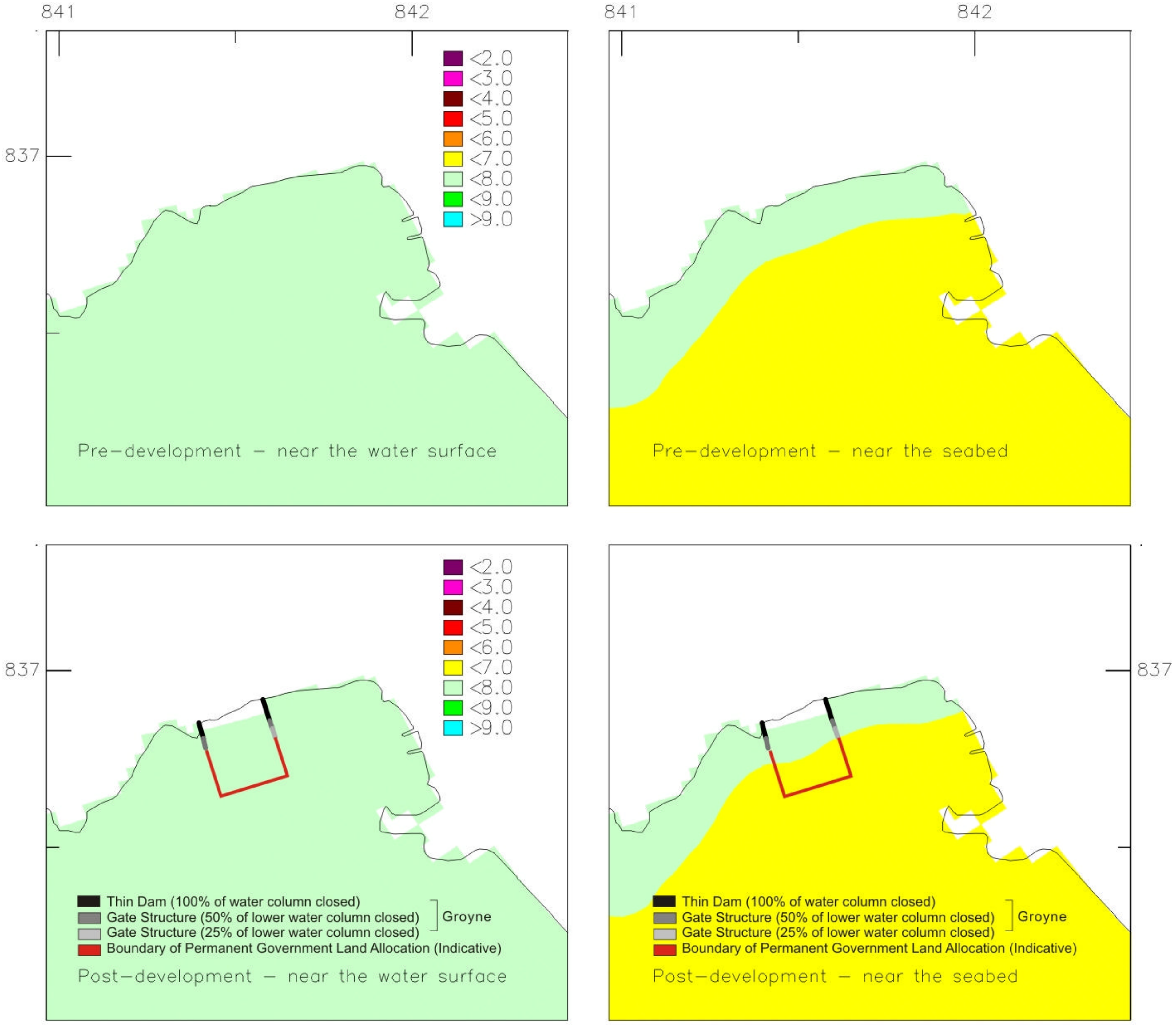


Figure 6.12 (c): Contour Plots (DO concentrations) for Operation Phase - 20% Sewerage Connection Rate (Dry Season)

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.12 (c)**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



Pre-development – near the water surface

Pre-development – near the seabed

Post-development – near the water surface

Post-development – near the seabed

Figure 6.13 (a): Contour Plots (DO concentrations) for Operation Phase - 60% Sewerage Connection Rate (Wet Season)

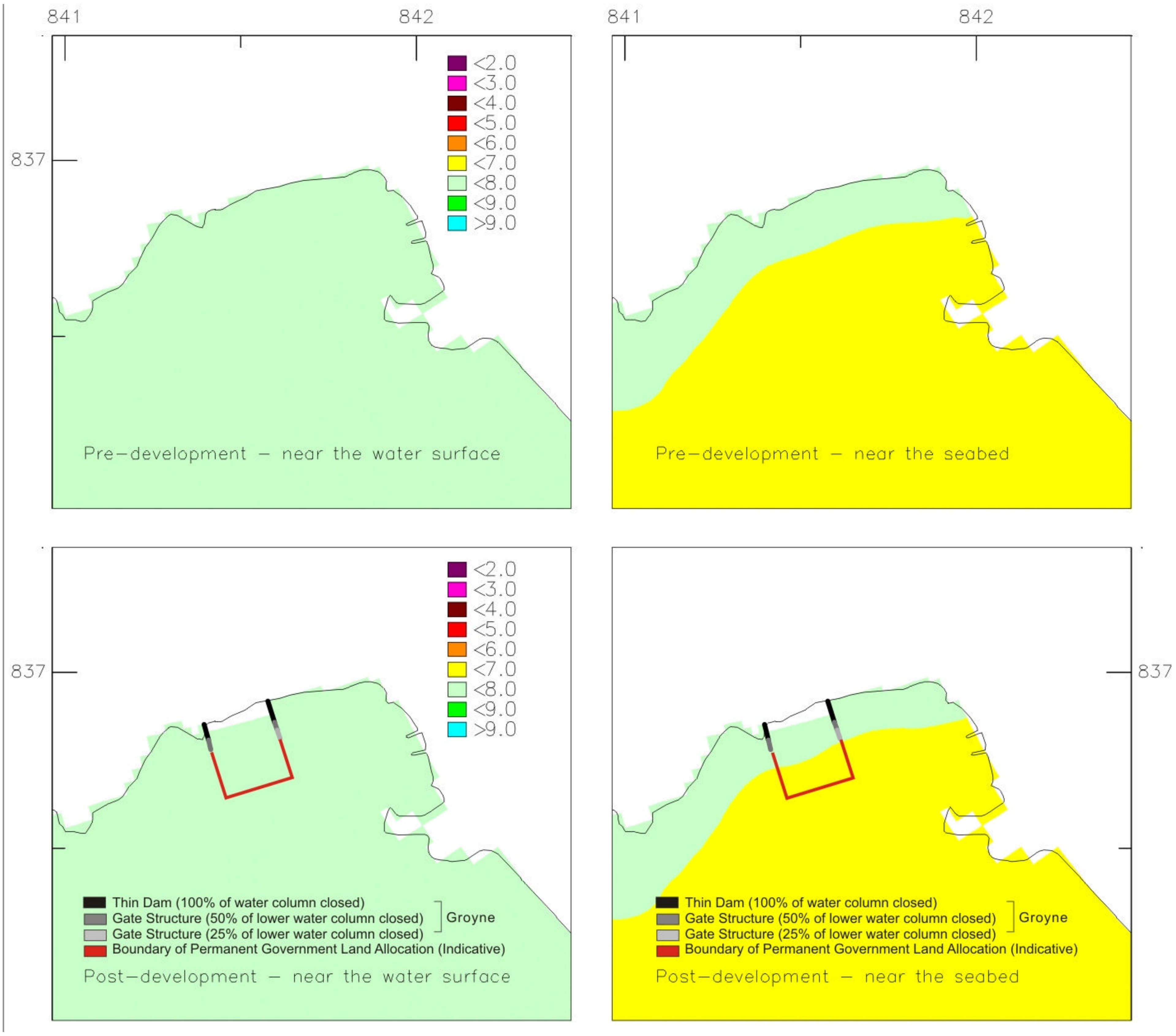


Figure 6.13 (b): Contour Plots (DO concentrations) for Operation Phase - 40% Sewerage Connection Rate (Wet Season)

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.13 (b)**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT

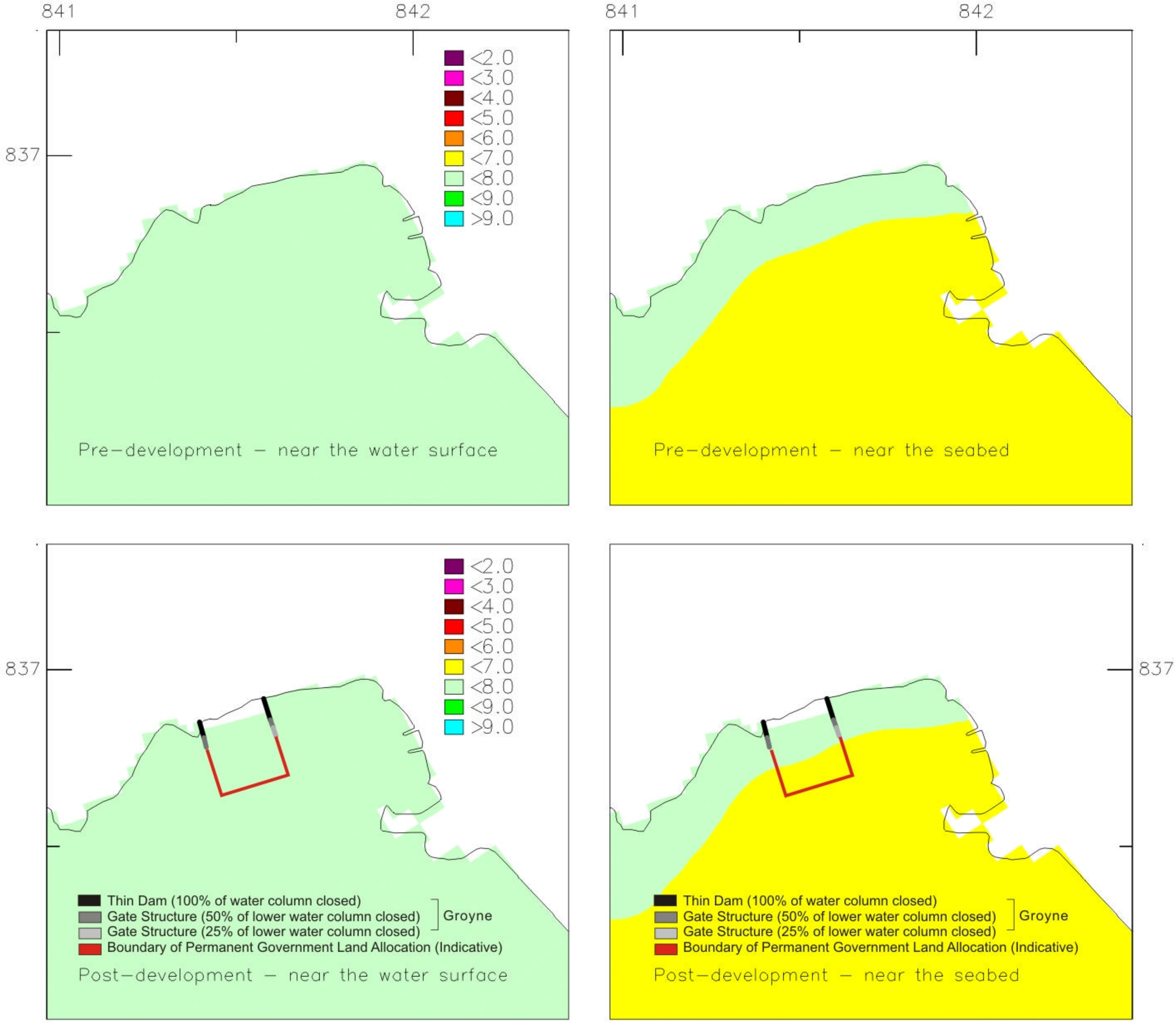
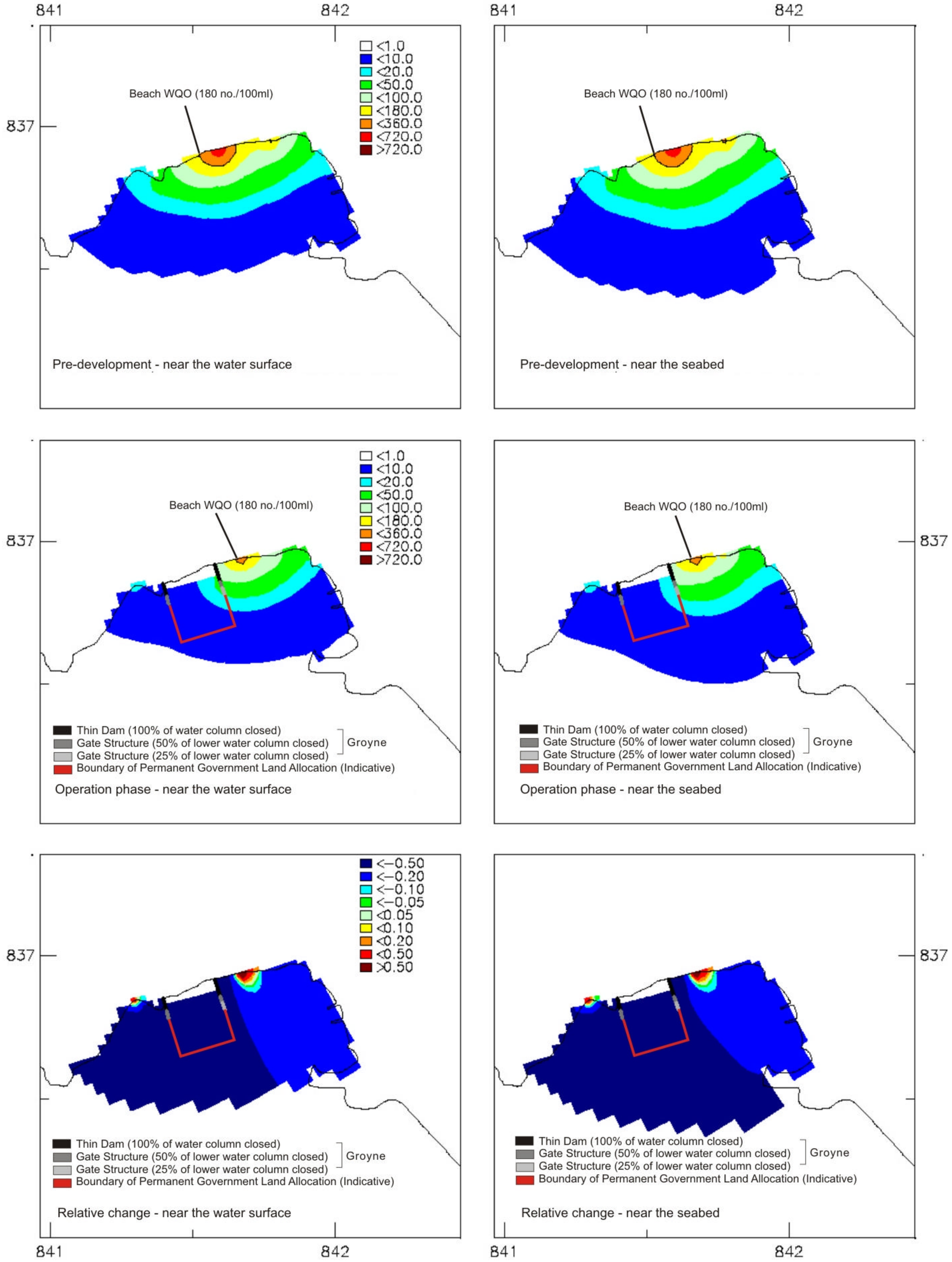


Figure 6.13 (c): Contour Plots (DO concentrations) for Operation Phase - 20% Sewerage Connection Rate (Wet Season)

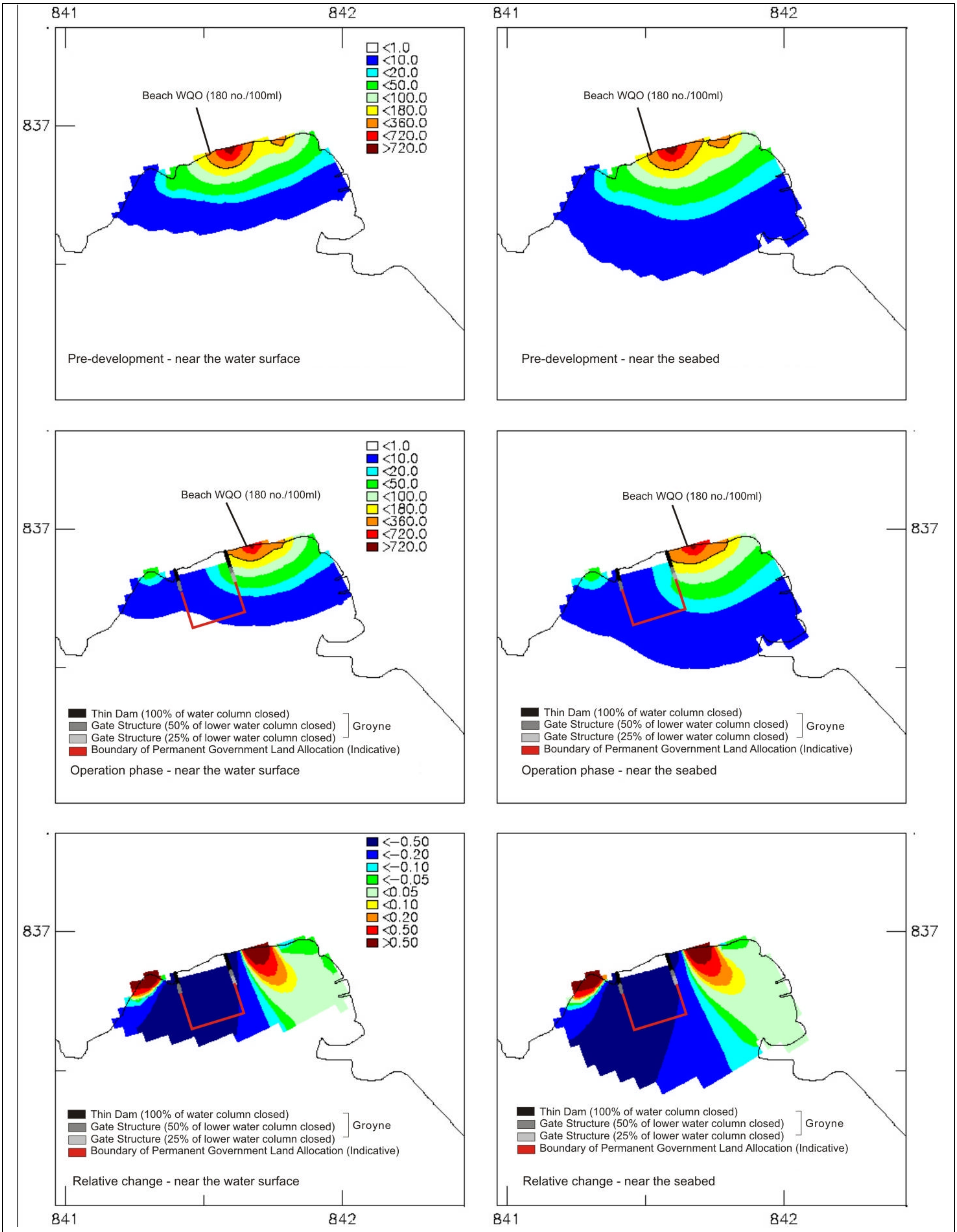
Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.13 (c)**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



Upper and centre plots : E.Coli count (no./ 100 ml), and
Lower plots ; Relative change from Pre-development to Operation Phase (-)
Dry season 60% sewerage connection rate

Figure 6.14: Contour Plots (*E.coli* concentrations) for Operation Phase - 60% Sewerage Connection Rate (Dry Season)

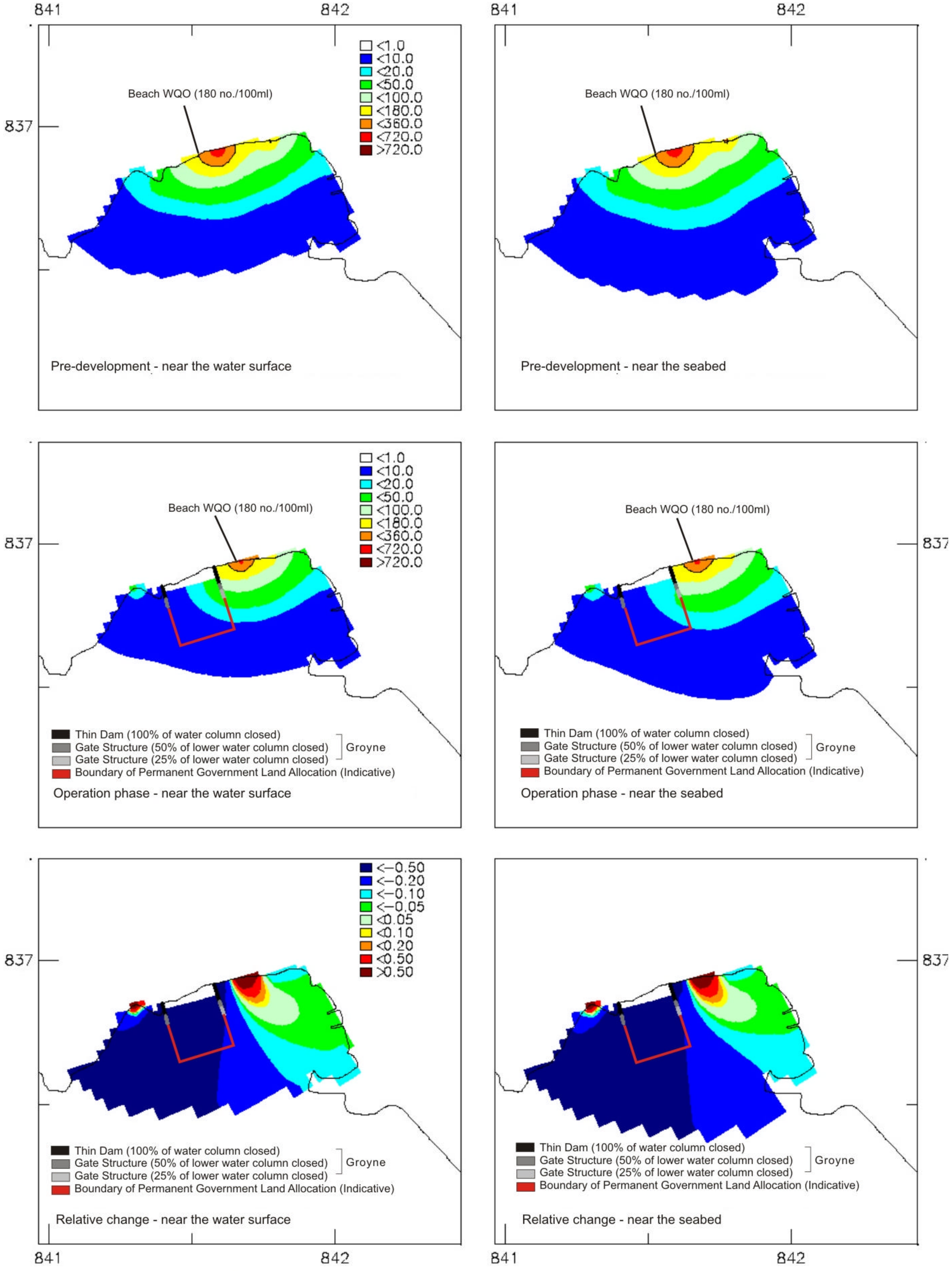
Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.14**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



Upper and centre plots : E.Coli count (no./ 100 ml), and
Lower plots ; Relative change from Pre-to post-development (-)
Wet season 60% sewerage connection rate

Figure 6.15: Contour Plots (*E.coli* concentrations) for Operation Phase - 60% Sewerage Connection Rate (Wet Season)

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.15**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



Upper and centre plots : E.Coli count (no./ 100 ml), and
Lower plots ; Relative change from Pre-development to Operation Phase (-)
Dry season 40% sewerage connection rate

Figure 6.16: Contour Plots (*E.coli* concentrations) for Operation Phase - 40% Sewerage Connection Rate (Dry Season)

Agreement No.: CE 59/2005(EP)

DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

FIGURE 6.16

Client

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer

Halcrow
Halcrow China Ltd.

ERM Environmental Resources Management as sub-consultant

WL | delft hydraulics as sub-consultant

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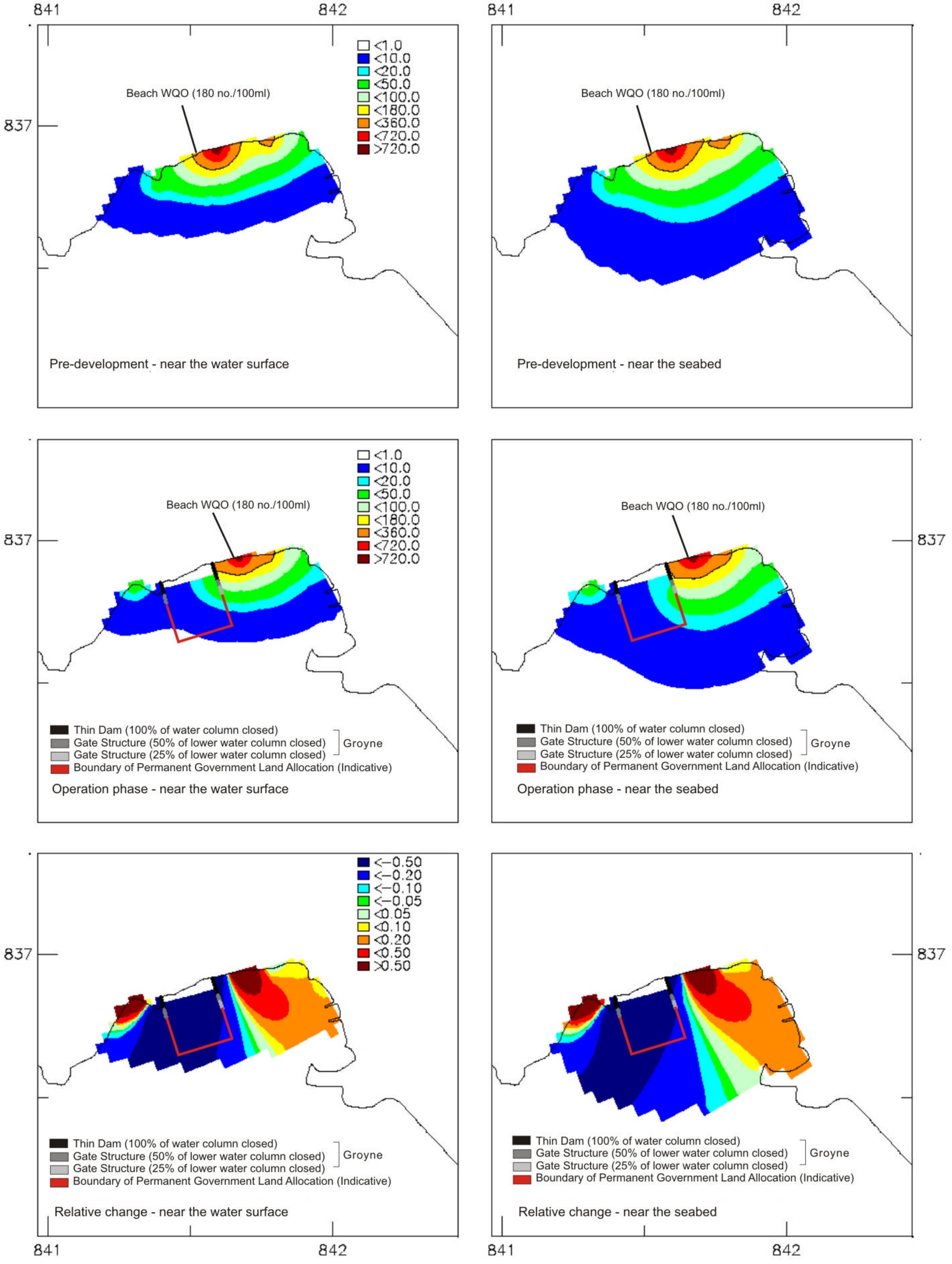
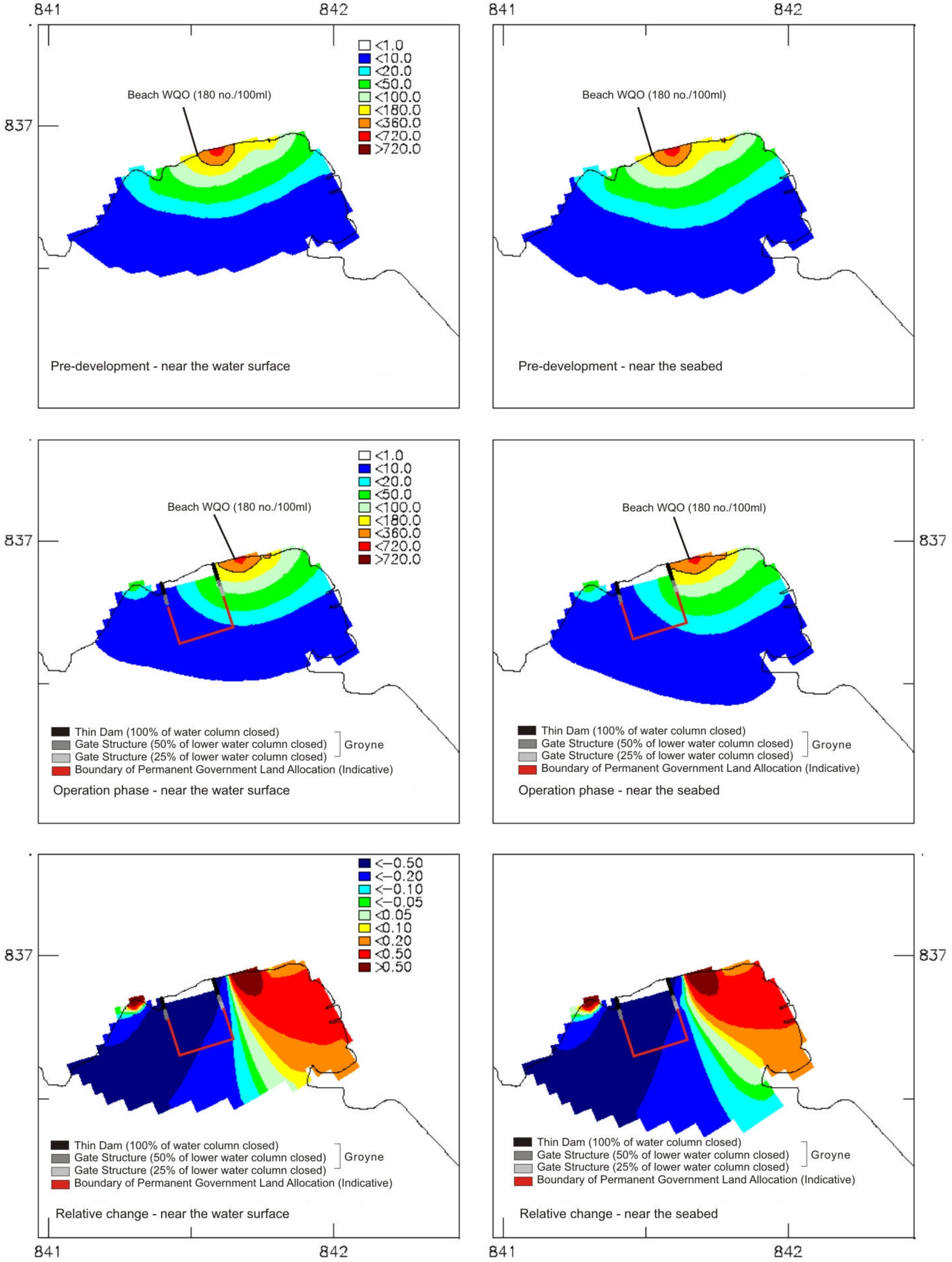


Upper and centre plots : E.Coli count (no./ 100 ml), and
Lower plots ; Relative change from Pre-to post-development (-)
Wet season 40% sewerage connection rate

Figure 6.17: Contour Plots (*E.coli* concentrations) for Operation Phase - 40% Sewerage Connection Rate (Wet Season)

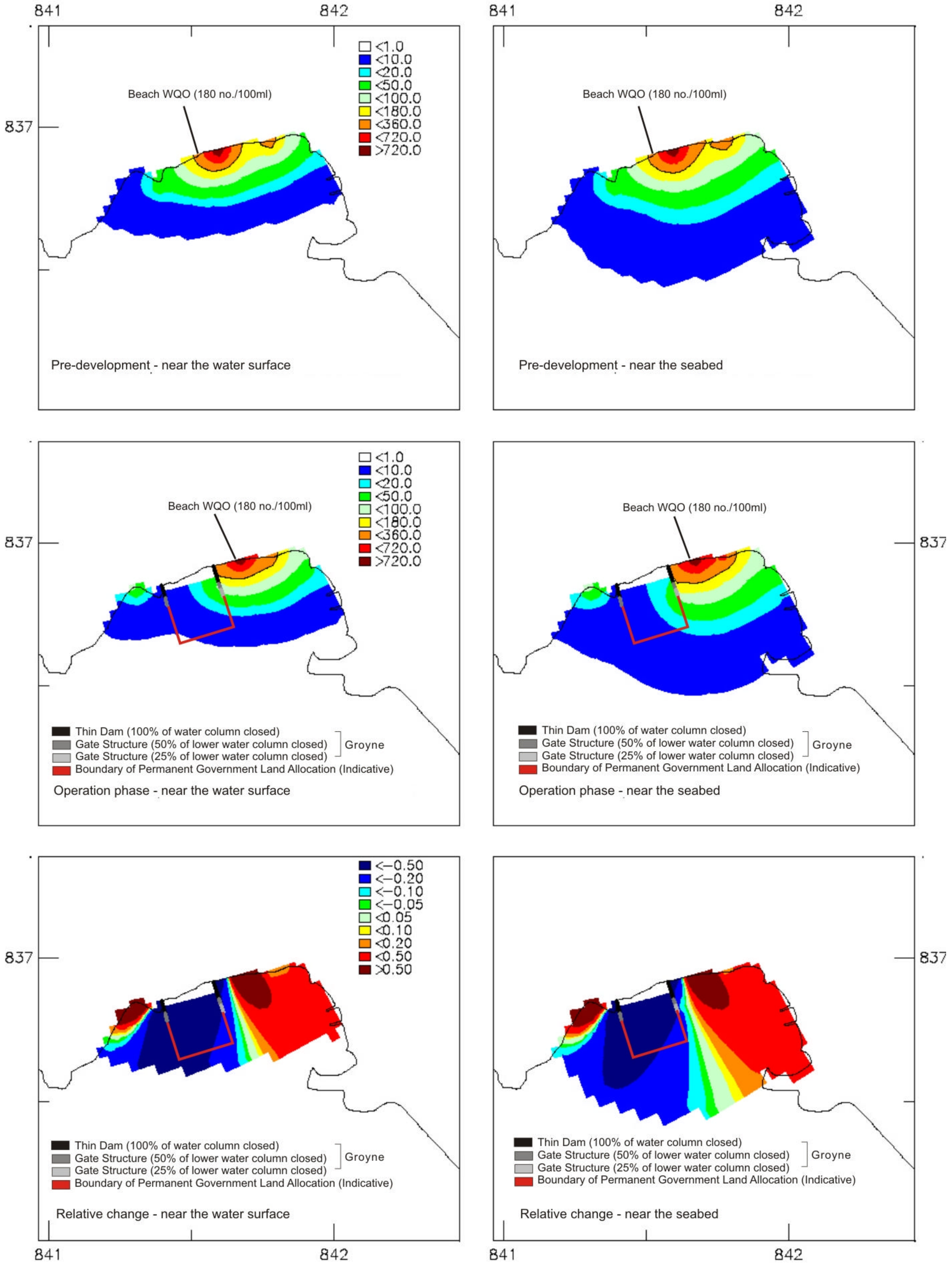
Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.17**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



Upper and centre plots : E.Coli count (no./ 100 ml), and
Lower plots ; Relative change from Pre-development to Operation Phase (-)
Dry season 20% sewerage connection rate

Figure 6.18: Contour Plots (*E.coli* concentrations) for Operation Phase - 20% Sewerage Connection Rate (Dry Season)

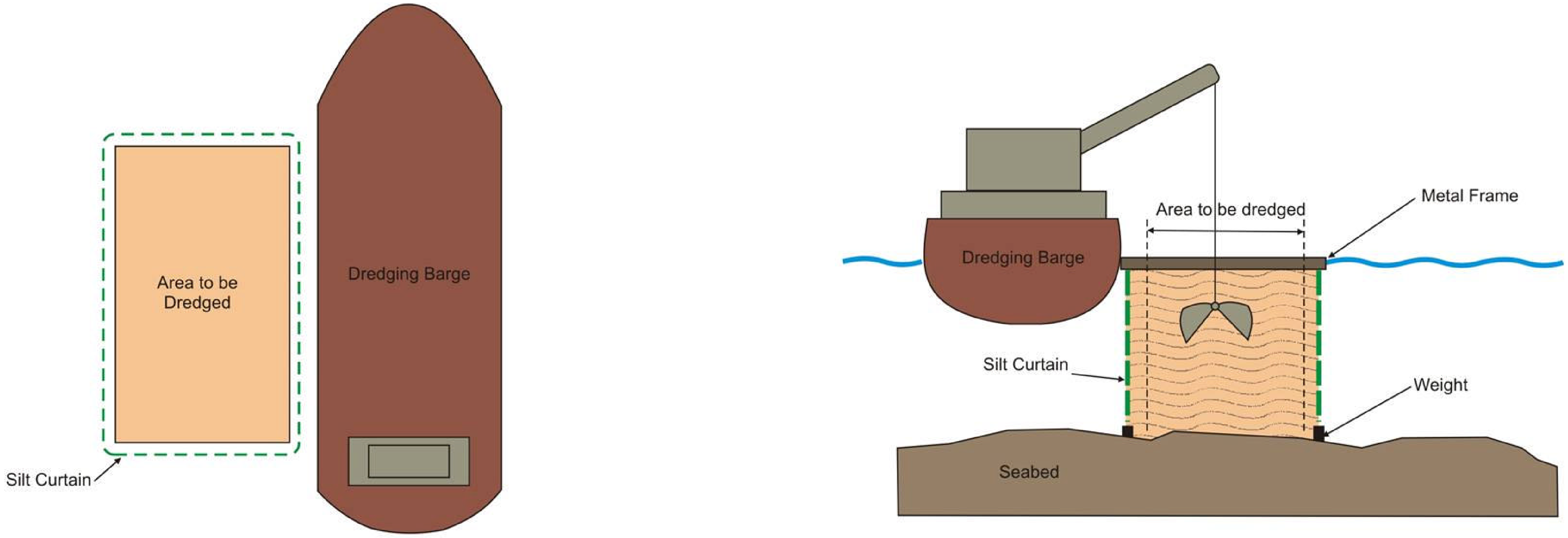
Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.18**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



Upper and centre plots : E.Coli count (no./ 100 ml), and
Lower plots ; Relative change from Pre-to post-development (-)
Wet season 20% sewerage connection rate

Figure 6.19: Contour Plots (*E.coli* concentrations) for Operation Phase - 20% Sewerage Connection Rate (Wet Season)

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 6.19**
Client CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow China Ltd. Environmental Resources Management as sub-consultant WL delft hydraulics as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



(a) Cage Type Silt Curtain Arrangement for Grab Dredging

(b) Cross-secton of Cage Type Silt Curtain Arrangment

Client

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DEPARTMENT

Consulting Engineer

Halcrow
Halcrow China Ltd.

ERM
Environmental
Resources
Management
as sub-consultant

Agreement No.: CE 59/2005(EP)

Project Title:

DEVELOPMENT OF A BATHING
BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:

INDICATIVE ARRANGEMENT OF CAGE TYPE /
METAL FRAME TYPE SILT CURTAIN

FIGURE 6.20

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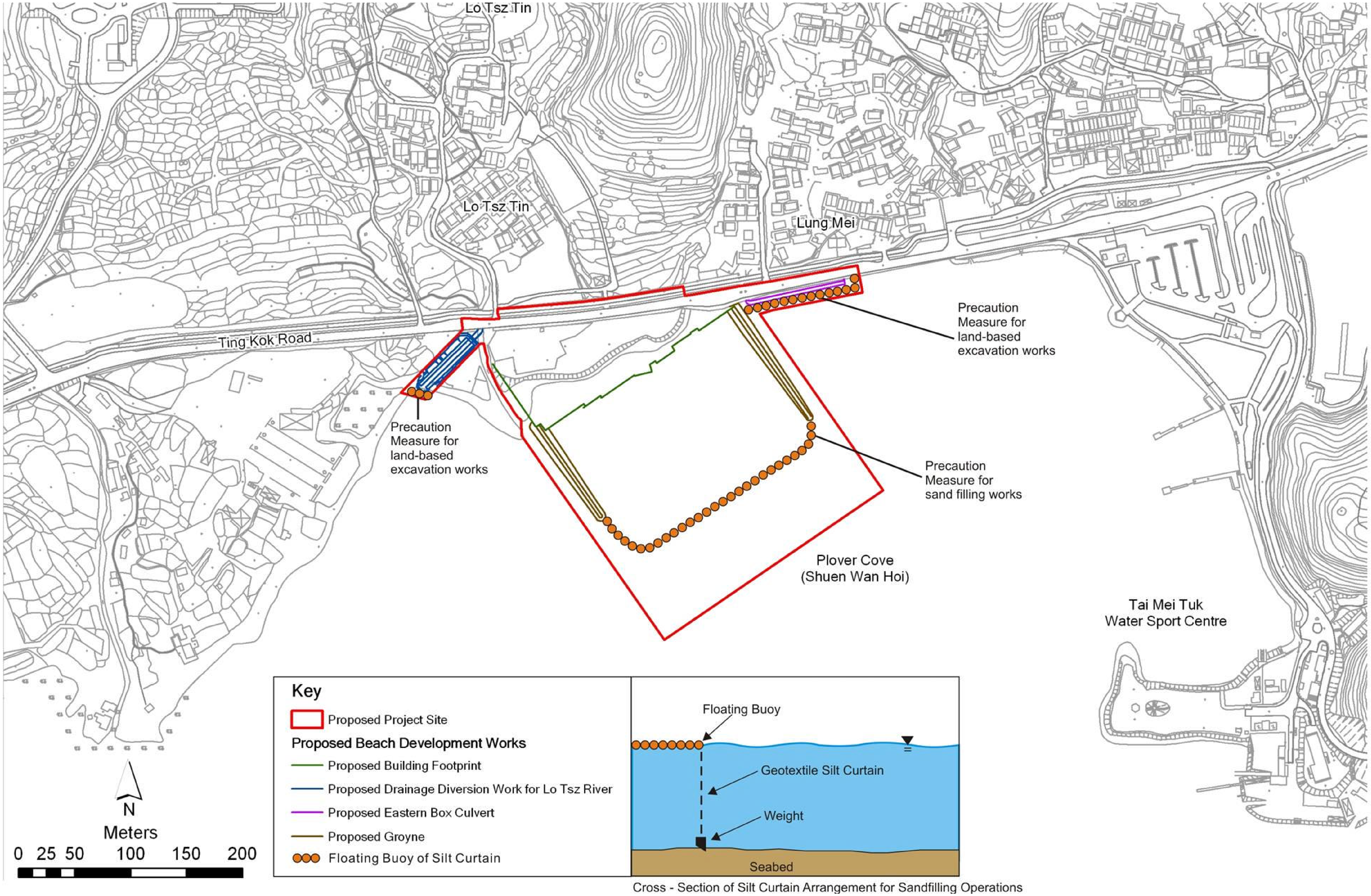
Designed -	Drawn KK	Date 28/08/2007



Client

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer

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Halcrow China Ltd.

ERM Environmental Resources Management as sub-consultant

Agreement No.: CE 59/2005(EP)

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FIGURE 6.21

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title:
INDICATIVE ARRANGEMENT OF STANDING TYPE SILT CURTAIN

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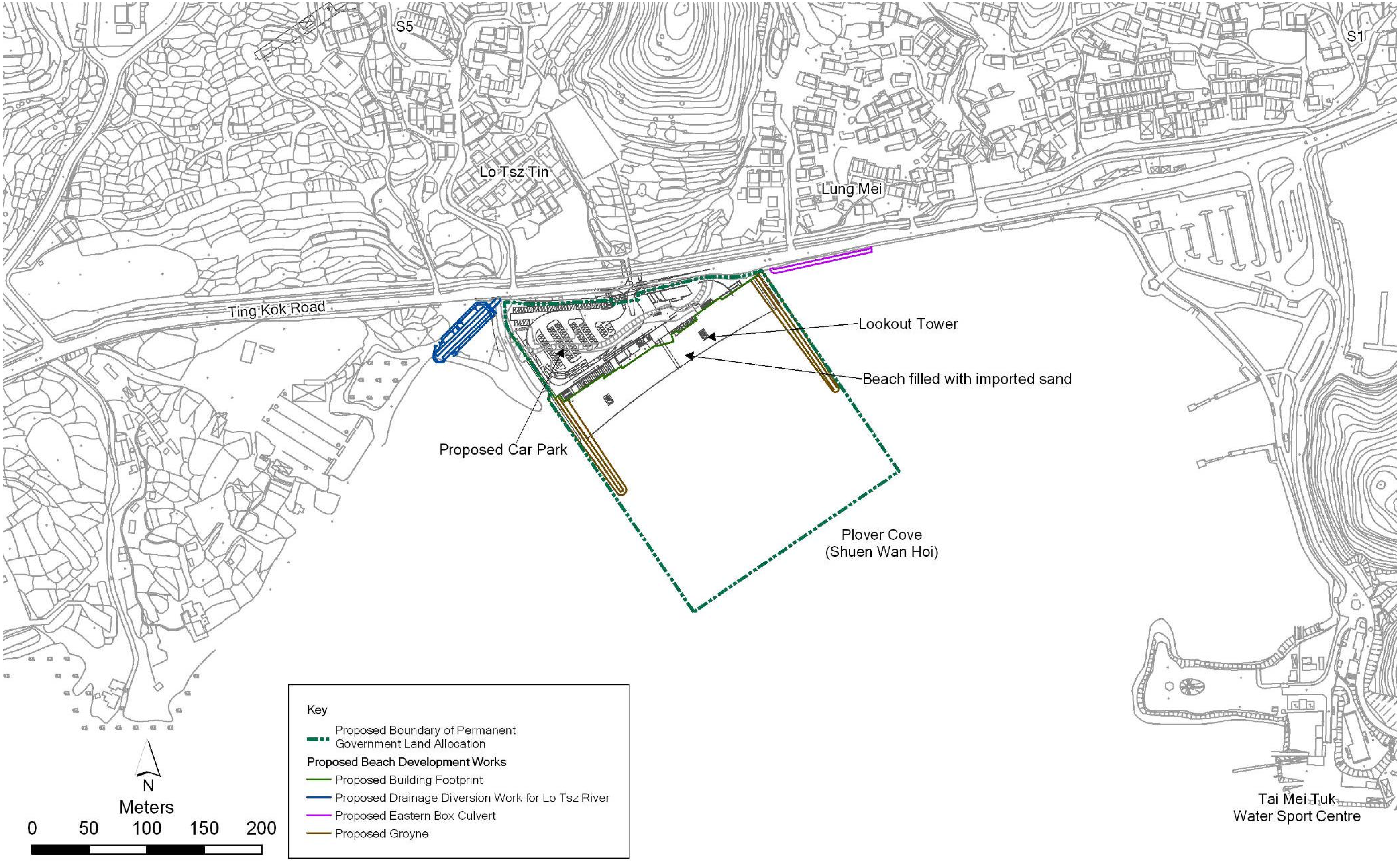
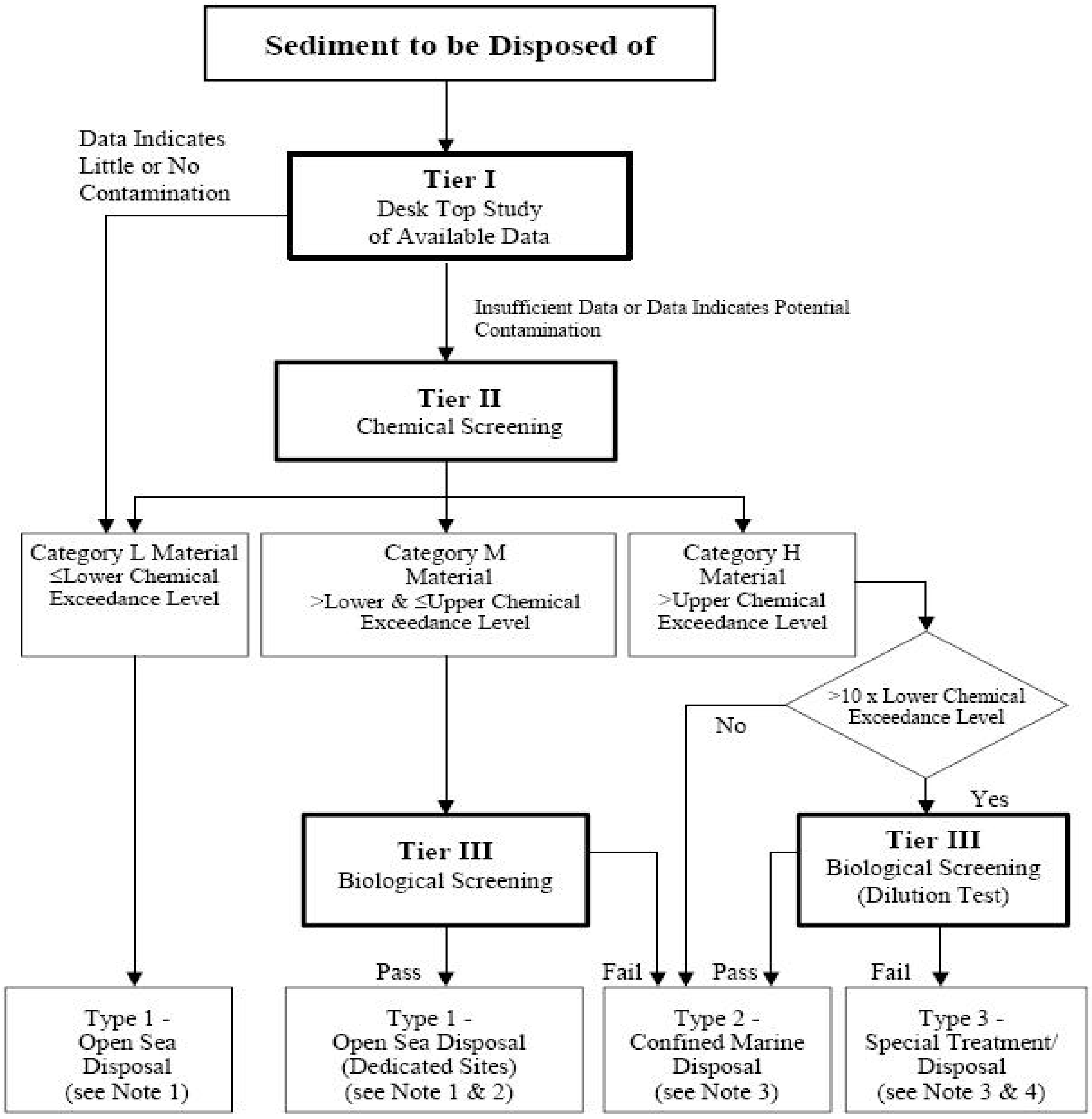
Designed -	Drawn KK	Date 06/07/2007



Client	Consulting Engineer	Agreement No.: CE 59/2005(EP)	ENVIRONMENTAL IMPACT ASSESSMENT REPORT	**FIGURE 6.22**		
CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: PROPOSED BOUNDARY OF PERMANENT GOVERNMENT LAND ALLOCATION	Checked TF	Scale AS SHOWN	Rev. 1
				Designed -	Drawn SW	Date 28/08/2007

Figure 7.1 Management Framework for Dredged/Excavated Sediment



Notes:

(1) Most open sea disposal sites are multi-user facilities and as a consequence their management involves a flexibility to accommodate varying and unpredictable circumstances. Contract documents will include provisions to allow the same degree of flexibility to divert from one disposal site to another during the construction period of a contract.

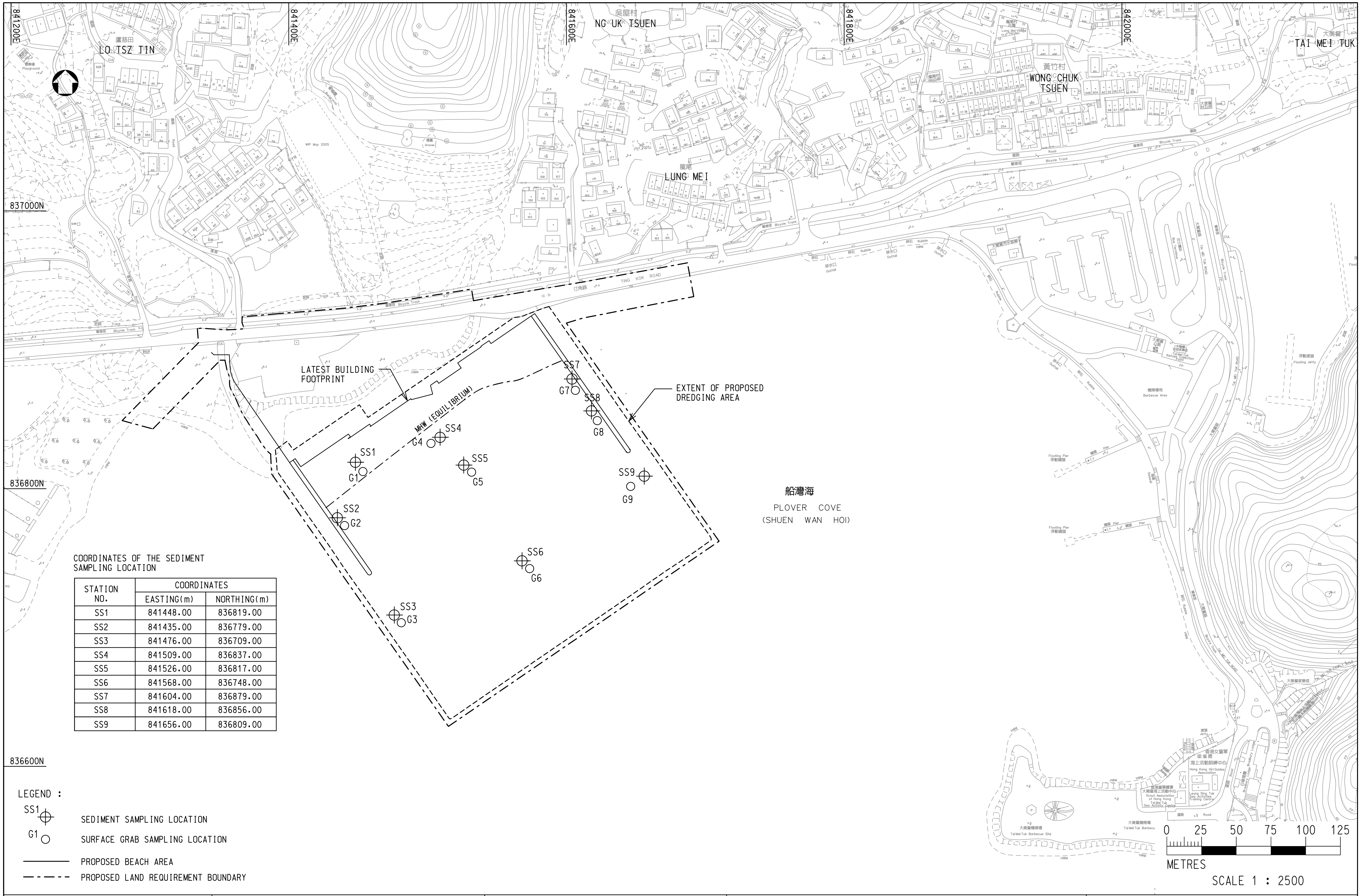
(2) Dedicated Sites will be monitored to confirm that there is no adverse impact.

(3) For sediment requiring Type 2 or Type 3 disposal, contract documents will state the allocation conditions of Marine Fill Committee (MFC) and DEP. At present, East Sha Chau Mud Pits are designated for confined marine disposal.

(4) If any sediment suitable for Type 3 disposal (Category H sediment failing the biological dilution test) is identified, it is the responsibility of the project proponent, in consultation with DEP, to identify and agree, the most appropriate treatment and/or disposal arrangement. Such a proposal is likely to be very site and project specific and therefore cannot be prescribed. This does not preclude treatment of this sediment to render it suitable for confined marine disposal.

(5) The allocation of disposal space may carry a requirement for the project proponent to arrange for chemical analysis of the sediment sampled from 5% of the vessels en-route to the disposal site. For Category M and certain Category H sediment, the chemical tests will be augmented by biological tests. Vessel sampling will normally entail mixing five samples to form a composite sample from the vessel and undertaking laboratory tests on this composite sample. All marine disposal sites will be monitored under the general direction of the CEDD. However, exceptionally large allocations might require some additional disposal site monitoring. These will be stipulated at the time of allocation.

(6) Trailer suction hopper dredgers disposing of sediment at the East Sha Chau Mud Pits must use a down-a-pipe disposal method, the design of which must be approved in advance by Director of the CEDD. The dredging contractor must provide equipment for such disposal.



COORDINATES OF THE SEDIMENT SAMPLING LOCATION

STATION NO.	COORDINATES	
	EASTING(m)	NORTHING(m)
SS1	841448.00	836819.00
SS2	841435.00	836779.00
SS3	841476.00	836709.00
SS4	841509.00	836837.00
SS5	841526.00	836817.00
SS6	841568.00	836748.00
SS7	841604.00	836879.00
SS8	841618.00	836856.00
SS9	841656.00	836809.00

LEGEND :

SS1 ⊕	SEDIMENT SAMPLING LOCATION
G1 ○	SURFACE GRAB SAMPLING LOCATION
———	PROPOSED BEACH AREA
—·—·—	PROPOSED LAND REQUIREMENT BOUNDARY

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer
Halcrow
Halcrow China Ltd.

ERM Enviromental Resources Management as sub-consultant

Agreement No. : CE 59/2005 (EP)

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title:
SEDIMENT SAMPLING LOCATION

FIGURE 7.2

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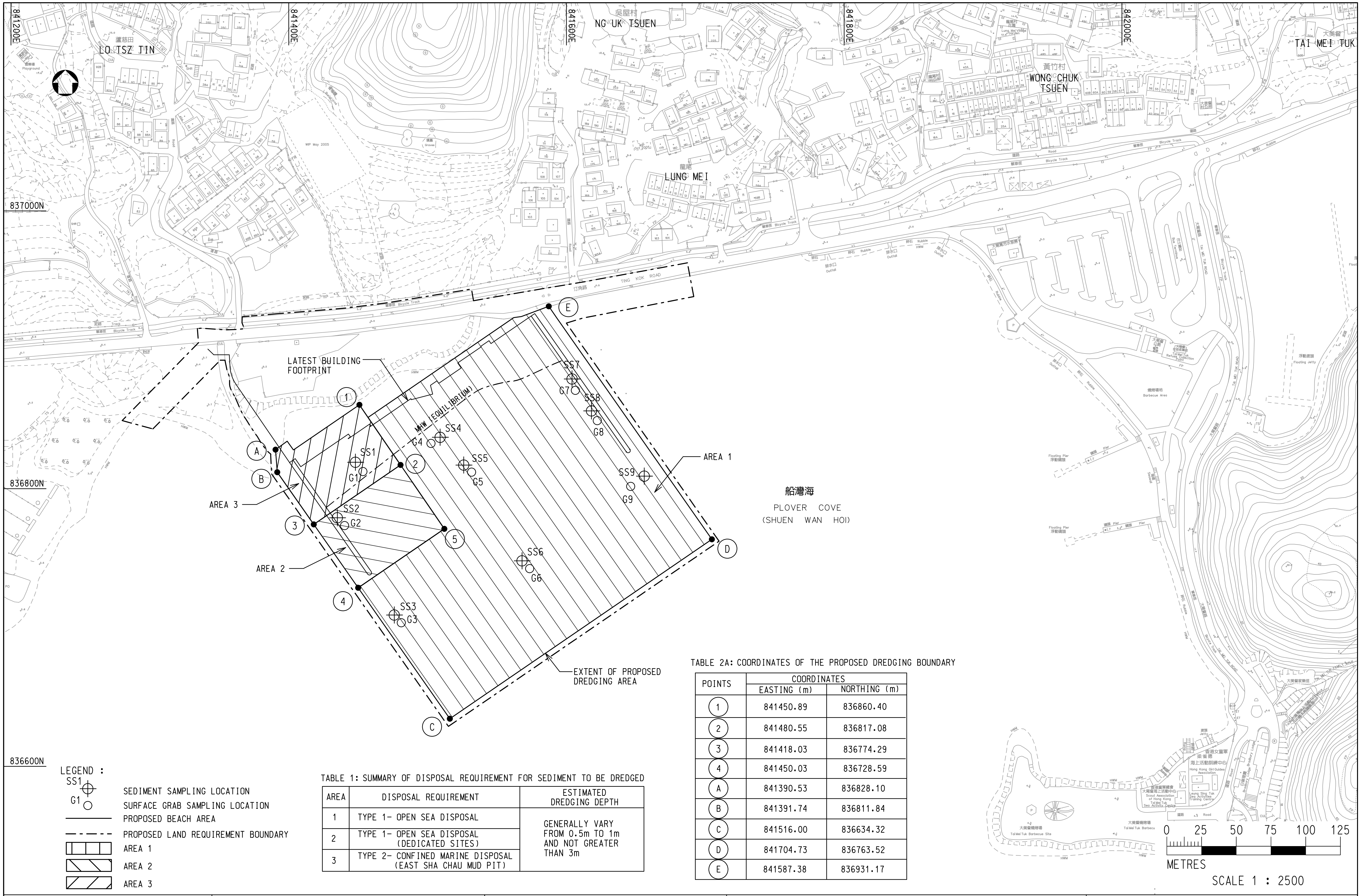
PS	1:2500 @ A3	2
Designed	**Drawn**	**Date**
YC	PF	14/03/2007

philipF 13/11/2007
e:*proj*CALBDS*Figure*E_IA_Rpt*FIG7_2_2_EIA_RPT.dgn



LEGEND :

SS1 ⊕	SEDIMENT SAMPLING LOCATION
G1 ○	SURFACE GRAB SAMPLING LOCATION
———	PROPOSED BEACH AREA
—·—·—	PROPOSED LAND REQUIREMENT BOUNDARY
▥	AREA 1
▧	AREA 2
▨	AREA 3

TABLE 1: SUMMARY OF DISPOSAL REQUIREMENT FOR SEDIMENT TO BE DREDGED

AREA	DISPOSAL REQUIREMENT	ESTIMATED DREDGING DEPTH
1	TYPE 1- OPEN SEA DISPOSAL	GENERALLY VARY FROM 0.5m TO 1m AND NOT GREATER THAN 3m
2	TYPE 1- OPEN SEA DISPOSAL (DEDICATED SITES)	
3	TYPE 2- CONFINED MARINE DISPOSAL (EAST SHA CHAU MUD PIT)	

TABLE 2A: COORDINATES OF THE PROPOSED DREDGING BOUNDARY

POINTS	COORDINATES	
	EASTING (m)	NORTHING (m)
①	841450.89	836860.40
②	841480.55	836817.08
③	841418.03	836774.29
④	841450.03	836728.59
Ⓐ	841390.53	836828.10
Ⓑ	841391.74	836811.84
Ⓒ	841516.00	836634.32
Ⓓ	841704.73	836763.52
Ⓔ	841587.38	836931.17

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer
Halcrow
Halcrow China Ltd.

ERM Enviromental Resources Management as sub-consultant

Agreement No. : CE 59/2005 (EP)

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title:
SEDIMENT DISPOSAL REQUIREMENT PLANS (DEPTH FROM 0m TO 0.9m)

FIGURE 7.3

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Designed YC
Drawn PF
Date 26/01/2007

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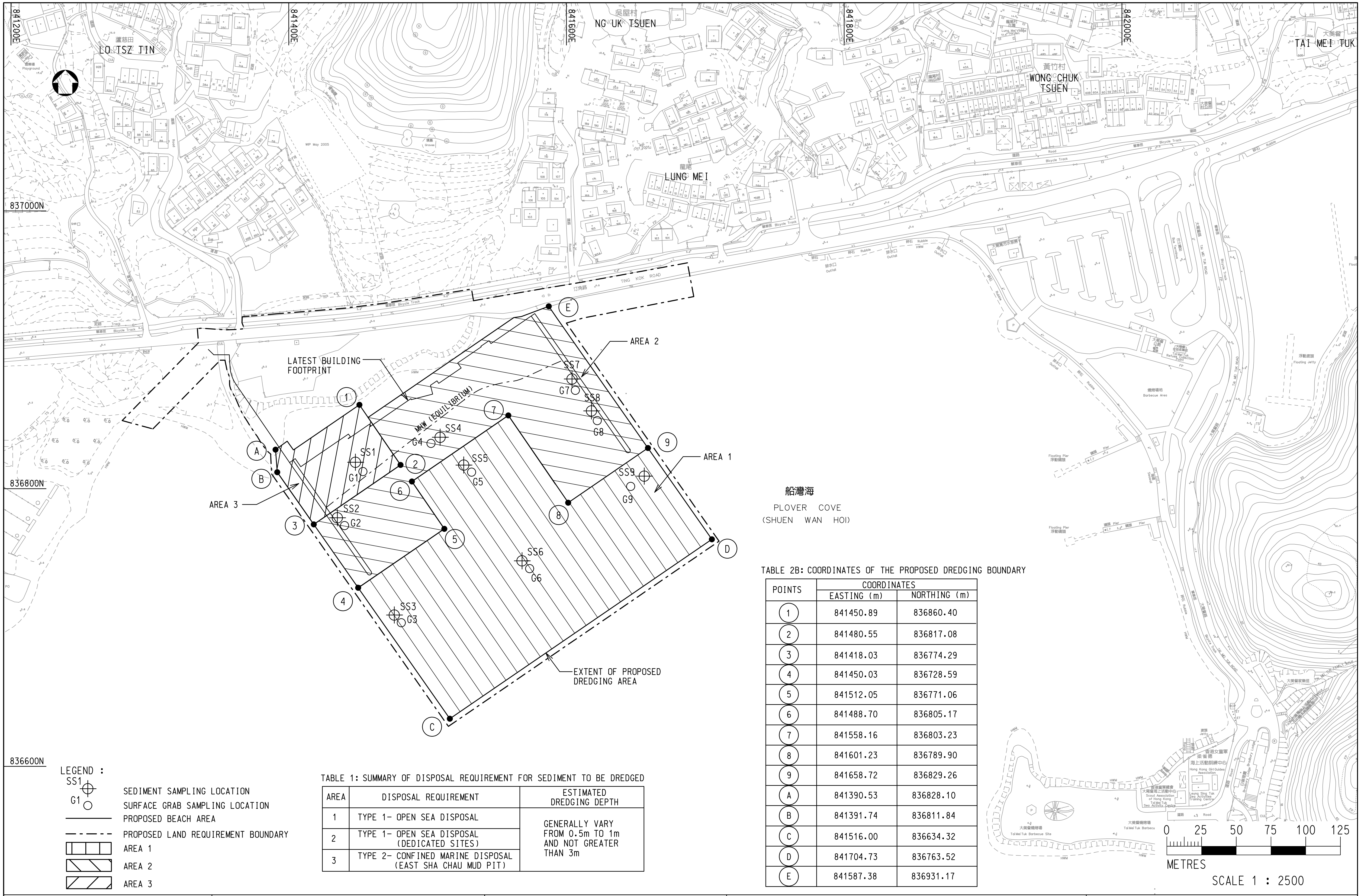

LEGEND :

SS1 ⊕	SEDIMENT SAMPLING LOCATION
G1 ○	SURFACE GRAB SAMPLING LOCATION
———	PROPOSED BEACH AREA
—·—·—	PROPOSED LAND REQUIREMENT BOUNDARY
▥	AREA 1
▧	AREA 2
▨	AREA 3

TABLE 1: SUMMARY OF DISPOSAL REQUIREMENT FOR SEDIMENT TO BE DREDGED

AREA	DISPOSAL REQUIREMENT	ESTIMATED DREDGING DEPTH
1	TYPE 1- OPEN SEA DISPOSAL	GENERALLY VARY FROM 0.5m TO 1m AND NOT GREATER THAN 3m
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3	TYPE 2- CONFINED MARINE DISPOSAL (EAST SHA CHAU MUD PIT)	

TABLE 2B: COORDINATES OF THE PROPOSED DREDGING BOUNDARY

POINTS	COORDINATES	
	EASTING (m)	NORTHING (m)
①	841450.89	836860.40
②	841480.55	836817.08
③	841418.03	836774.29
④	841450.03	836728.59
⑤	841512.05	836771.06
⑥	841488.70	836805.17
⑦	841558.16	836803.23
⑧	841601.23	836789.90
⑨	841658.72	836829.26
Ⓐ	841390.53	836828.10
Ⓑ	841391.74	836811.84
Ⓒ	841516.00	836634.32
Ⓓ	841704.73	836763.52
Ⓔ	841587.38	836931.17

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Halcrow
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Agreement No. : CE 59/2005 (EP)

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

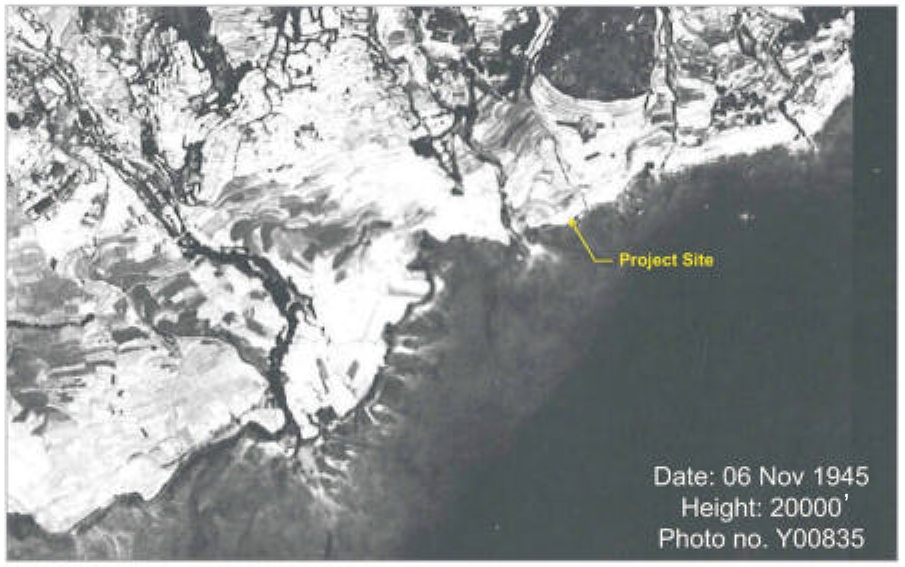
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
SEDIMENT DISPOSAL REQUIREMENT PLANS (DEPTH FROM 0.9m TO 2.9m)

FIGURE 7.4

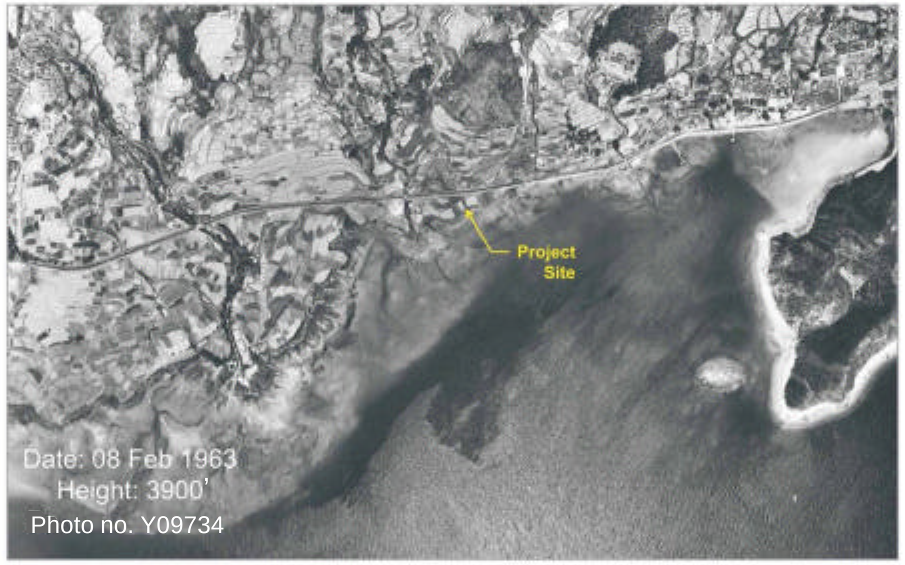
Checked	Scale	Rev.
PS	1:2500 @ A3	1
Designed	Drawn	Date
YC	PF	02/04/2007

philipF 13/11/2007
e:*proj*CALBDS*Figure*E_IA_Rpt*FIG7_4_1_EIA_RPT.dgn



Date: 06 Nov 1945
Height: 20000'
Photo no. Y00835

1945 - Agriculture Land

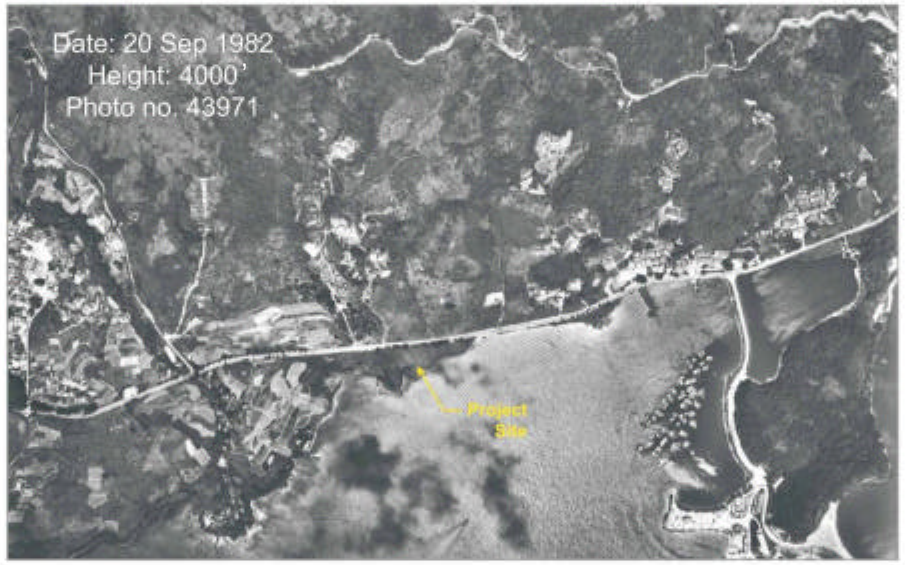


Date: 08 Feb 1963
Height: 3900'
Photo no. Y09734

1963 - Agriculture Land

Date: 22 Nov 1974
Height: 3300
Photo no. 9917

1974 - Agriculture Land



Date: 20 Sep 1982
Height: 4000'
Photo no. 43971

1982 - Abandoned Land surrounded by agriculture land and village type development

Date: 18 Oct 1990
Height: 4000
Photo no. A23361

1990 - Abandoned Land with a Hard Standing Area (without any structure on top) surrounded by agriculture land and village type development

Date: 11 Jun 2004
Height: 2500'
Photo no. CW57411

2004 - Abandoned Land with a Hard Standing Area (without any structure on top) surrounded by agriculture land and village type development

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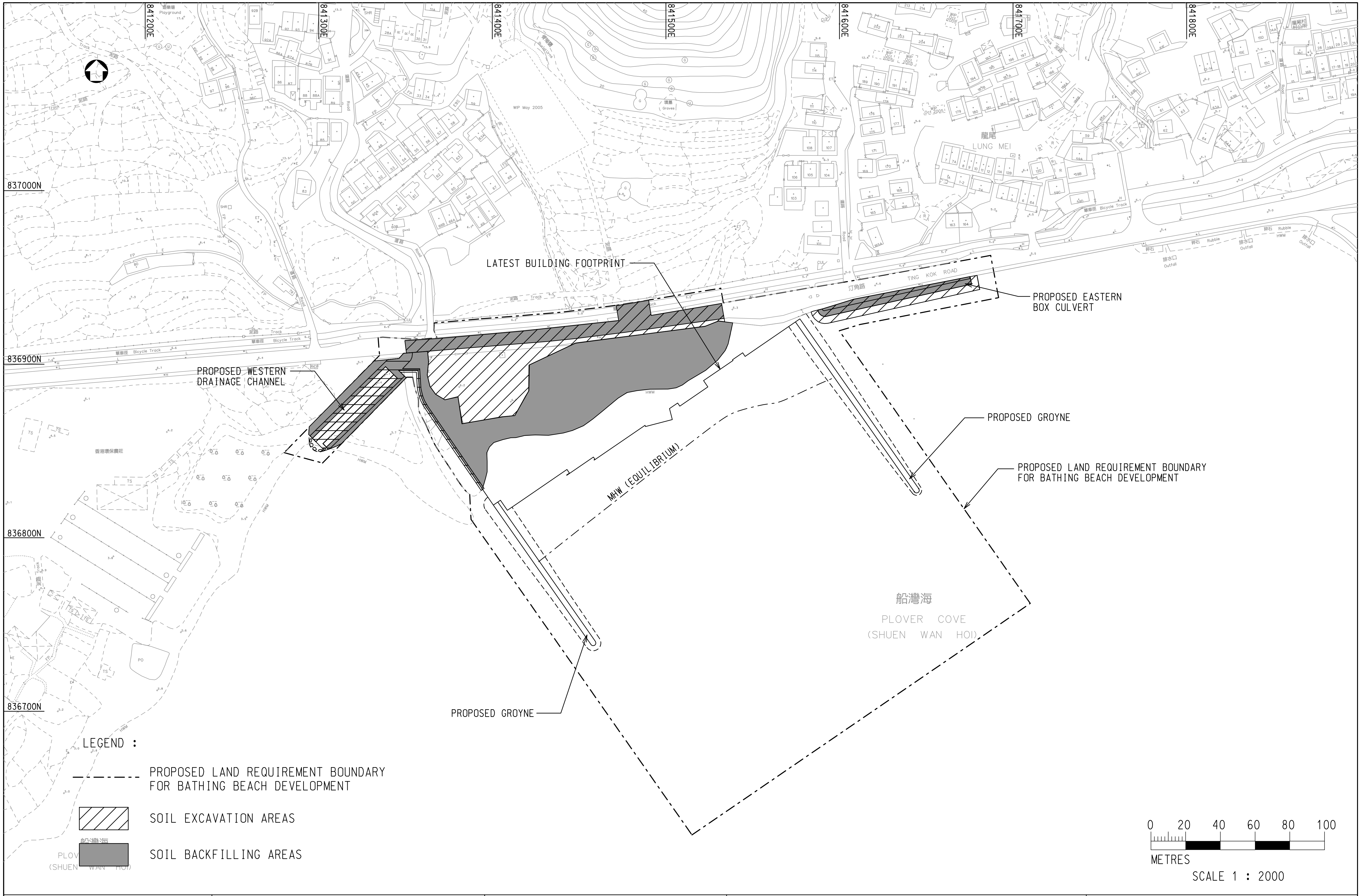
FIGURE 7.5

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

Figure Title:
SITE HISTORY AND AERIAL PHOTOGRAPHS OF THE PROJECT SITE

Checked	Scale	Rev.
-	N/A	0
Designed	**Drawn**	**Date**
-	KK	27/08/2007



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		Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: LOCATION PLAN OF SOIL EXCAVATION AND BACKFILLING AREAS	Checked PS Scale 1: 2000 @ A3 Rev. 0 Designed YC Drawn MJY Date 14/03/2007

phillipF
e:*proj*CALBDS*Figure*E_IA_Rpt*Fig7_6_0_EIA_RPT.dgn
13/11/2007

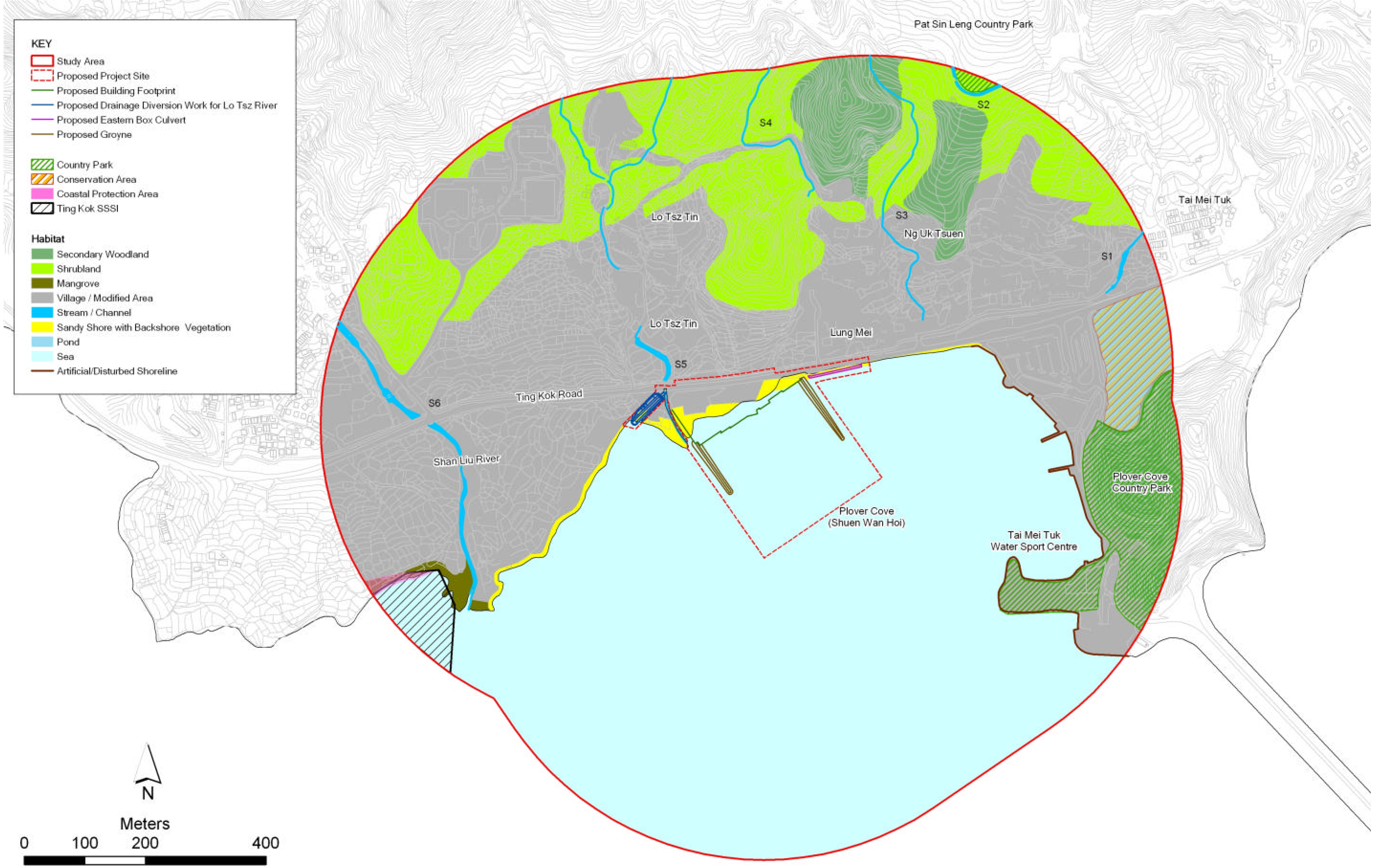

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Figure Title: HABITAT MAP OF THE STUDY AREA

FIGURE 8.1

Checked -

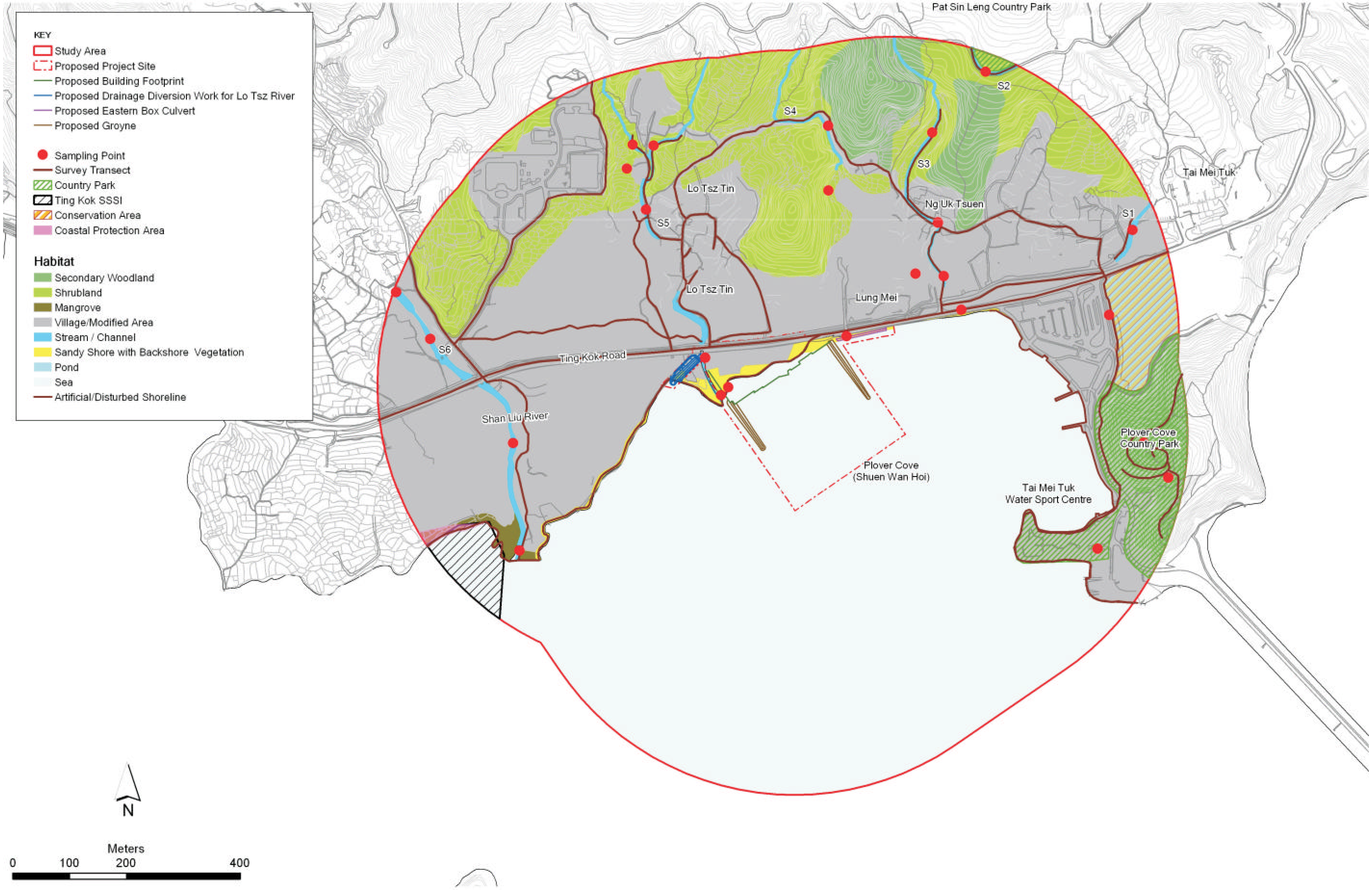
Scale AS SHOWN

Rev. 2

Designed -

Drawn KK

Date 06/07/2007



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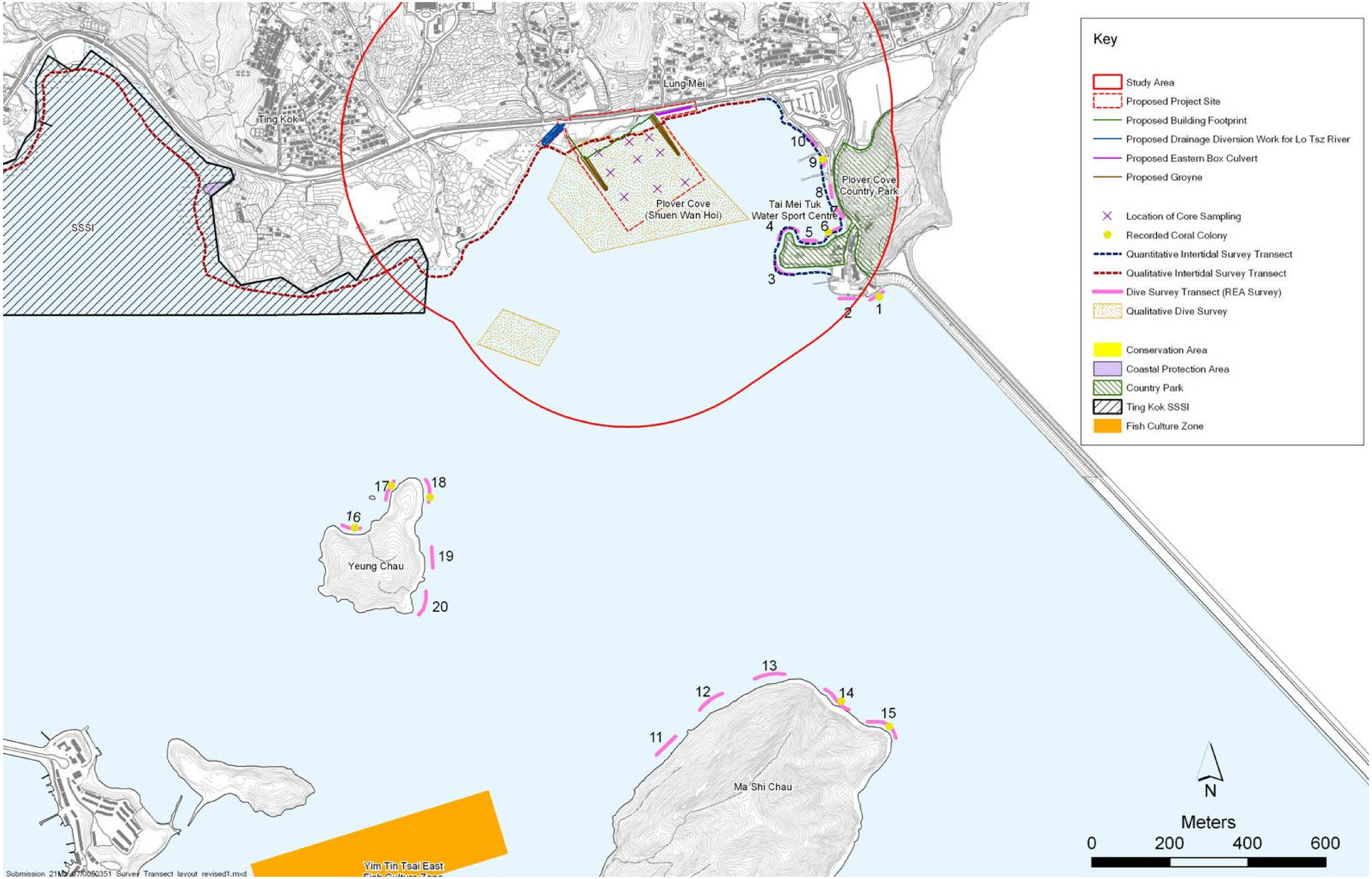
Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title: TERRESTRIAL ECOLOGICAL SURVEY LOCATIONS

FIGURE 8.2

Checked	Scale	Rev.
-	AS SHOWN	2
Designed	**Drawn**	**Date**
-	KK	06/07/2007



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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FIGURE 8.3

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

Figure Title:
MARINE ECOLOGICAL SURVEY LOCATIONS

Checked -	Scale AS SHOWN	Rev. 2
Designed -	Drawn KK	Date 06/07/2007

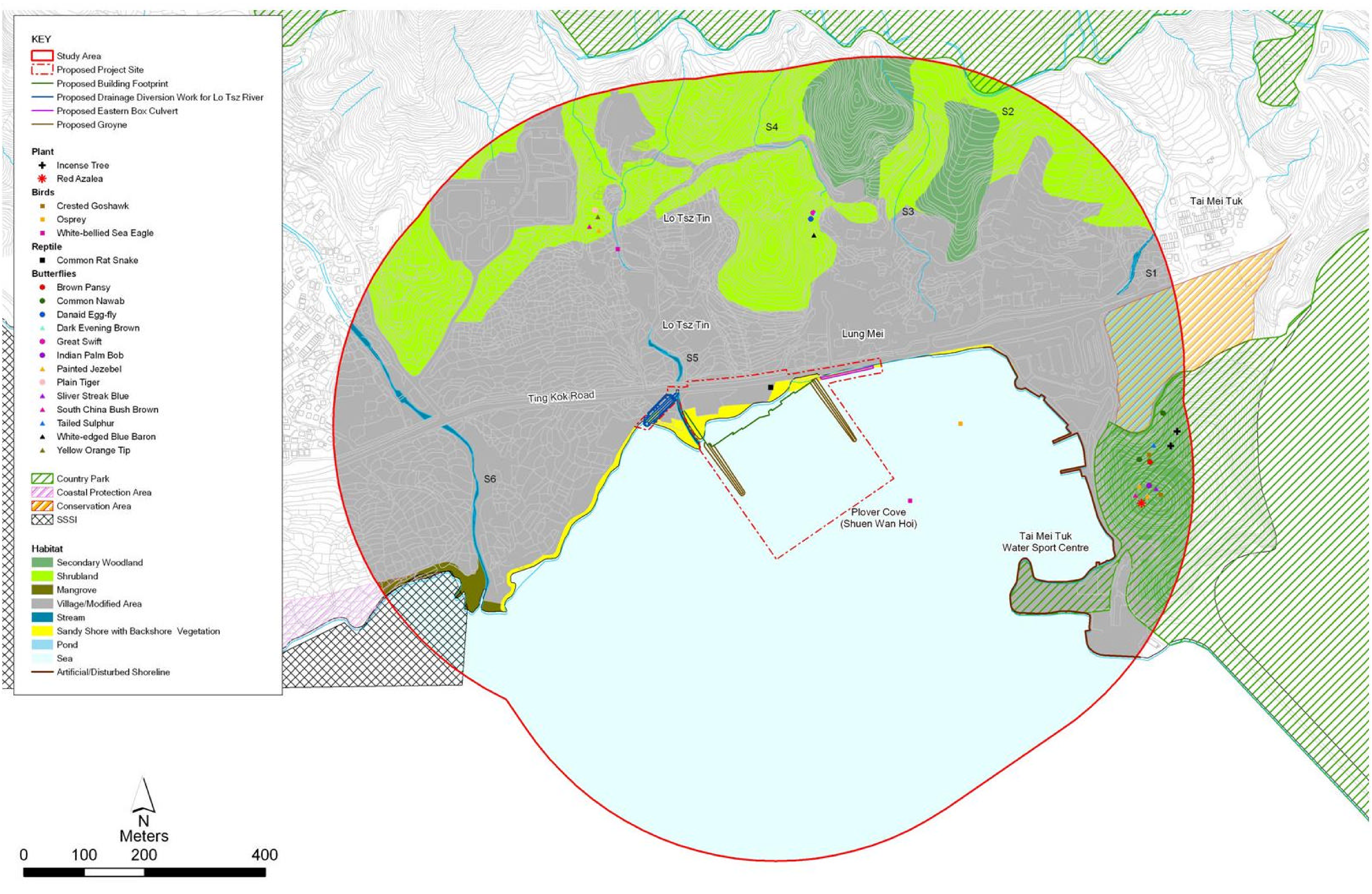

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Figure Title: SPECIES OF CONSERVATION INTEREST RECORDED DURING SURVEY

FIGURE 8.4

Checked -	Scale AS SHOWN	Rev. 2
Designed -	Drawn KK	Date 06/07/2007

A patch of mature secondary woodland was found at the east of the Study Area, which is located within the Plover Cove Country Park. The structural complexity and ecological value of the woodland are moderate to high.

A pond was located at the east of the Study Area, which was under management for recreational purpose. The pond was designated as Conservation Area.

Shrubland was found on the hill and located at the north of the Study Area. The shrubland was dominated by small shrub species with low to moderate species diversity and structural complexity.

Village/modified area within the Study Area comprised of village houses, wasteland, landscape area and concrete roads.

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DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
PHOTOGRAPHIC RECORDS OF VARIOUS TERRESTRIAL HABITATS
WITHIN THE STUDY AREA

FIGURE 8.5

Checked	Scale	Rev.
-	N/A	1
Designed	**Drawn**	**Date**
-	KK	23/05/2007

The lower course of S1, located within the village area, was channelised and has negligible ecological value.

Drainage channel S2 was found at the fringe of Pat Sin Leng Country Park.

The lower course of stream S3 was highly disturbed by the construction activities of the village area.

The riparian vegetation of stream S4 was dominated by weed plants common in the village area.

The middle and upper course of Lo Tsz River (S5) was quite narrow with weedy riparian vegetation growing on the stream bank.

Shan Liu River (S6) was partially channelised with disturbed stream banks. The substratum was undisturbed and with natural gravels and rubbles.

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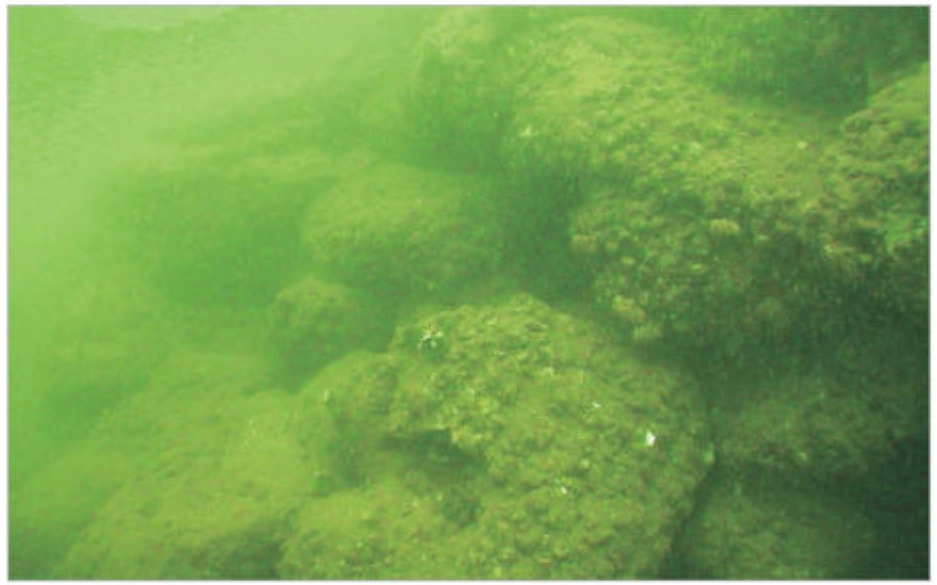
Agreement No.: CE 59/2005(EP)	ENVIRONMENTAL IMPACT ASSESSMENT REPORT	**FIGURE 8.6**			
Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: PHOTOGRAPHIC RECORDS OF STREAM AND CHANNEL WITHIN THE STUDY AREA	Checked -	Scale N/A	Rev. 1	
		Designed -	Drawn KK	Date 23/05/2007	

Mangrove habitat within the Ting Kok SSSI was less disturbed by human activities and mature in age. The mangrove was dominated by *Kandelia obovata*, *Excoecaria agallocha*, *Bruguiera gymnorrhiza* and *Aegiceras corniculatum*.

The substratum of the higher intertidal zone of the sandy shore is mainly course sand and dominated by backshore vegetation including *Thespesia populnea* and *Macaranga tanarius*. Individual dwarf mangrove plants (< 0.5 m in height) and seedlings such as *Aegiceras corniculatum* were found scattered along the sandy shore.

The substratum of the middle and lower intertidal zones of the sandy shore is mixed with pebbles, small boulders and soft substrate (i.e. sand and mud), which exposed during low tide.

Artificial shoreline was recorded along the coastline close to the BBQ sites at the east of the Study Area.



The subtidal hard bottom habitat along the artificial shore was mainly composed of boulders/bedrocks with sand and rubbles in between. Scattered small colonies of hard coral *Oulastrea crispate* were recorded during dive survey.

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Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
PHOTOGRAPHIC RECORDS OF COASTAL HABITATS
RECORDED WITHIN THE STUDY AREA AND TING KOK SSSI

FIGURE 8.7

Checked -	Scale N/A	Rev. 2
Designed -	Drawn KK	Date 23/05/2007

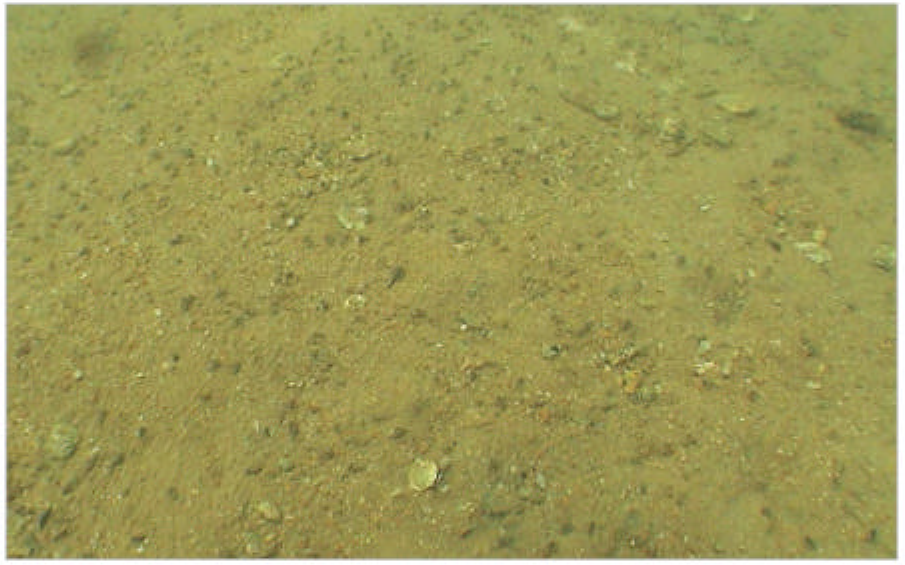
Vegetation removal was recorded within the village/modified area located at the east of the Proposed Beach Development site.

The lower course of Lo Tsz River which located outside the Project Site boundary was densely shaded by the surrounding vegetation such as *Exoecaria agallocha*, *Thespesia populnea* and *Hibiscus tiliaceus*.

The lower course of Lo Tsz River was were mainly surrounded by village/modified area with human settlement and were observed to be partially channelised and polluted.

Sandy shore with backshore vegetation was recorded along the shoreline of the Proposed Beach Development Site. The backshore vegetation was susceptible to certain level of disturbance by human activities (i.e. littering).

Existing conditions of the nearshore area located within the Proposed Land Requirement Boundary. The sandy bottom scattered with pebbles and small boulders during low tide.



Photographic record of the seabed conditions within the Project Site subtidal area. The soft bottom habitats were covered by fine sediments with scattered rubbles. No corals or marine species of conservation interest were recorded during the dive surveys.

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CE 59/2005(EP)

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
PHOTOGRAPHIC RECORDS OF HABITATS RECORDED WITHIN AND IN THE
CLOSE VICINITY OF THE PROPOSED BEACH DEVELOPMENT SITE

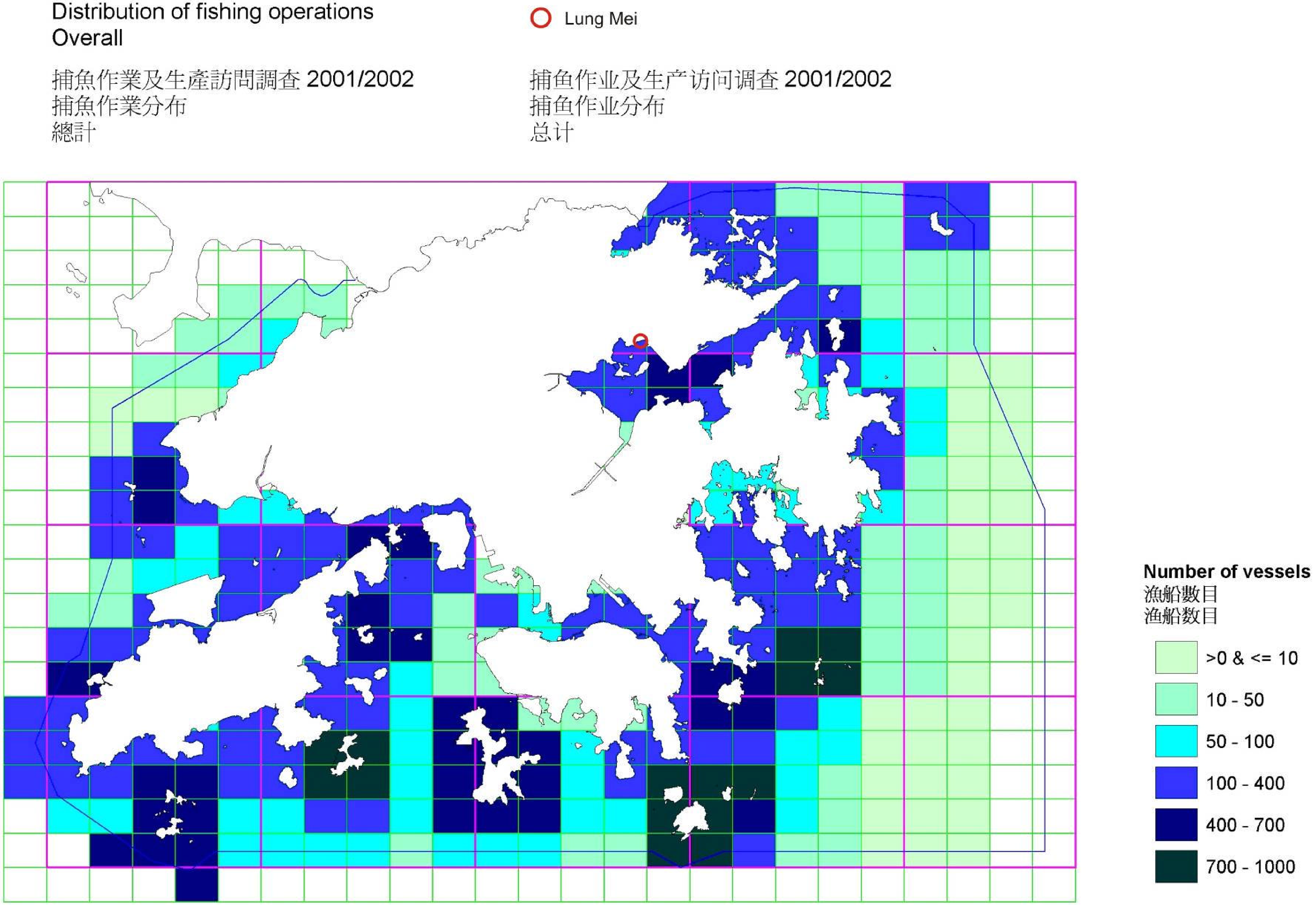
FIGURE 8.8

Checked -	Scale N/A	Rev. 1
Designed -	Drawn KK	Date 23/05/2007

Port Survey 2001/2002
Distribution of fishing operations
Overall

捕魚作業及生產訪問調查 2001/2002
捕魚作業分布
總計

捕鱼作业及生产访问调查 2001/2002
捕鱼作业分布
总计



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Agreement No.: CE 59/2005(EP)

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
DISTRIBUTION OF FISHING OPERATIONS (ALL VESSELS) IN HONG KONG WATERS AS RECORDED BY AGRICULTURE, FISHERIES AND CONSERVATION DEPARTMENT IN PORT SURVEY 2001/2002

FIGURE 9.1

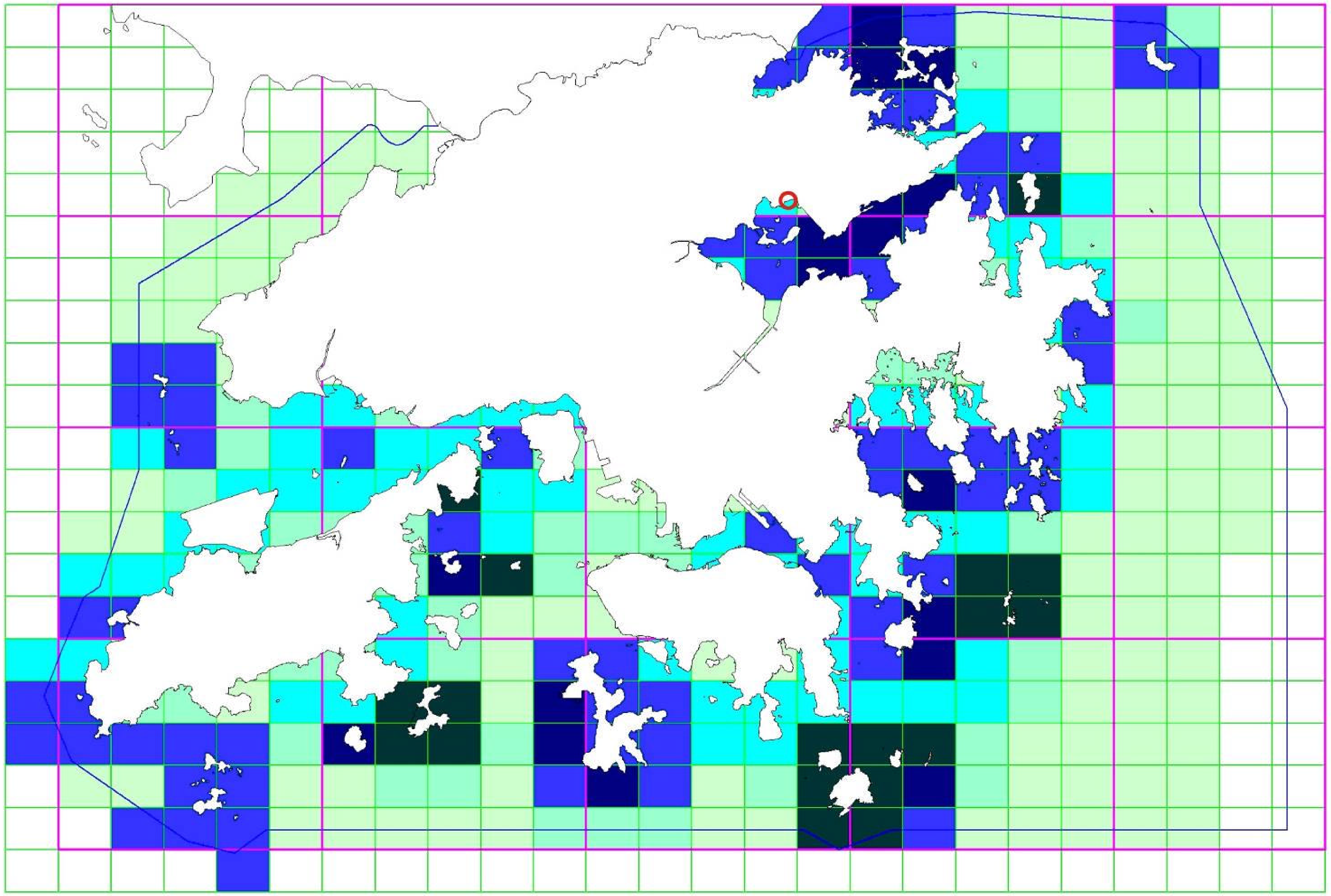
Checked JF	Scale N/A	Rev. 0
Designed -	Drawn KK	Date 13/03/2007

Port Survey 2001/2002
Distribution of fisheries production (adult fish)
Overall

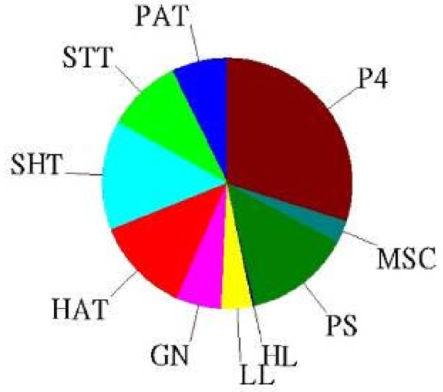
捕魚作業及生產訪問調查 2001/2002
漁產分布 (成魚)
總計

捕鱼作业及生产访问调查 2001/2002
渔产分布 (成鱼)
总计

○ Lung Mei



Production by vessel type
漁產與作業形式比例
渔产与作业形式比例



Vessel type:
作業形式:
作业形式:

PAT	Pair Trawler	雙拖	双拖
STT	Stern Trawler	單拖	单拖
SHT	Shrimp Trawler	蝦拖	虾拖
HAT	Hang Trawler	掺繒	掺缯
GN	Gill Netter	刺網	刺网
LL	Long Liner	延繩釣	延绳钓
HL	Hand Liner	手釣	手钓
PS	Purse Seiner	圍網	围网
MSC	Misc. Craft	雜項船	杂项船
P4	Sampan	舢舨	舢舨

Production (kg/ha)
產量 (公斤/公頃)
产量 (公斤/公顷)

🟩	>0 & <= 50
🟩	50 - 100
🟦	100 - 200
🟦	200 - 400
🟦	400 - 600
⬛	600 - 1000

Client CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow China Ltd. Environmental Resources Management as sub-consultant	Agreement No.: CE 59/2005(EP)	ENVIRONMENTAL IMPACT ASSESSMENT REPORT
		Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: DISTRIBUTION OF FISHERIES PRODUCTION (ADULT FISH) IN TERMS OF WEIGHT (kg ha-1) IN HONG KONG WATERS AS RECORDED BY AGRICULTURE, FISHERIES AND CONSERVATION DEPARTMENT IN PORT SURVEY 2001/2002

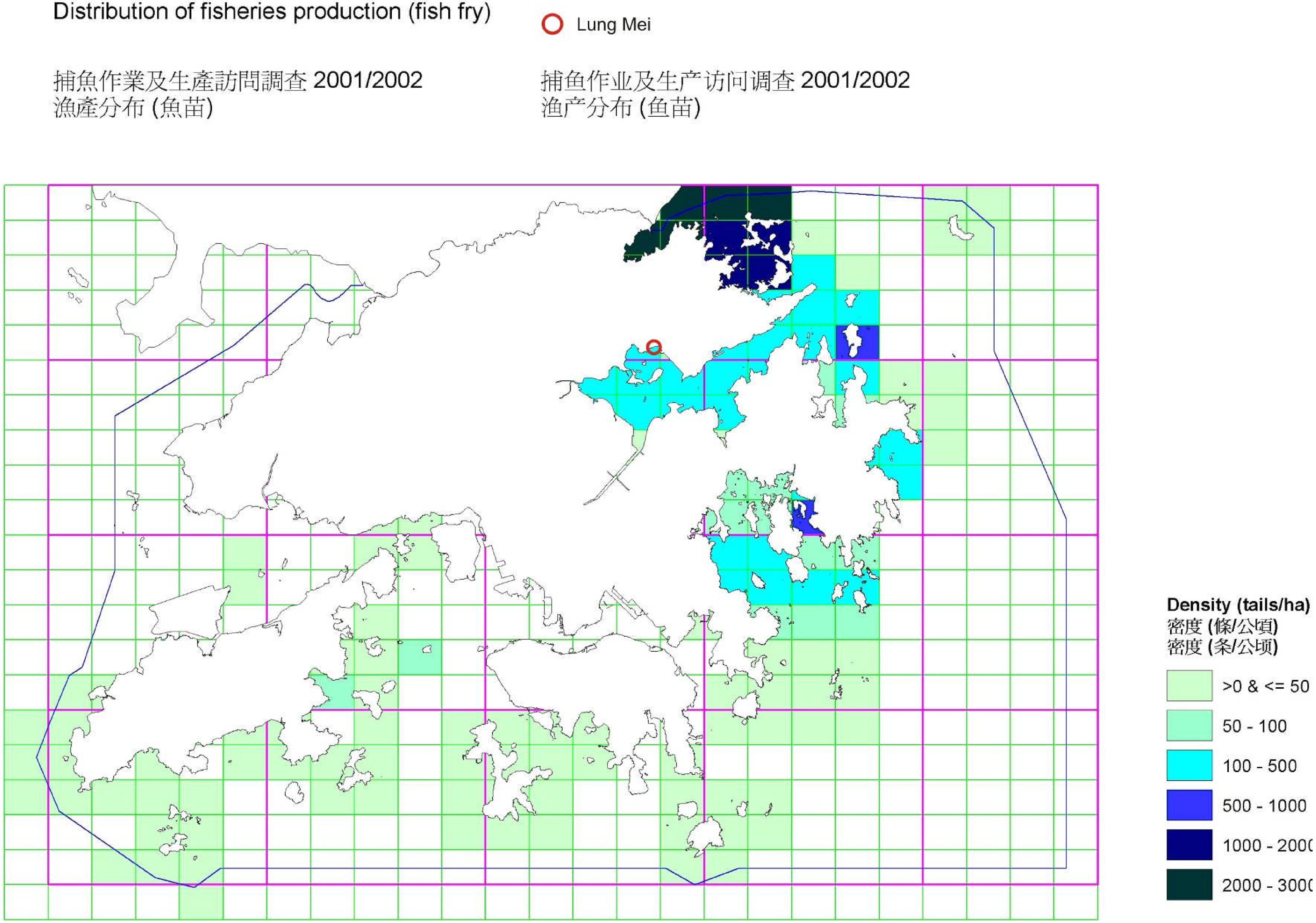
FIGURE 9.2

Checked JF	Scale N/A	Rev. 0
Designed -	Drawn KK	Date 13/03/2007

Port Survey 2001/2002
Distribution of fisheries production (fish fry)

捕魚作業及生產訪問調查 2001/2002
漁產分布 (魚苗)

捕鱼作业及生产访问调查 2001/2002
渔产分布 (鱼苗)



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		Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: DISTRIBUTION OF FISHERIES PRODUCTION (FISH FRY) IN HONG KONG WATERS AS RECORDED BY AGRICULTURE, FISHERIES AND CONSERVATION DEPARTMENT IN PORT SURVEY 2001/2002

FIGURE 9.3

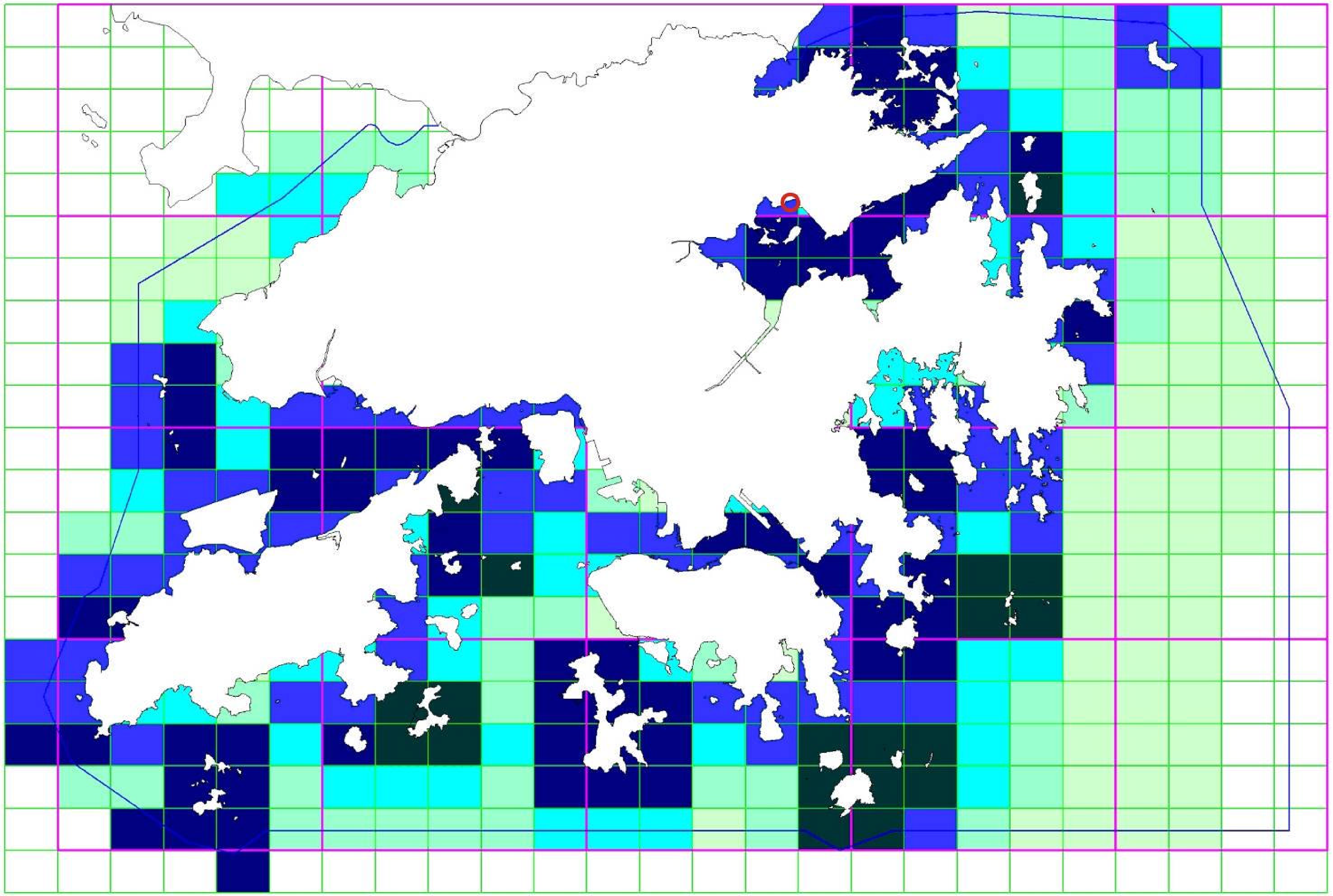
Checked JF	Scale N/A	Rev. 0
Designed -	Drawn KK	Date 13/03/2007

Port Survey 2001/2002
Distribution of fisheries production (adult fish and fish fry)
Overall

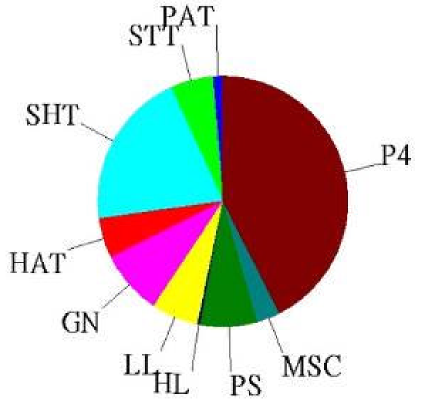
捕魚作業及生產訪問調查 2001/2002
漁產分布 (成魚及魚苗)
總計

捕鱼作业及生产访问调查 2001/2002
渔产分布 (成鱼及鱼苗)
总计

○ Lung Mei



Production by vessel type
漁產與作業形式比例
渔产与作业形式比例



Vessel type:
作業形式:
作业形式:

PAT	Pair Trawler	雙拖	双拖
STT	Stern Trawler	單拖	单拖
SHT	Shrimp Trawler	蝦拖	虾拖
HAT	Hang Trawler	摻繒	掺缯
GN	Gill Netter	刺網	刺网
LL	Long Liner	延繩釣	延绳钓
HL	Hand Liner	手釣	手钓
PS	Purse Seiner	圍網	围网
MSC	Misc. Craft	雜項船	杂项船
P4	Sampan	舢舨	舢舨

Value (HK$/ha)
價值 (港元/公頃)
价值 (港元/公顷)

🟩	>0 & <= 500
🟩	500 - 1000
🟦	1000 - 2000
🟦	2000 - 5000
■	5000 - 10000
■	10000 - 20000

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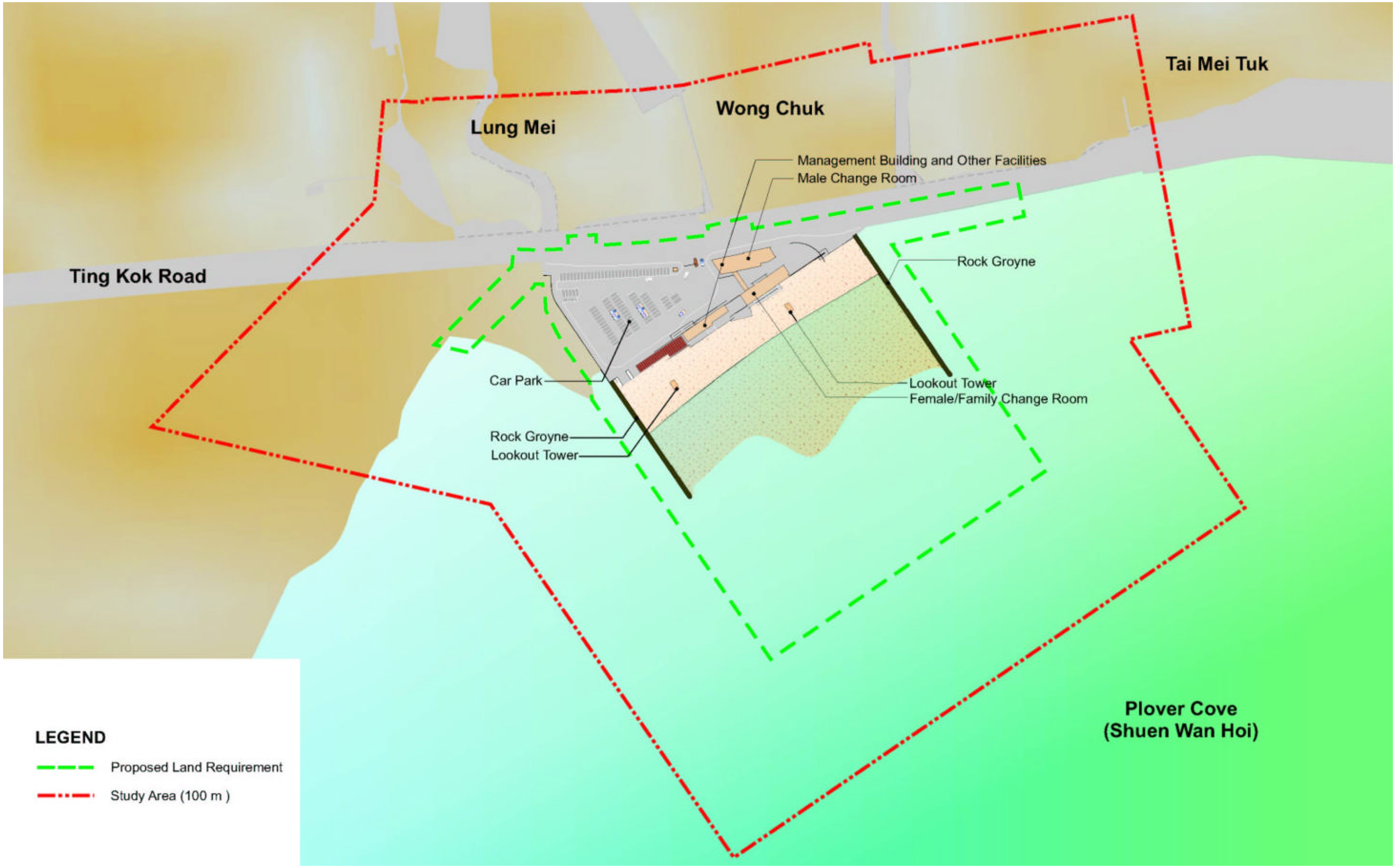
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FIGURE 9.4

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title:
DISTRIBUTION OF FISHERIES PRODUCTION (ADULT FISH & FISH FRY) IN TERMS OF VALUE (HK$ ha-1) IN HONG KONG WATERS AS RECORDED BY AGRICULTURE, FISHERIES AND CONSERVATION DEPARTMENT IN PORT SURVEY 2001/2002

Checked	Scale	Rev.
JF	N/A	0
Designed	**Drawn**	**Date**
-	KK	13/03/2007



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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FIGURE 10.1

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

Figure Title:
LANDSCAPE LAYOUT

Checked SL	Scale 1:2500 @ A3	Rev. 2
Designed SL	Drawn MT	Date 31/05/2007

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FIGURE 10.2

Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title: OZP PLAN

Checked: SL

Scale: NTS

Rev.: 0

Designed: SL

Drawn: -

Date: 08/03/2007

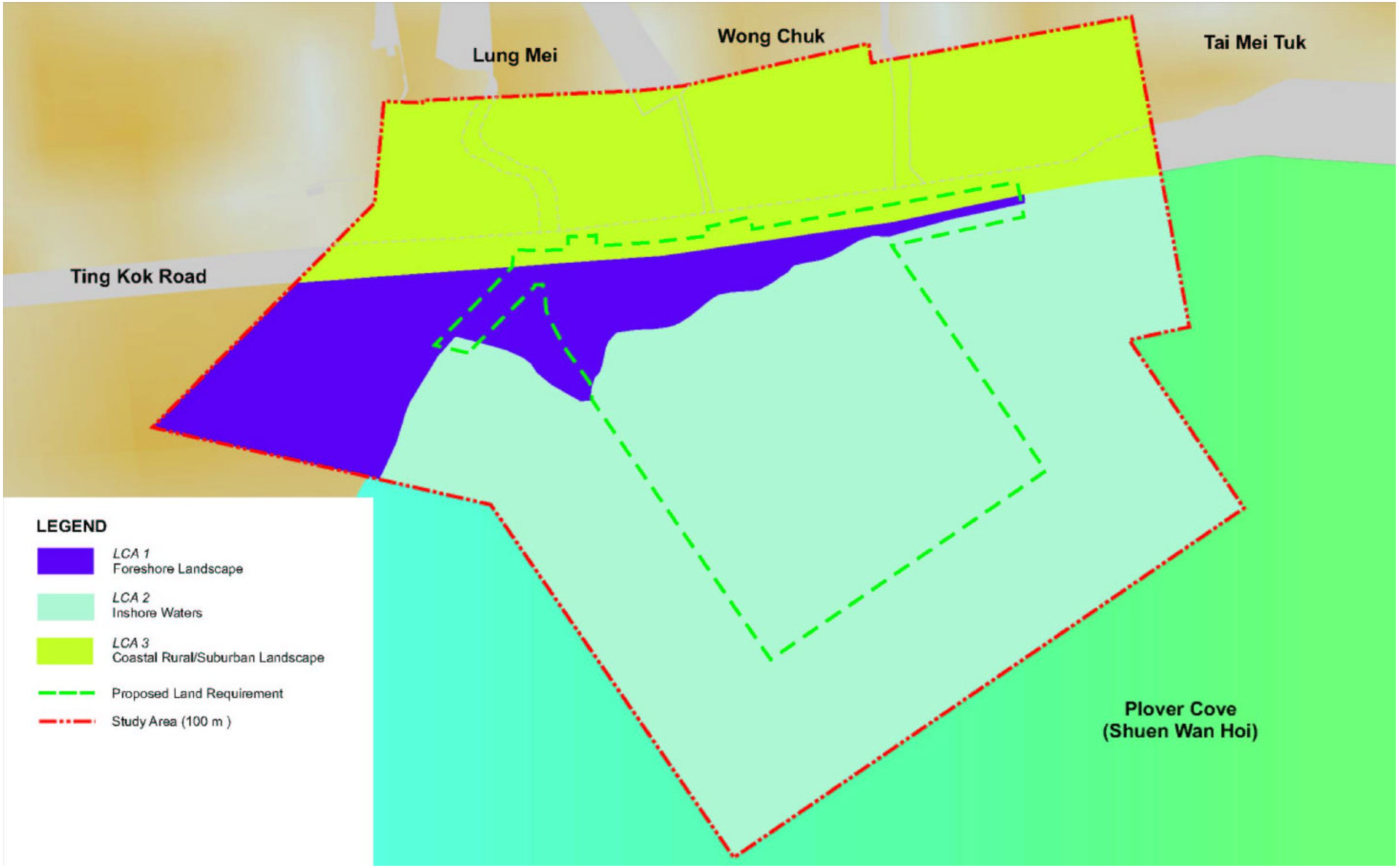
Figure 10.3: Foreshore Landscape

Figure 10.4: Inshore Waters Landscape

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURES 10.3 AND 10.4**
Client CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow China Ltd. Environmental Resources Management as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure 10.5: Coastal Rural/Suburban Landscape

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 10.5**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



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Agreement No.: CE 59/2005(EP)

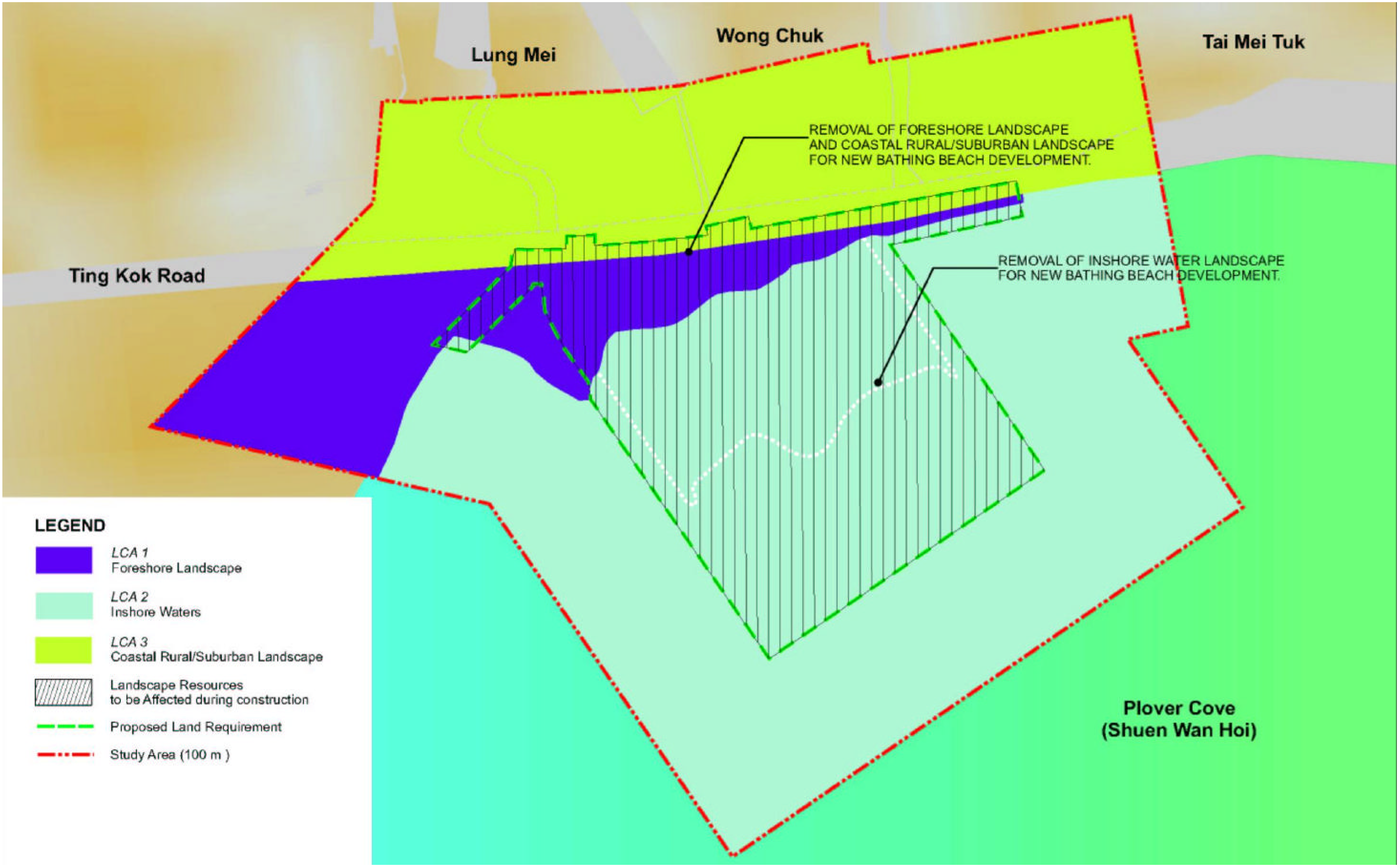
Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title: EXISTING LANDSCAPE CHARACTER AREAS

FIGURE 10.6

Checked SL	Scale 1:2500 @ A3	Rev. 2
Designed SL	Drawn MT	Date 08/03/2007



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Agreement No.: CE 59/2005(EP)

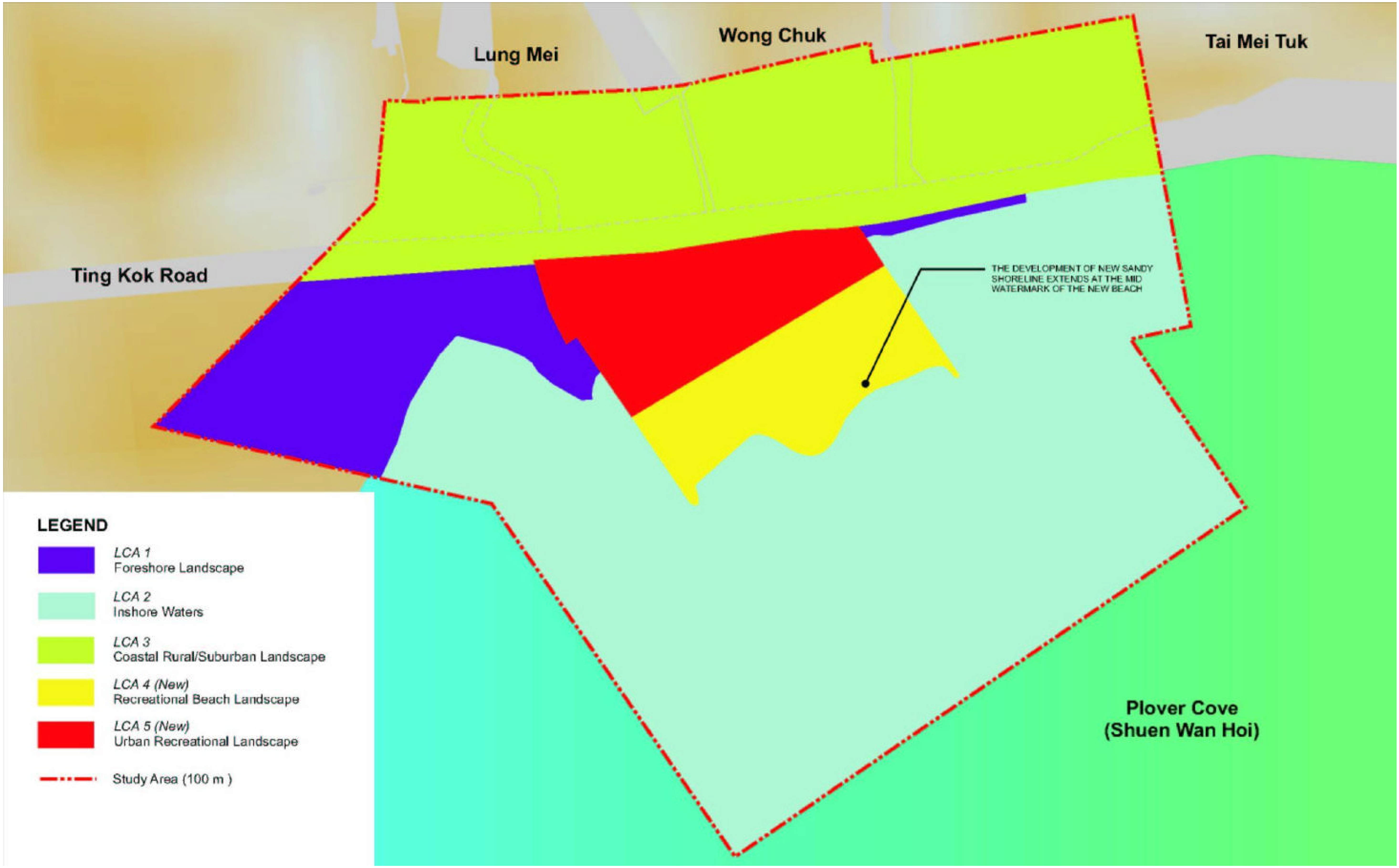
Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title: LANDSCAPE CHARACTER AREAS UNMITIGATED IMPACT

FIGURE 10.7

Checked SL	Scale 1:2500 @ A3	Rev. 3
Designed SL	Drawn MT	Date 14/09/2007



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Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title: LANDSCAPE CHARACTER AREAS MITIGATED IMPACT

FIGURE 10.8

Checked SL	Scale 1:2500 @ A3	Rev. 2
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Figure 10.9: Shrubland

Figure 10.10: Trees / Backshore Vegetation

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURES 10.9 AND 10.10**
Client CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow China Ltd. Environmental Resources Management as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure 10.11: Water

Figure 10.12: River

Figure 10.13: Sandy / Rocky Beach

Figure 10.14: Road

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURES 10.13 AND 10.14**
Client CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow China Ltd. Environmental Resources Management as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure 10.15: Village/Developed Area

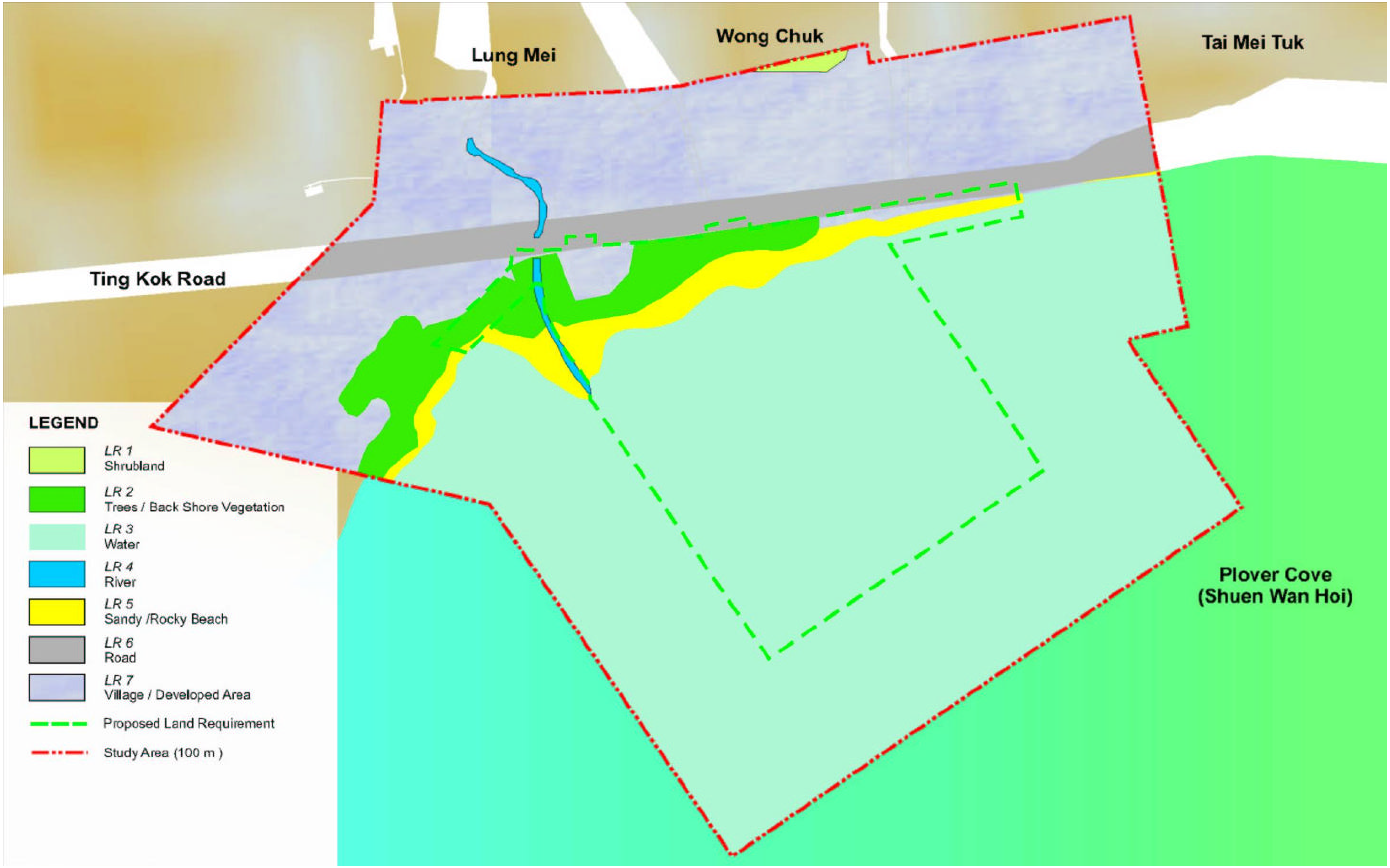

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FIGURE 10.16

Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title: EXISTING LANDSCAPE RESOURCES

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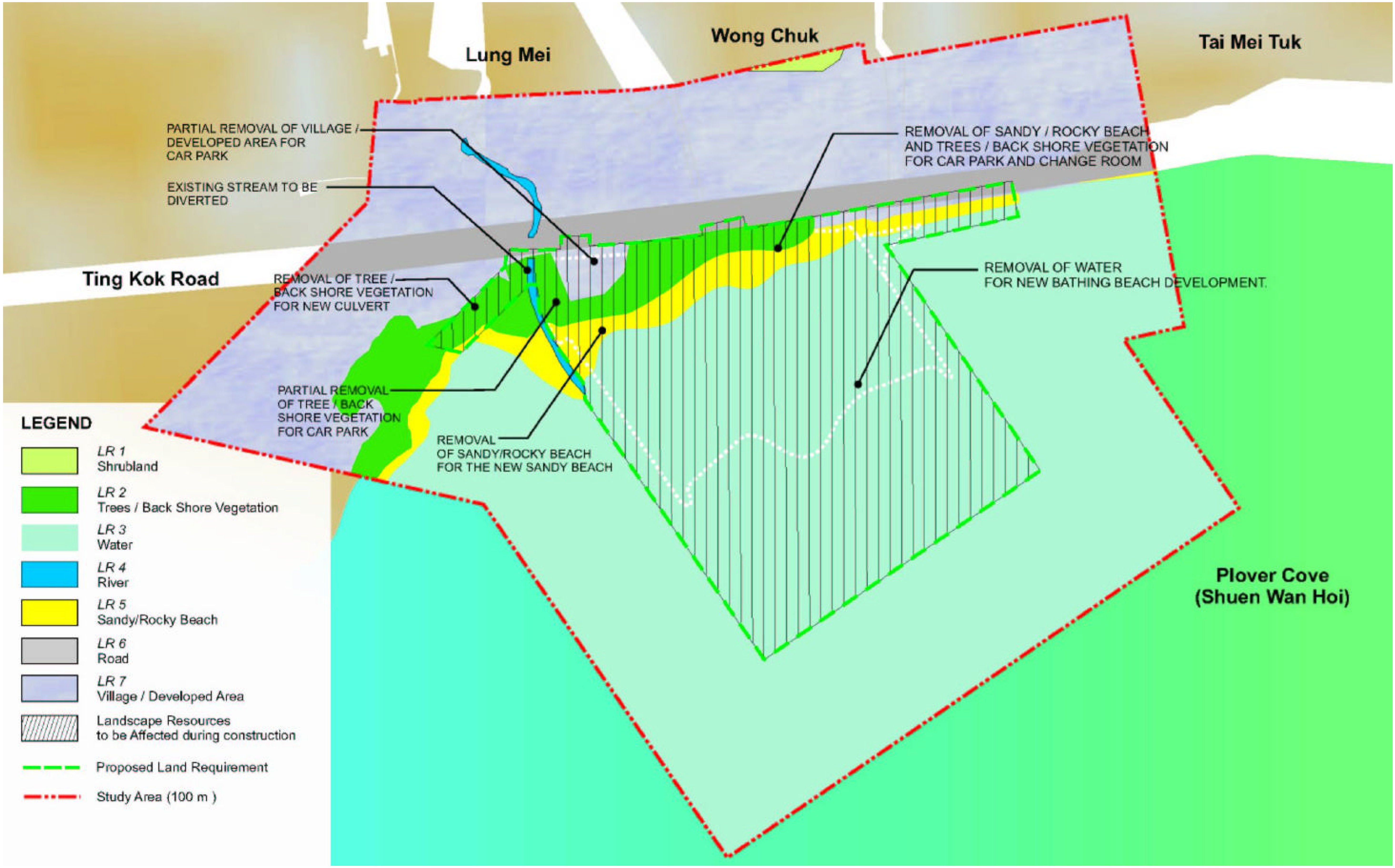

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FIGURE 10.17

Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title: UNMITIGATIED LANDSCAPE RESOURCE IMPACTS

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THE DEVELOPMENT OF NEW SANDY SHORELINE EXTENDS AT THE MID-WATERMARK OF THE NEW BEACH

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Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT
Figure Title: MITIGTED LANDSCAPE RESOURCE IMPACTS

FIGURE 10.18

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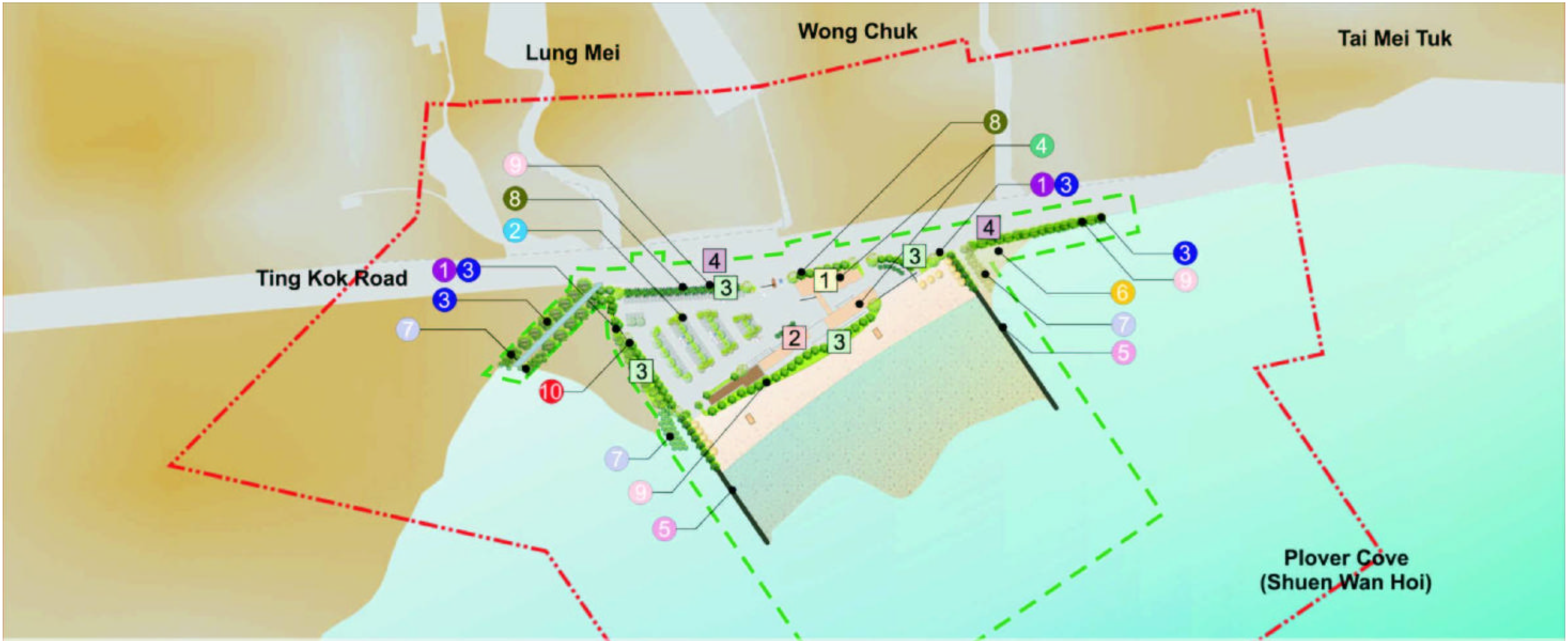
SL	MT	12/09/2007



LANDSCAPE AND VISUAL MITIGATION MEASURES

① **CULTIVATION OF AREAS IMPACTED DURING CONSTRUCTION**
Areas impacted during the construction phase that are not required during the operations phase, are to be cultivated to a depth of 300mm in accordance with accepted Hong Kong practices and guidelines.

② **CAR PARK TREE PLANTING**
Advanced trees are to be planted to provide shade to the car park areas and to reduce the mass of the paved areas.

③ **TREE AND SHRUB PLANTING**
All planting of trees and shrubs is to be carried out in accordance with accepted Hong Kong practices and guidelines. Plant densities are to be provided in future detailed design documents and are to be selected so as to achieve a finished landscape that matches the surrounding, undisturbed, equivalent landscape types. This mitigation measure will require establishment maintenance which will be the responsibility of the project proponent.

④ **ROOF TERRACE PLANTING**
Trees, shrubs and climbers shall be established in planters on the roof terraces of the new structures where technically feasible.

⑤ **NATURAL ROCK GROYNES**
The new rock groynes are to utilise natural stone.

⑥ **INTER-TIDAL RE-GENERATION**
It is likely that a build up of sediment and sand will occur at the outer edges of the rock groyne. This is a natural process and the development proponent has no control over the implementation of this mitigation measure.

⑦ **MANGROVE RE-GENERATION**
Mangroves of similar species to existing to be established.

⑧ **BUFFER PLANTING**
Trees and shrubs are to be planted along Ting Kok Road to screen the development from nearby village/ developed area.

⑨ **EARLY PLANTING**
Works Where technically feasible, new plantings are to be installed during the construction works to reduce landscape impacts.

⑩ **TREE PROTECTION/TRANSPLANTATION**
Where technically feasible, existing trees in the Trees/Backshore Vegetation LR are to be retained. Those trees that cannot be retained that are of value are to be transplanted.

1 **VMM1 DESIGN OF STRUCTURES**
Where possible, built structures will utilise appropriate designs to complement the surrounding landscape. Materials and finishes will also be considered during detailed design.

2 **VMM2 COLOURS**
Colours for the structures can be used to complement the surrounding area. Lighter colours such as shades of light grey and light brown may be utlised where technically feasible to reduce the visibility of the structures.

3 **VMM3 PLANTINGS**
Appropriate new plantings will be installed as appropriate to help integrate the new structures into the surrounding landscape.

4 **VMM4 COLOUR OF SITE HOARDINGS**
Construction hoardings to be erected at a uniform height with a uniform colour to complement the surrounding landscape.

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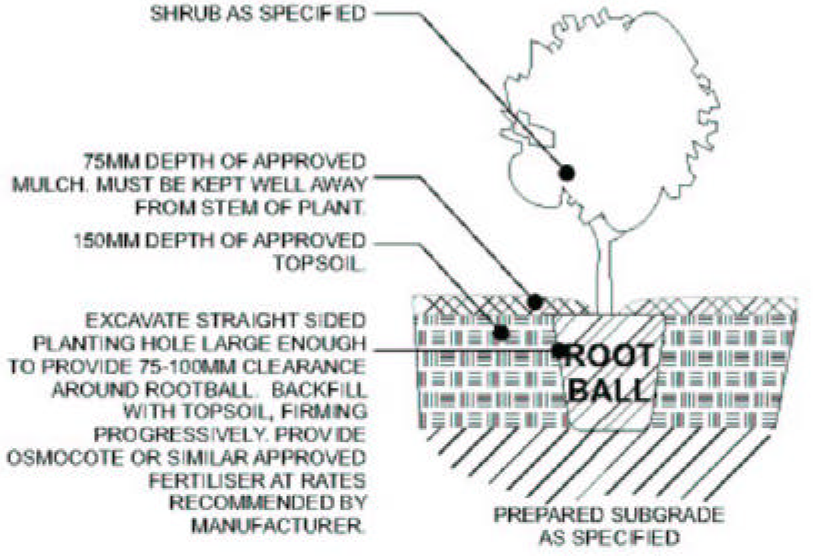
		Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: LANDSCAPE MITIGATION PLAN	Checked SL Designed SL	Scale 1:2500 @ A3 Drawn MT	Rev. 2 Date 31/05/2007

PRELIMINARY PLANT SCHEDULE

(Preferred native species)

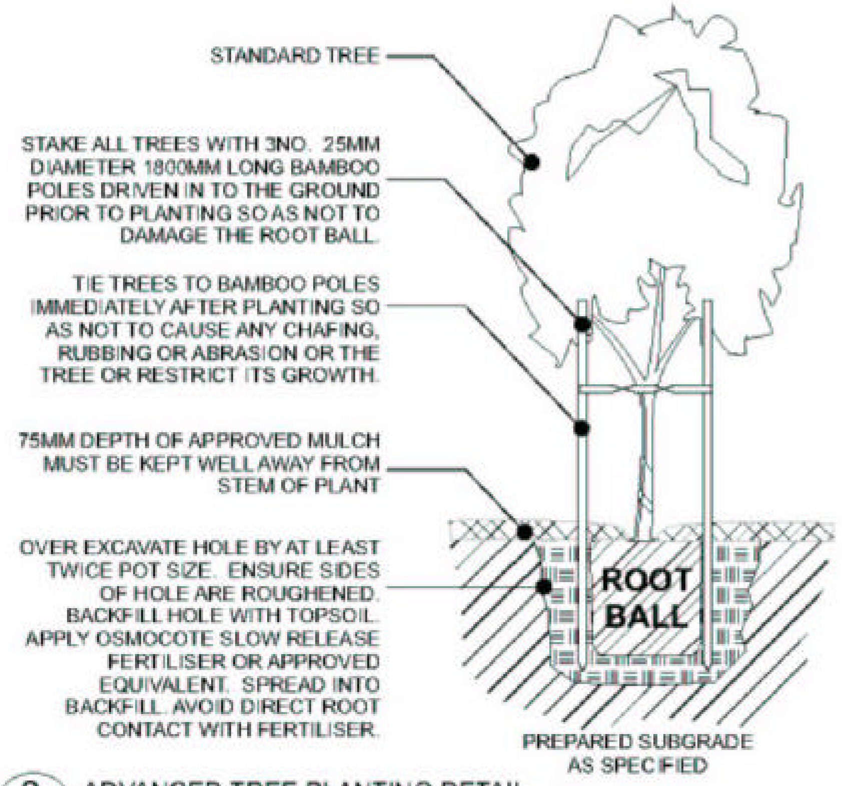
DESCRIPTION / ORIGIN

	NATIVE (N)/ EXOTIC (E)
TREES	
Casuarina equisetifolia	N
Celtis sinensis	N
Cerbera manghas	E
Ficus microcarpa	N
Ficus superba	N
Hibiscus tiliaceus	N
Macaranga tanarius	N
Mallotus paniculatus	N
Melia azedarach	N
Microcos paniculata	N
Sterculia lanceolata	N
Thespesia populnea	N
SHRUBS	
Bridelia tomentosa	N
Cratoxylum cochinchinensis	N
Gardenia jasminoides	N
Ilex asprella	N
Lantana camara	E
Ligustrum sinense	N
Melastoma candidum	N
Melastoma sanguineum	N
Pandanus tectorius	N
Phyllanthus cochinchinensis	N
Phoenix hanceana	N
Rhaphiolepis indica	N
Rhodomyrtus tomentosa	N
Sapium discolor	N
Sapium sebiferum	N
Scaevola sericea	N
Schefflera octophylla	N
CLIMBING PLANTS	
Embelia laeta	N
Ipomoea brasiliensis	N
Wedelia chinensis	N



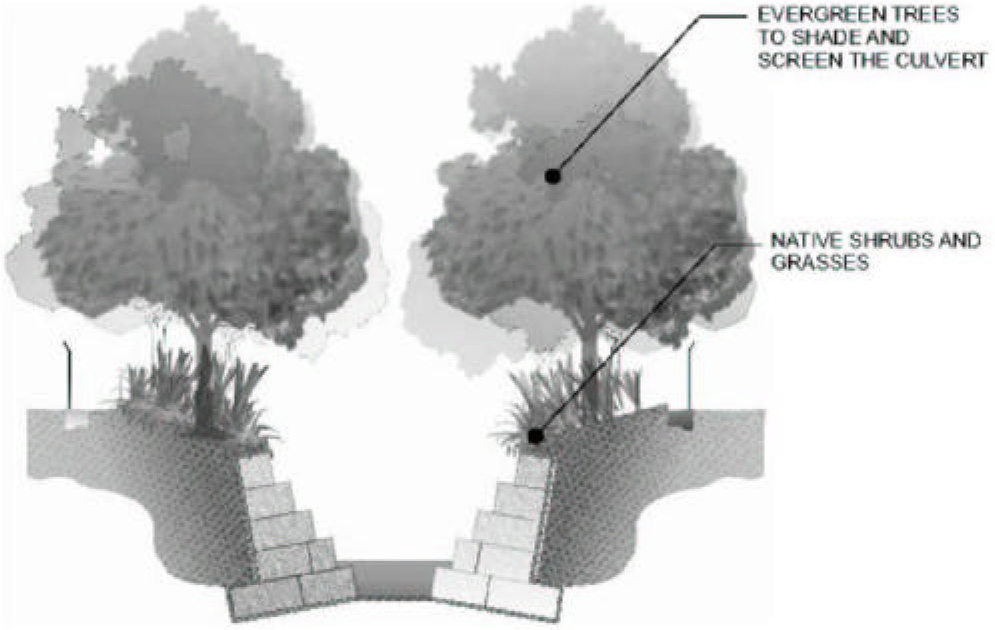
1 SHRUB PLANTING DETAIL

NOT TO SCALE



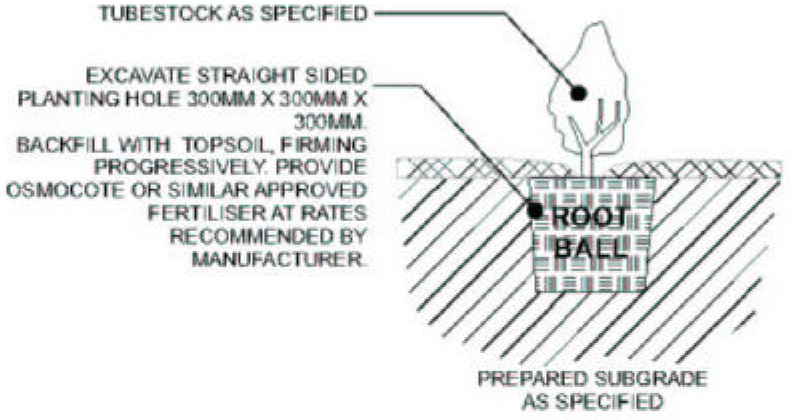
2 ADVANCED TREE PLANTING DETAIL

NOT TO SCALE



3 WESTERN BOX CULVERT PLANTING DETAIL

NOT TO SCALE



4 TUBE PLANTING DETAIL

NOT TO SCALE

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Figure Title: LANDSCAPE MITIGATION DETAILS

FIGURE 10.20

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Figure 10.21: Horizontal Field of View

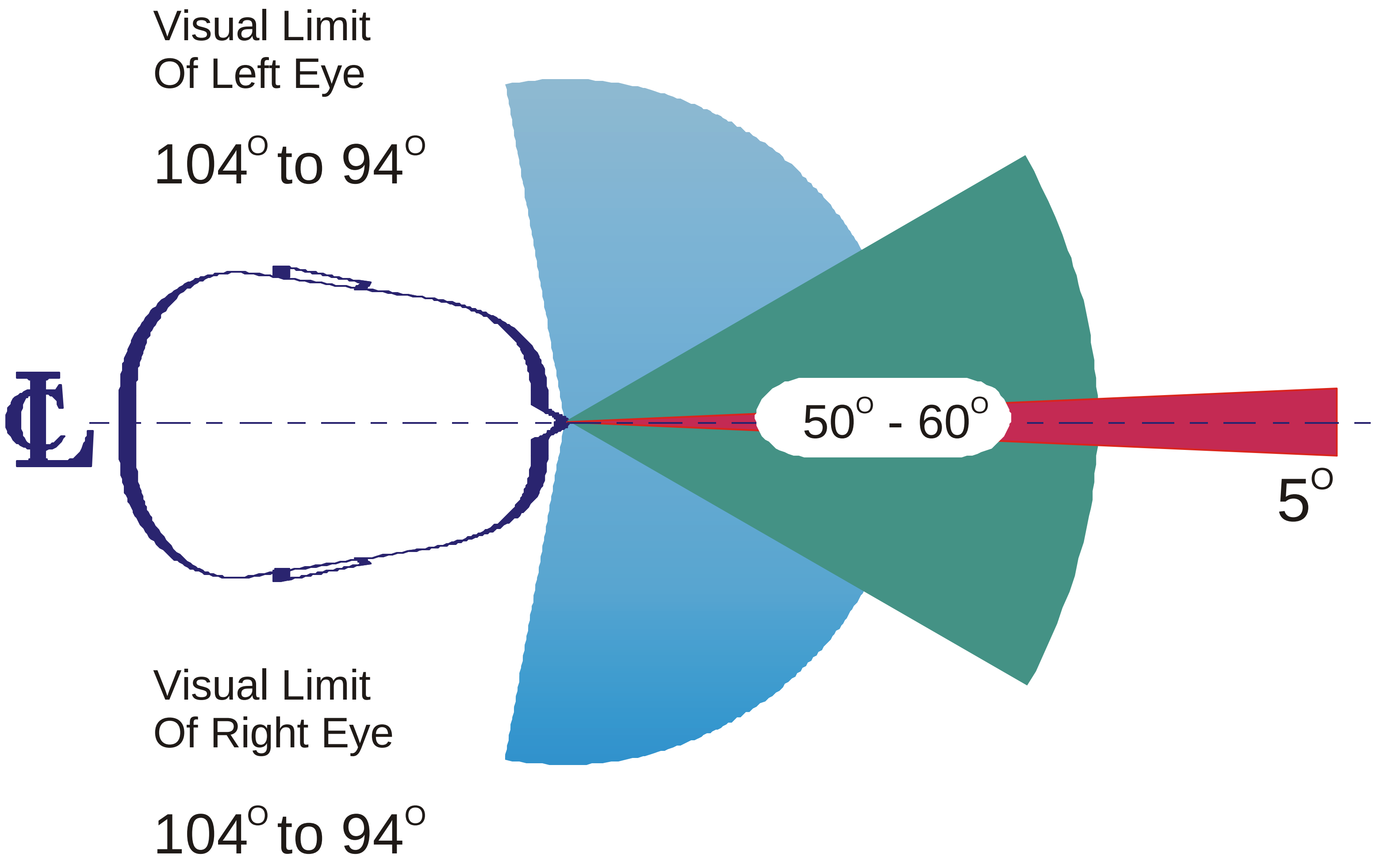
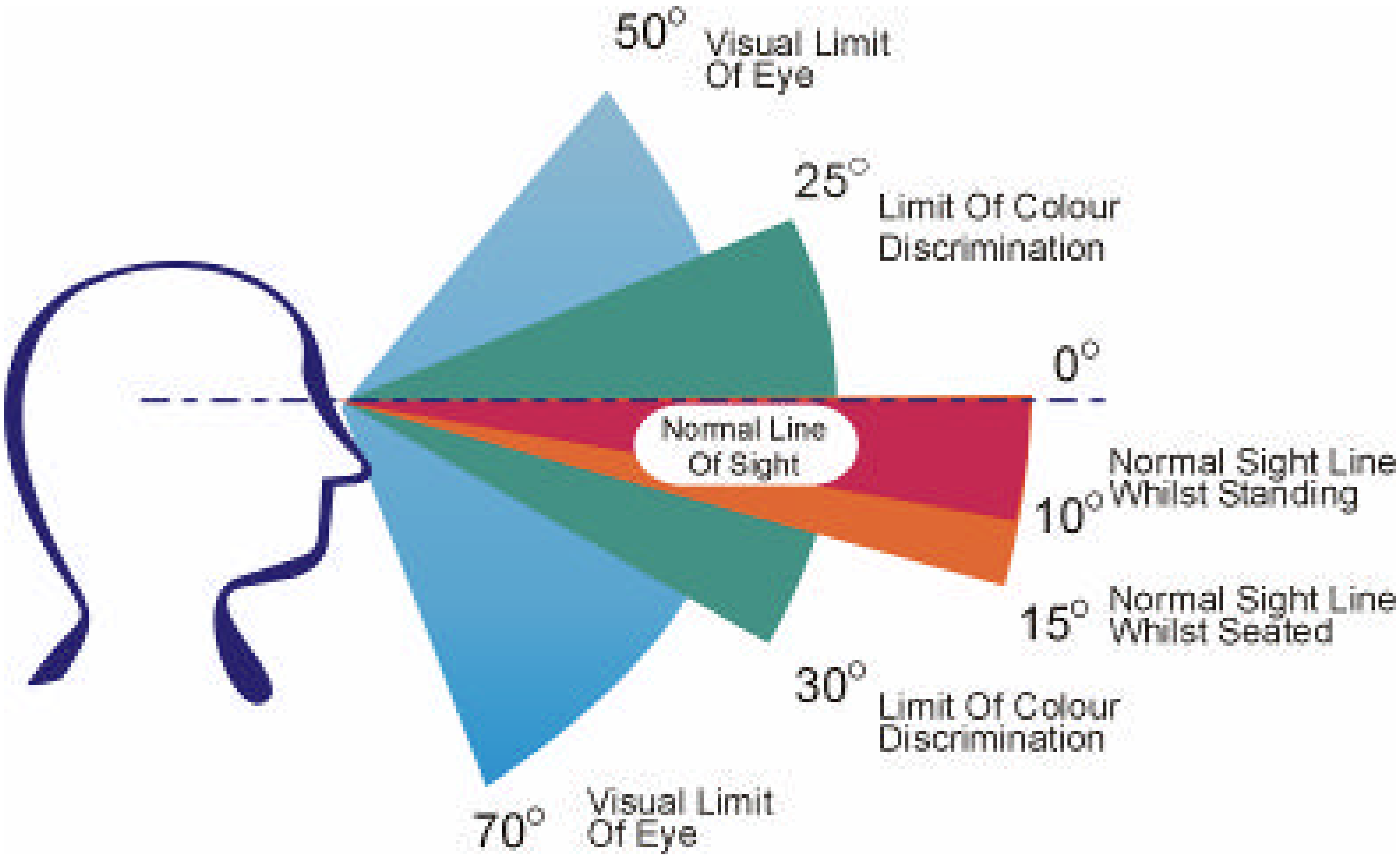


Figure 10.22: Vertical Field of View



Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURES 10. 21 AND 10.22**
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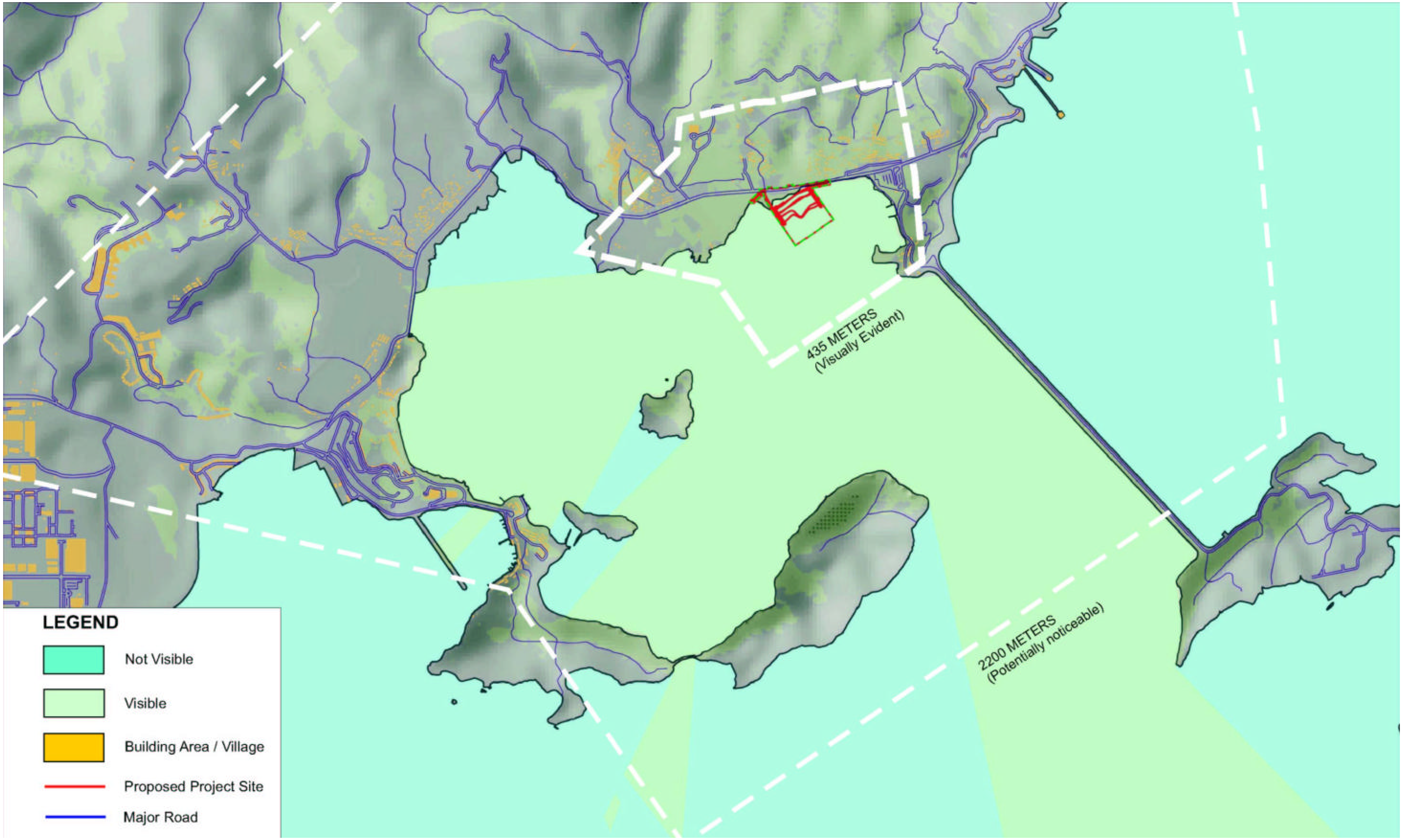

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title: GIS VIEWSHED MAP

FIGURE 10.23

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Figure 10.24: Hong Kong Weather (Source: Hong Kong Observatory)

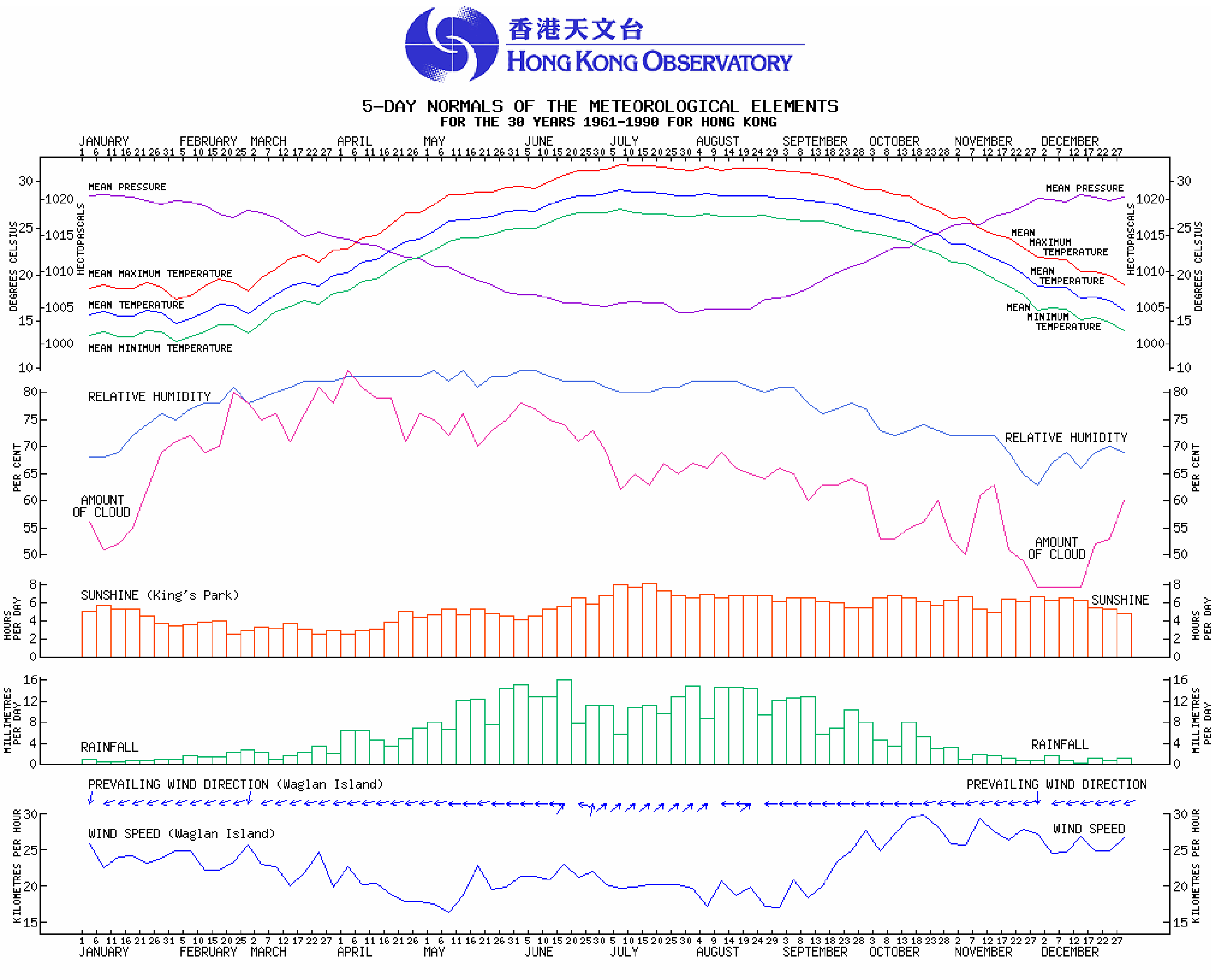
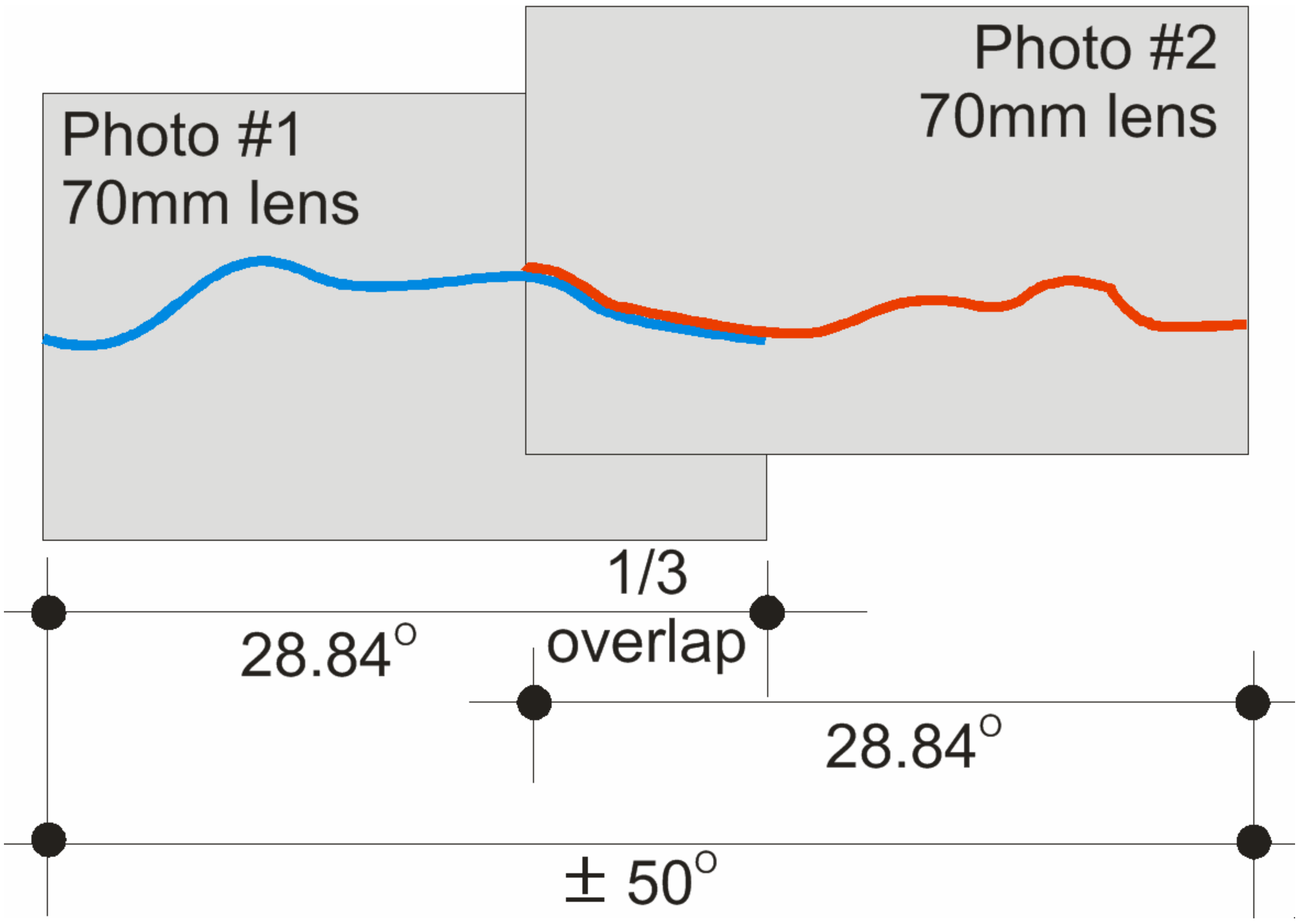


Figure 10.25: Photomontage Preparation



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DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
VISUAL SENSITIVE RECEIVERS LOCATION

FIGURE 10.26

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Rev.: 2
Designed: SL
Drawn: MT
Date: 08/03/2007

Figure 10.27: VSR 1 Location

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Existing view looking towards the Development from Tai Mei Tuk BBQ area.

View displaying the 3D Model of the Proposed Development Day 1 Operation No Mitigation

View displaying the 3D Model of the Proposed Development Day 1 Operation with Mitigation

View displaying the 3D Model of the Proposed Development Year 10 Operation with Mitigation

Figure 10.28
Photomontage
Visually Sensitive Receiver 1
View from Tai Mei Tuk BBQ Area

Visually Sensitive Receiver 1

GPS: Easting:	114 13' 55.11"
Northing:	22 28' 07.58"
Grid X:	842192.1878
Grid Y:	836416.57659
Distance from development:	380 meters

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURES 10.28**
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Figure 10.29: VSR 2 Location

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EXISTING VIEW LOOKING TOWARDS THE DEVELOPMENT FROM LUNG MEI RESIDENTS.

VIEW DISPLAYING THE 3D MODEL OF THE PROPOSED DEVELOPMENT DAY 1 OPERATION NO MITIGATION

VIEW DISPLAYING THE 3D MODEL OF THE PROPOSED DEVELOPMENT DAY 1 OPERATION WITH MITIGATION

VIEW DISPLAYING THE 3D MODEL OF THE PROPOSED DEVELOPMENT YEAR 10 OPERATION WITH MITIGATION

FIGURE 10.30
PHOTOMONTAGE
VISUALLY SENSITIVE RECEIVER 2
VIEW FROM LUNG MEI RESIDENTS

VISUALLY SENSITIVE RECEIVER 2

GPS: EASTING:	114 13' 45.15"
NORTHING:	22 28' 19.87"
GRID X:	841907.30127
GRID Y:	836794.52714
DISTANCE FROM DEVELOPMENT:	75 METERS

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Figure 10.31 VSR 3 Location

EXISTING VIEW LOOKING TOWARDS THE DEVELOPMENT FROM BBQ'S WEST OF SITE.

VIEW DISPLAYING THE 3D MODEL OF THE PROPOSED DEVELOPMENT DAY 1 OPERATION NO MITIGATION

VIEW DISPLAYING THE 3D MODEL OF THE PROPOSED DEVELOPMENT DAY 1 OPERATION WITH MITIGATION

VIEW DISPLAYING THE 3D MODEL OF THE PROPOSED DEVELOPMENT YEAR 10 OPERATION WITH MITIGATION

FIGURE 10.32
PHOTOMONTAGE
VISUALLY SENSITIVE RECEIVER 3
VIEW FROM BBQ'S WEST OF SITE

VISUALLY SENSITIVE RECEIVER 3

GPS: EASTING:	114 13' 29.94"
NORTHING:	22 28' 12.69"
GRID X:	841472.52803
GRID Y:	836573.52483
DISTANCE FROM DEVELOPMENT:	200 METERS

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 10.32**
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Figure 10.33 VSR 4 Location

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Existing view looking towards the Development from Lo Tsz Tin Residents.

View displaying the 3D Model of the Proposed Development Day 1 Operation No Mitigation

View displaying the 3D Model of the Proposed Development Day 1 Operation with Mitigation

View displaying the 3D Model of the Proposed Development Year 10 Operation with Mitigation

Figure 10.34
Photomontage
Visually Sensitive Receiver 4
View from Lo Tsz Tin Residents

Visually Sensitive Receiver 4

GPS: Easting:	114"13'37.10
Northing:	22"28'20.67"
Grid X:	841423.674483
Grid Y:	836988.525146
Distance from development:	80 meters

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURES 10.34**
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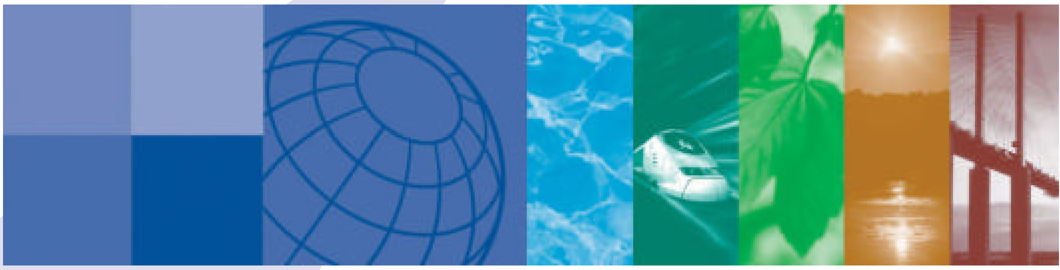
AGREEMENT NO. CE 59/2005 (EP)
Development of a Bathing Beach at Lung Mei, Tai Po
Environmental, Drainage and Traffic Impact
Assessments - Investigation
Environmental Impact Assessment Report
Volume II – Appendices

November 2007



**The Government of Hong Kong Special
Administrative Region
Civil Engineering and Development Department
Port Works Division**

Halcrow

Volume I – MAIN TEXT

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APPENDIX B	**Wave and Sediment Modelling Report (September 2007) [Appendices not included]**
APPENDIX C	**Proposed Sequencing of Works**
APPENDIX D	**Noise Assessment Supporting Information**
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APPENDIX H	**Tree Survey Data**
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Appendix A

Assessment of Option Layouts

[Extracted from Feasibility Study for Proposed Beach Improvement Works at Lung Mei Beach – Final Report (June 2001)]

3. PRELIMINARY LAYOUT DESIGN

3.1 Introduction

3.1.1 According to design specification as stipulated in the Study Brief, the improvement work includes construction of sand retaining structures, seawalls, laying of imported sand on seashore and provides a beach area of 6,000 sq.m. above high water mark and a parking area for 200 cars which has been subsequently reduced to 105 due to site constraint. A beach building providing changing facilities for visitors will be constructed on the reclamation land. The design capacity of the beach is 2,000 per day with a maximum load of up to 4,000 to cater for the peak period.

3.1.2 An extensive area of mangrove fed by several streams stretches along the coast to the west of Lung Mei to Ting Kok. The avoidance of potential impact on this mangrove area is a major concern. The most significant part of this falls within the Ting Kok Site of Special Scientific Interest (SSSI) whose eastern boundary is about 500m west of the proposed site.

3.2 Option layouts

3.2.1 Several options of beach layout have been investigated to meet the above requirements and constraints. After evaluation, the selected option has been chosen for more detailed modelling and study.

3.2.2 The key parameters used for the design of option layouts are shown in **Table 3-1**. As some of these parameters are not specified in the Study Brief, relevant information is taken from other beaches as reference to work out the corresponding requirements.

Table 3- 1 : Design Parameters for Option Layouts

Parameter	**Requirements/ Assumptions**
Forecasted number of user	The Study Brief specifies the estimated numbers of users are 2,000 and 4,000 nos. per day for non-swimming and swimming season respectively.
Dry sand area	The dry sand area is interpreted as the area at elevation above the highest watermark. It is stated in the Study Brief that a beach area of 6,000 sq.m above high water mark is required. As it is assumed that 4000 beach goers in the swimming season, the dry sand area is estimated to be 1.5 sq.m per bather. There is no formally established standard for occupation area of dry sand beach per bather in Hong Kong. In the United States of America, a rule of thumb of 7 to 9 sq.m of dry beach per bather is used. This figure is considered high, given the population density and living standard between Hong Kong and the States are significant different. A comparison is therefore made to other beaches in Hong Kong, it is found that the figure of 1.5 sq.m per bather is higher than those of the existing beaches at Casam, Kiu Tsui, Turtle Cove and Big Wave Bay.
Car park spacing	The Study Brief specifies that 200 no. car pots are required.
Floor area of facilities house	No standard and guideline has been published for reference. The relevant figures of the existing beach at Casam are therefore used as a reference.

3.2.3 Various constraints on the beach location and option layouts have been identified. These constraints are summarised in **Table 3-2**:

Table 3- 2 : Constraints on Design of Optional Layout

Boundaries of Proposed Beach	**Constraints**
East	Seawall along Tin Kok Road and stormwater outfalls being constructed. A lay-by for bus stop is to be built adjacent to the seawall under the project of Ting Kok Road upgrading work. There is the nearest boundary line in a distance of 500m away the existing pond designated as conservative area.
South	Cost and quantity of borrow materials for sand filling onto the beach become higher as beach extend further to the south. The shoreline of the beach extension would be susceptible to higher erosion, especially during typhoon period. It is better to minimise the extension to south in order to provide more buffer distance between the sand beach and the existing activity zone designated by Tai Mei Tuk Water Sport Centre. More existing mooring facilities would be required to be relocated as the beach extends in south.
West	It is required to minimise the impact of the beach improvement works on the potential seasonal wetland and the proposed beach should be kept away from the SSSI as far as possible. The existing natural stream mentioned above is a natural barrier to beach users. If any beach improvement works encroach into the stream, it would disturb or damage the existing ecological important area. (Note: This constraint makes the equilibrium orientation of the proposed beach shoreline not in the order of 140 to 150^0N as suggested in the Hydraulic Modelling Studies) ?
North	Seawall being constructed along Ting Kong Road forming a natural boundary.

3.2.4 The above design parameters and site constraints have been duly considered. The location of the proposed beach is confined within the region to the east of the existing Lo Tsz stream and committed box culvert outfall at east of the beach site. Four option layouts are evaluated as shown in **Figure Nos. 3-1, 3-2, 3-3** and **3-4** with reference to the above criteria. It should be noted that there is no significant variation of the location of the proposed beach as the various site constraints depict its location.

3.2.5 The option layouts therefore focus on different orientations of car park, beach building, sea wall requirements, etc in order to facilitate the beach users, reduce construction cost and minimise the environmental and engineering impacts.

3.2.6 It is anticipated that the key construction activities for the proposed beach will include:
- dredging and sand borrowing and filling;
- decking for car park area;
- construction of beach building;
- construction of an engineering channel to divert the Lo Tsz stream;
- diversion of the existing outfall(s) that are protruding into the existing beach area;
- construction of a seawall to protect car park decking (optional); and
- construction of groins to enhance stability of sand filling (optional).

3.2.7 For all options, it is recommended to provide about 10m wide buffer zone with soft or hard landscape on the beach area to screen the ancillary facilities such as carriageway, car park and beach building off the sand area.

3.2.8 It is to be noted that the profiles of high water mark for all beach layouts are indicative only. Their exact shapes depend on the specific conditions at the site, e.g. the variations in the wave climate. The beach orientation will in the long run adapt to changes in the local wave climate. This means that the shape of the beach would show some variation with the season if the prevailing wave direction is different. It is therefore necessary to carry out a computation of the long-shore sediment transport based on the normal wave climate in order to give a better indication of the orientation (e.g. shape) and to provide further guideline for the beach layout.

3.3 Option Evaluation

3.3.1 The comparison is based on an evaluation of the following factors:

- utilisation of beach area and facilities
- extent of sand filling work on the seaward
- sand stability control
- construction cost
- impact on environment
- air pollution to beach users
- traffic circulation
- channelisation of natural stream and maintenance.

3.3.2 Considering the various pros and cons listed in **Table 3-3**, we have recommended that Option 1 is to be adopted for further investigation and development. This option has a better utilisation of the beach area and the extent of sand filling work on seaward is smaller than that required for Options 2 and 3. The sand stability is better control with the provision of a groin. The construction cost is moderate in comparison with those required for options 2 and 3. As regards the potential nuisance of traffic air to the beach users, a wider buffer zone with appropriate landscaping would reduce the impact.

3.3.3 Further development on Option 1 revealed that a better balance of the areas between the proposed sandy regions and car park site was required. The number of car parking stalls was consequently reduced from 200 to 105. In addition, the car park site and beach building were shifted eastward to avoid decking over the Lo Tsz Stream. The final recommended beach layout is shown in **Figure 3-5**. The car park and beach building layouts are shown in **Figure Nos. 3-6** and **3-7** respectively.

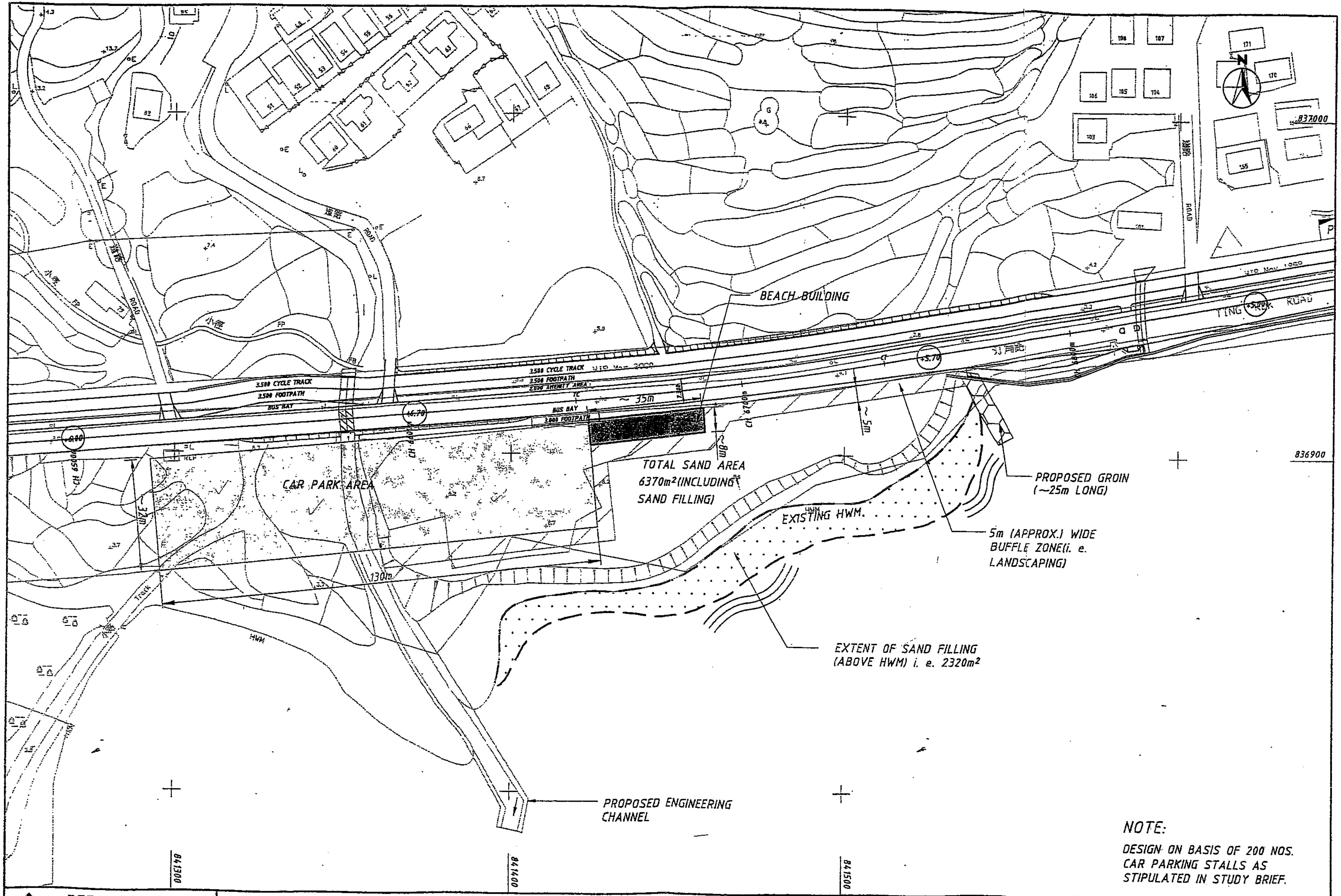
Table 3- 3 : Comparison for Proposed Beach Option Layouts above Highest Water Mark

Review on	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Utilisation of beach area and facilities	As the car park sets back from the beach area, a longer waterline is provided, this may be of interest from recreation point of view. Eastern half of parking area to be probably occupied first, as it is closer to the facilities house and the beach area. Longer walk is required for other users coming late.	The car park is close to the main beach area. It is more convenient for beach users. As compared to Option 1, the facilities house has a longer distance to the main beach area. Also a shorter waterline is provided.	The car park is split into two portions and the facilities house is located at midway between the two parking areas. It is convenient for beach users to park their cars and access to the facilities house. The facilities house is close to the main beach area; however, a shorter waterline is provided as compared to Option 1.	Two rows instead of four car pots are provided. This provides more usable beach area, and results in a long waterline. Eastern half of parking area to be probably occupied first. Longer walk from west of the car park area for other users coming late
Extent of sand filling work on seaward	Approximate 2,000m^2	Approximate 4,000m^2	Approximate 4,000m^2	Approximate 2,000m^2
Sand stability control	Better because of presence of revetment or groin.	Wave turbulence likely created at southeast corner of car park resulting in local scouring and increasing the loss of sand. A groin may be required to overcome this situation.	Same as Option 2	A groin likely to be required to prevent the loss of sand.
Construction cost	Moderate. Groin construction is required.	Expensive because of seawall construction and either regular replenishment of sand or provision of a groin.	Same as Option 2	Cheaper.

Review on	Option 1	Option 2	Option 3	Option 4
Impact on environment	Construction of car park decking close to the SSSI and wetland.	A longer distance to the SSSI and wetland.	Same as Option 2	Same as Option 1
Air pollution to beach user due to traffic at Ting Kok Road	Poor because sand area closed to Ting Kok Road.	Better because of car park area and the facilities house shield away the Road	Same as Option 2	Same as Option 2
Traffic control	Better traffic circulation flow inside car park. Alternative route available for diversion traffic flow if one of the routes is blocked.	Same as Option 1	Same as Option 1 but increase in junctions of car park exit and entrance interfere the traffic flow at Ting Kok Road	Poor traffic circulation inside car park.
Channelisation of natural stream and maintenance	A section of some 35 m long channel will be decked. Maintenance of the decked channel may be of concern.	Channel will not be decked.	Same as Option 2	Same as Option 1

Appendix A1

Figures for Beach Option Layouts



NOTE:

DESIGN ON BASIS OF 200 NOS. CAR PARKING STALLS AS STIPULATED IN STUDY BRIEF.

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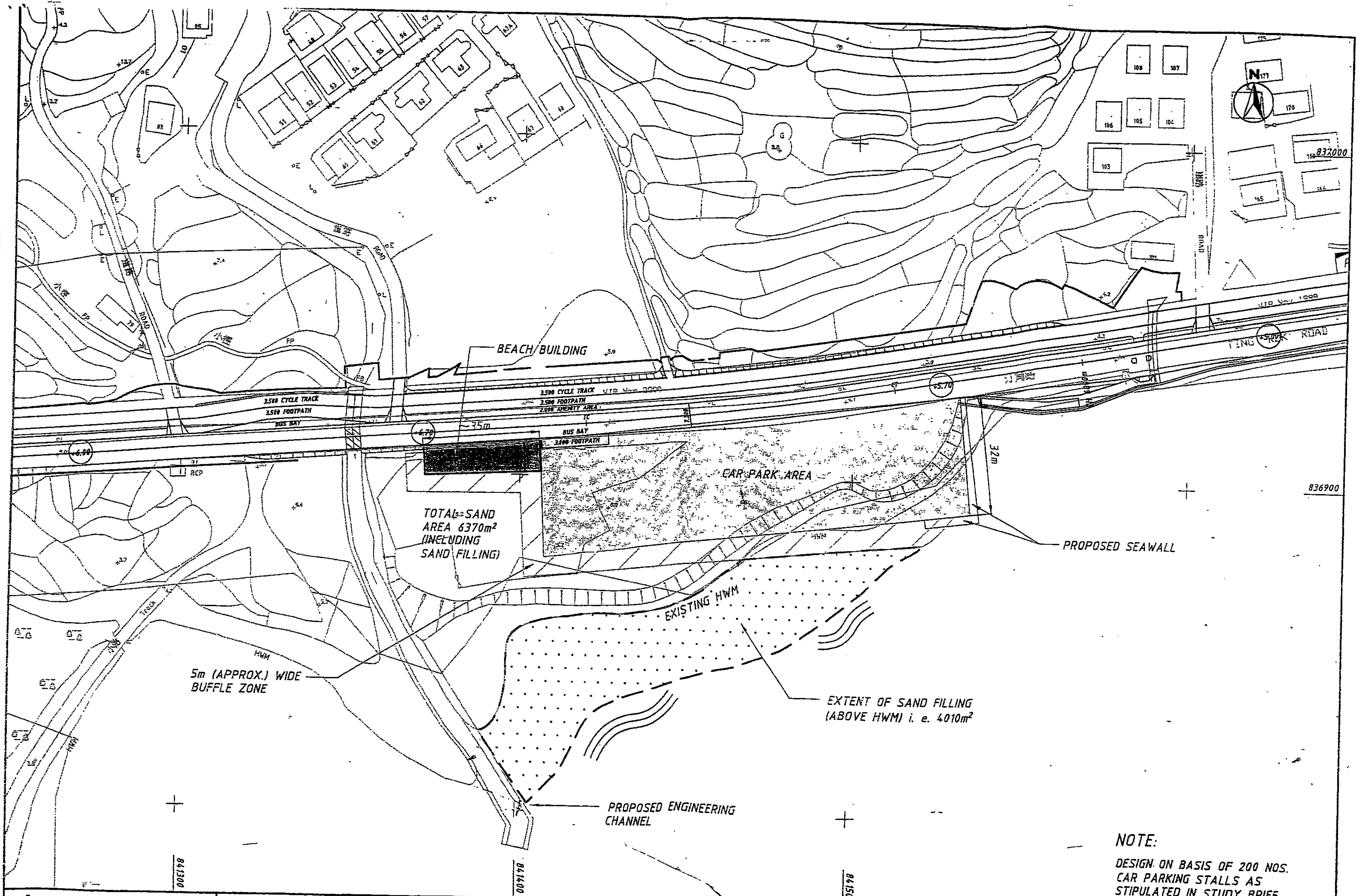
FEASIBILITY STUDY FOR PROPOSED BEACH IMPROVEMENT WORK AT LUNG MEI BEACH

PROPOSED BEACH LAYOUT - OPTION 1

SCALE	1:1000	DATE	JUNE 2001		
CHECK	-	DRAWN	TSG		
JOB No.	97099	FIGURE No.	3-1	REV	-



NOTE:

DESIGN ON BASIS OF 200 NOS. CAR PARKING STALLS AS STIPULATED IN STUDY BRIEF.

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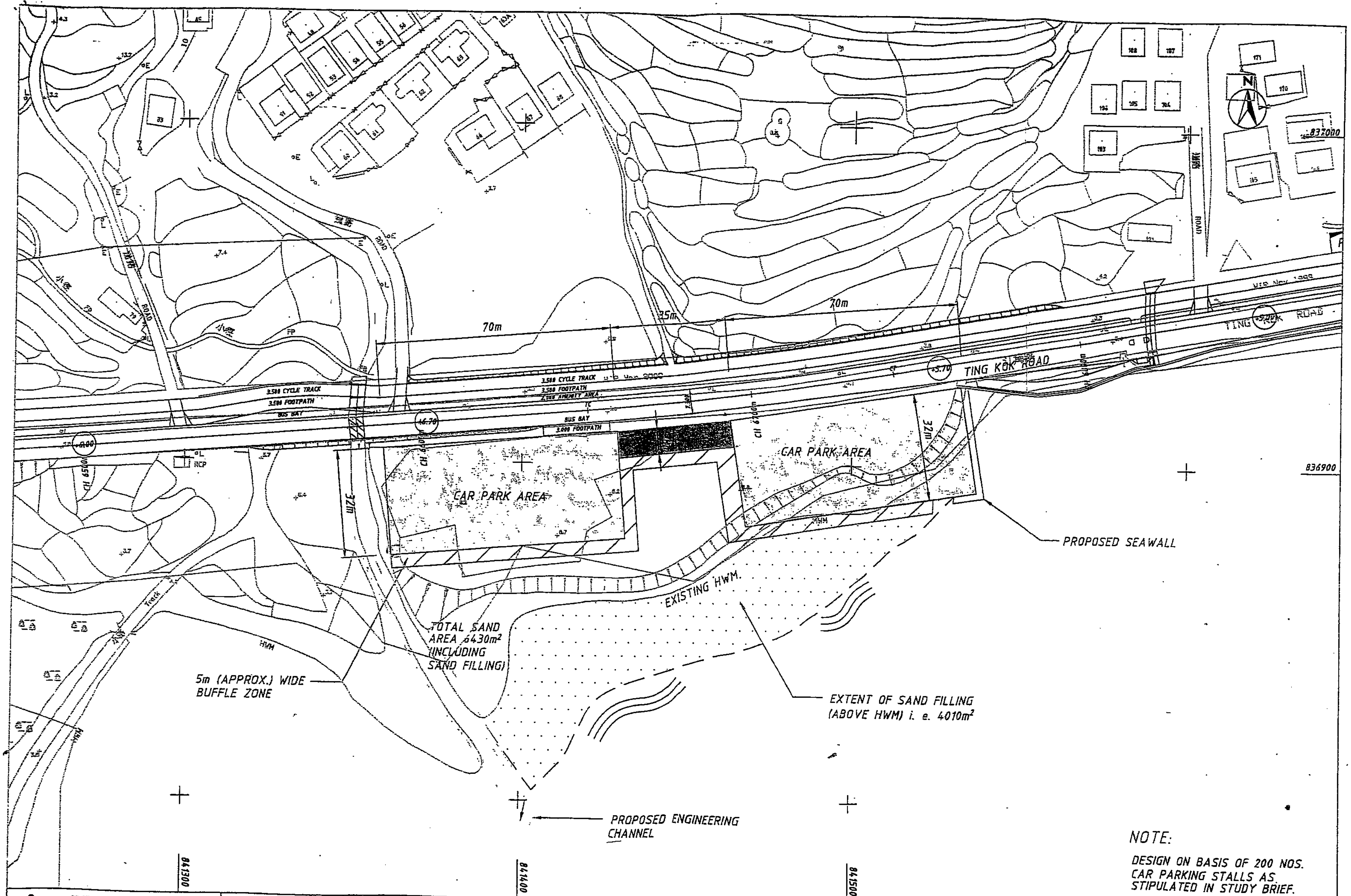
FEASIBILITY STUDY FOR PROPOSED BEACH IMPROVEMENT WORK AT LUNG MEI BEACH

PROPOSED BEACH LAYOUT - OPTION 2

SCALE	1:1000	DATE	JUNE 2001
CHECK	-	DRAWN	TSG
JOB No.		FIGURE No.	



NOTE:

DESIGN ON BASIS OF 200 NOS. CAR PARKING STALLS AS STIPULATED IN STUDY BRIEF.

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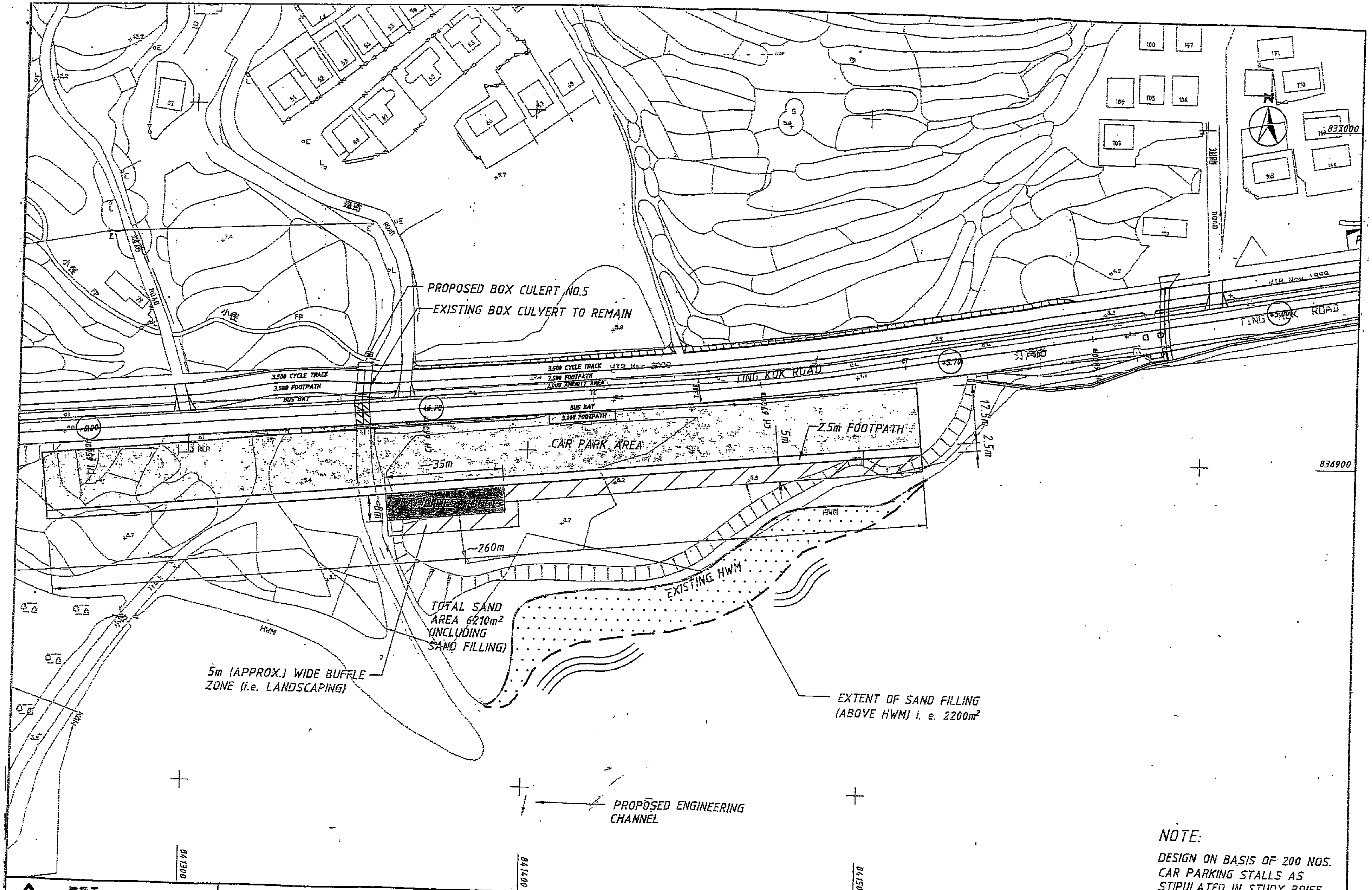
FEASIBILITY STUDY FOR PROPOSED BEACH IMPROVEMENT WORK AT LUNG MEI BEACH

PROPOSED BEACH LAYOUT - OPTION 3

SCALE	1:1000	DATE	JUNE 2001	
CHECK	-	DRAWN	TSG	
JOB No.	97099	FIGURE No.	3.3	REV



NOTE:

DESIGN ON BASIS OF 200 NOS.
CAR PARKING STALLS AS
STIPULATED IN STUDY BRIEF.

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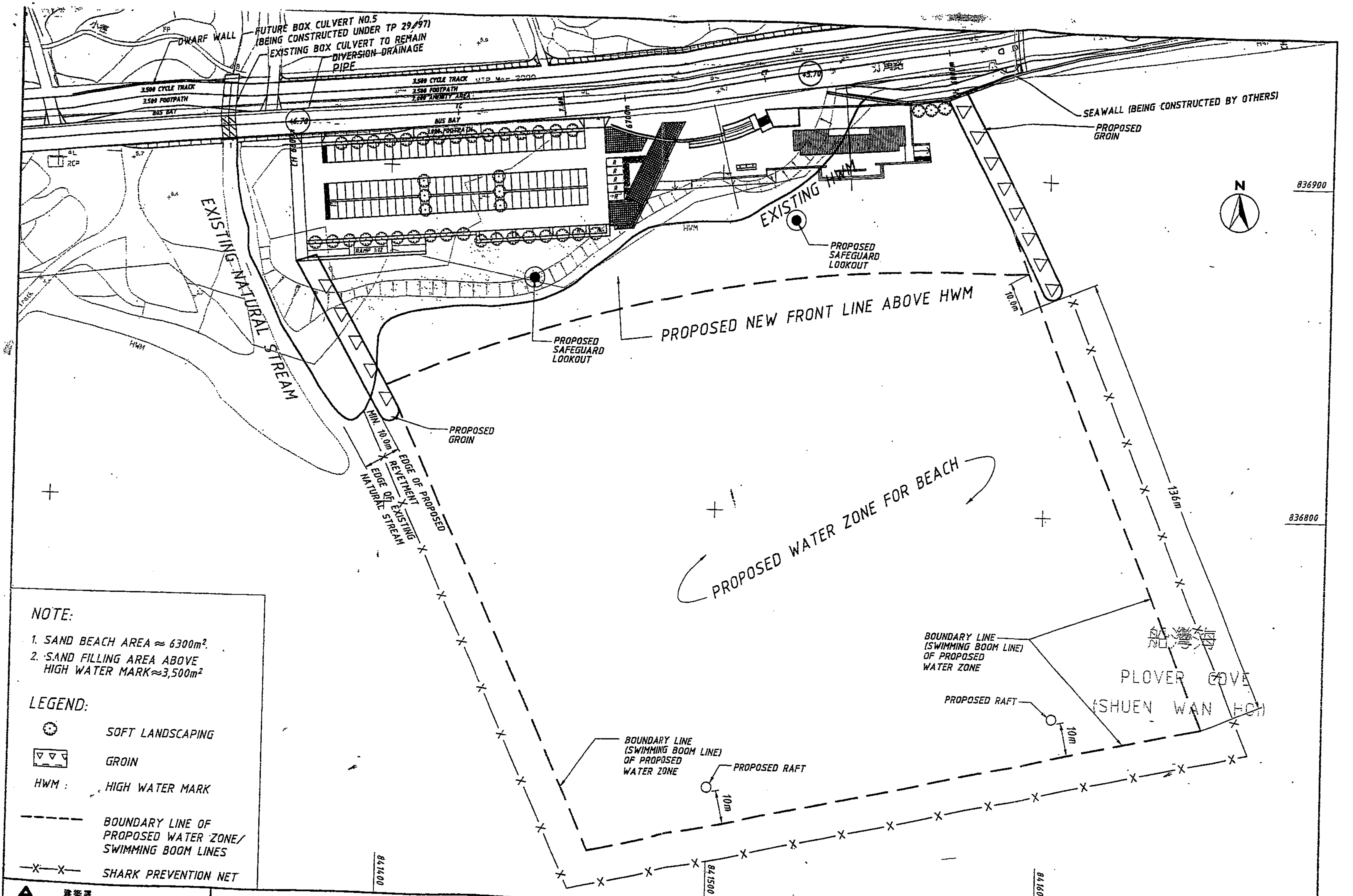
FEASIBILITY STUDY FOR PROPOSED BEACH IMPROVEMENT WORK AT LUNG MEI BEACH

PROPOSED BEACH LAYOUT - OPTION 4

SCALE	1:1000	DATE	JUNE 2001
CHECK	–	DRAWN	TSG
JOB No.	97099	FIGURE No.	3-4
		REV	–

P:\PROJECTS\97099\DWG\3-4.DWG



NOTE:

1. SAND BEACH AREA ≈ 6300m².
2. SAND FILLING AREA ABOVE HIGH WATER MARK≈3,500m²

LEGEND:

◌	SOFT LANDSCAPING
▽▽▽	GROIN
HWM :	HIGH WATER MARK
– – – –	BOUNDARY LINE OF PROPOSED WATER ZONE/ SWIMMING BOOM LINES
—X—X—	SHARK PREVENTION NET

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FEASIBILITY STUDY FOR PROPOSED BEACH IMPROVEMENT WORK AT LUNG MEI BEACH

RECOMMENDED BEACH LAYOUT

SCALE	1:1000	DATE	JUNE 2001
CHECK	-	DRAWN	TSG
JOB No.	97099	FIGURE No.	3-5
		REV	-

Q:\PROJECTS\97099\DWG\3-5.DWG

Appendix B

Wave and Sediment Modelling Report (September 2007)

[Appendices not included]

Halcrow China Limited

AGREEMENT NO. CE 59/2005 (EP)
Development of a Bathing Beach at Lung Mei, Tai Po
Environmental, Drainage and Traffic Impact
Assessments - Investigation

Working Paper 2.5 - Wave and Sediment Modelling Report

September 2007

The Government of Hong Kong Special Administrative Region
Civil Engineering and Development Department
Port Works Division

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 General

Civil Engineering and Development Department (CEDD) has appointed Halcrow China Limited to provide Consultancy Services in respect of the "Development of a Bathing Beach at Lung Mei, Tai Po – Environmental, Drainage and Traffic Impact Assessments – Investigation" under Agreement No. CE 59/2005 (EP), hereafter called "the Assignment"

Part of the Assignment is to look at the wave, tidal flow and sediment transport of the proposed bathing beach at Lung Mei, therefore, this working paper describes our verification of the work carried out in the feasibility study and our latest findings due to current data and information.

1.2 Brief Description of Project

The Assignment is to carry out detailed investigations for the development of a bathing beach at Lung Mei of Tai Po. The proposed site is at the seaside of Lung Mei and adjacent to a prominent leisure site, Tai Mei Tuk, with well-established facilities for holiday-makers and water-based recreation activities. However, in order to provide public swimming at Lung Mei, the proposed works include the development of a 200m long recreational beach, with the rate of loss of beach material controlled by the use of two groynes, a beach building, a car park, construction of retaining walls, drainage diversion works and other ancillary facilities.

A plan is presented on Figure 1.1, showing the location of the bathing beach and the study area.

1.3 Objectives

The objective of this working paper is to investigate and verify Delft's 'preferred option' and with current data and information, to progress to preliminary design of beach and groyne structures. The preliminary design of the beach and groyne structures will be discussed in a separate report, Working Paper 3.0 – Study of Alternative Options.

In the feasibility stage, Delft Hydraulics (Delft) had carried out a study of the Lung Mei beach based on numerical modelling of wave, tidal flow and sediment transport. Delft's work was presented in the April 2001 report 'Beach Improvement at Lung Mei Beach'. Therefore, in order to verify Delft's work, we used the information of wind data from the Delft Report, wind data from Tai Mei Tuk Station (2000-2006), extreme wind data from Port Works Design Manual, surveyed beach profiles, fetch lengths and sediment size and carried out limited modelling work. The locations of the wind data station is indicated on Figure 1.1. Consequently, our modelling results have been used to check Delft's modelling results.

Our independent modelling work included the following:

- Wave hindcasting based on the local wind data.
- Cross-shore sediment modelling using COSMOS.
- Long-shore sediment modelling based on wave and sediment data.

Subsequently, comparison of our modelling results with Delft's modelling results has been carried out. Therefore, conclusions have been drawn from the comparison.

Figures of the study area are shown in Figures 1.1 and 1.2. Figure 1.1 presents the overall location of the proposed beach development, Figure 1.2 shows the extent of various potential wave fetch length angles that apply to the location of the proposed beach development.

1.4 Structure of this report

The structure of this working paper is divided in the following sections:

- Section 2 describe the wave modelling
- Section 3 talks about the long shore modelling.
- Section 4 discusses the cross-shore modelling
- Section 5 gives the conclusion of the working paper.

2. WAVE MODELLING

2.1 Wave Hindcasting

According to the Delft report, there was no wave data available for the Lung Mei beach in their study. However, there are local wind data now available. Delft therefore carried out a hindcast analysis to generate the local wave climate. Using the same wind information, we have carried out an independent hindcasting analysis.

Since no measured wave data are available, the wave climate must be synthesised from a long term time series of measured wind data or from a wind frequency table, by a process known as hindcasting. In this process the characteristics of the waves arriving at the model boundary depend upon the wind speed, the period of time for which it has been blowing in that direction, the water depth, and the length of water across which it has been blowing (the 'fetch' length), which in turn is a function of the wind direction and the geography of the region. The result of this process is a time series or a frequency distribution of wave height and direction at the defined model boundary, which may be analysed for extreme events and to obtain a scatter plot of frequency of occurrence by wave height and direction, which identifies the wave conditions to use as boundary conditions for the area model. For this project the wave hindcasting results can be used directly for design purpose. The local wind data for the Lung Mei beach from the Delft Report is shown in Table 2.1. The wind rose for this data is provided in Figure 2.1.

Table 2.1 Probability of wind occurring in the given speed and direction sectors at Tai Po Kau (in %).

Wind Speed	**Wind direction [°N]**												
[m/s]	**0**	**30**	**60**	**90**	**120**	**150**	**180**	**210**	**240**	**270**	**300**	**330**	**Total**
<0.5	1.28	.26	.31	.68	.24	.60	.79	.88	.75	.97	.53	.53	7.83
0.5 – 1.8	.46	.47	1.40	3.57	3.65	7.25	4.74	1.55	1.77	2.23	.83	.59	28.50
1.8 – 3.3	.30	.27	1.66	8.97	6.98	3.31	4.18	.66	1.28	4.18	1.28	.69	33.76
3.3 – 5.4	.22	.14	1.64	8.98	5.71	.36	.24	.79	.13	2.12	2.80	.61	23.73
5.4 – 8.5	.04	.01	.22	3.79	.90	.01	.01	.04	.07	.11	.79	.01	6.03
8.5 – 11.0	.04			.10						.01			.15
Total	2.33	1.16	5.23	26.08	17.47	11.53	9.97	3.93	4.00	9.63	6.22	2.43	100.00

Note: Wind data are retrieved from Appendix A12: Hydraulic Modelling Study Report of 128ML – Feasibility Study for Proposed Beach Improvement Works at Lung Mei Beach, Tai Po. (April 2001).

The wind data in Table 2.1 were used to generate local wave data. The hindcast modelling was carried out using Jonswap method, which is recommended by the latest Costal Engineering Manual, and provides the basis for our analysis. For shallow water, evidence from Bouws et al. (1985) indicates that wave spectra in shallow water do not appear to have a noticeable dependence on variation in bottom sediments. Consequently, it is recommended that the deepwater wave growth formulae (Jonswap) be used for all depths, with the constraint that no wave period can grow past a limiting value as shown by the equation Tp=9.78(d/g)^0.5, where d is the water depth. The hindcasting results are shown in Table 2.2. The wave rose for this data is provided in Figure 2.2.

Table 2.2 Local wave conditions from wave hindcasting results for the proposed beach development

	Wind direction (deg. N)											
Wind speed	**90**			**105**			**120**			**135**		
[m/s]	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%
<0.5	0.01	0.38	0.34	0.01	0.41	0.23	0.01	0.41	0.12	0.01	0.69	0.21
0.5-1.8	0.02	0.58	1.79	0.02	0.63	1.81	0.02	0.63	1.83	0.05	1.05	2.73
1.8-3.3	0.04	0.71	4.49	0.04	0.77	3.99	0.04	0.77	3.49	0.09	1.29	2.57
3.3-5.4	0.06	0.84	4.49	0.07	0.91	3.67	0.07	0.91	2.86	0.14	1.52	1.52
5.4-8.5	0.09	0.98	1.90	0.10	1.06	1.17	0.10	1.06	0.45	0.22	1.77	0.23
8.5-11	0.12	1.06	0.05	0.13	1.15	0.03	0.13	1.15	0.00	0.29	1.93	0.00

	Wind direction (deg. N)											
Wind speed	**150**			**165**			**180**			**195**		
[m/s]	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%
<0.5	0.02	0.84	0.30	0.01	0.55	0.30	0.01	0.57	0.30	0.01	0.66	0.42
0.5-1.8	0.06	1.28	3.63	0.03	0.85	3.63	0.04	0.87	3.63	0.04	1.01	1.57
1.8-3.3	0.12	1.57	1.66	0.06	1.03	1.66	0.07	1.07	1.66	0.08	1.23	1.21
3.3-5.4	0.19	1.85	0.18	0.10	1.22	0.18	0.11	1.26	0.18	0.13	1.45	0.26
5.4-8.5	0.30	2.15	0.01	0.16	1.42	0.01	0.17	1.47	0.01	0.21	1.69	0.01
8.5-11	0.39	2.34	0.00	0.21	1.55	0.00	0.22	1.60	0.00	0.27	1.84	0.00

	Wind direction (deg. N)								
Wind speed	**210**			**225**			**240**		
[m/s]	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%
<0.5	0.01	0.60	0.44	0.01	0.63	0.41	0.01	0.66	0.41
0.5-1.8	0.04	0.92	0.78	0.04	0.96	0.83	0.04	1.01	0.83
1.8-3.3	0.07	1.13	0.33	0.08	1.18	0.49	0.08	1.24	0.49
3.3-5.4	0.12	1.33	0.40	0.12	1.39	0.23	0.13	1.46	0.23
5.4-8.5	0.18	1.55	0.02	0.20	1.62	0.03	0.21	1.70	0.03
8.5-11	0.24	1.69	0.00	0.25	1.76	0.00	0.27	1.85	0.00

Notes: Wave information where the percent occurrence is zero is not included in the analysis.

Wave conditions are calculated using Jonswap based on wind data presented in Appendix A12: Hydraulic Modelling Study Report of 128ML – Feasibility Study for Proposed Beach Improvement Works at Lung Mei Beach, Tai Po. (April 2001).

Comparison between the Delft wave conditions (Table 4.4 of the Delft report) and the present wave conditions in Table 2.2 show that the dominant wave direction is from 90° to 120° according to our results, but a dominant wave direction of 120° to 150° is found from the Delft Report. The maximum wave height from the Delft work is 0.24m, which is slightly lower than what we ascertain, which is 0.30m. The maximum wave period from the Delft work is 1.75s, which is also slightly lower than our result of 2.15s. There is no detailed description of the hindcasting work in the Delft Report. It is therefore difficult to comment further on the normal wave conditions generated in the Delft Report. However, Delft's wave conditions were used in the Delft study of the long-shore sediment transport modelling. Further comments are given in the Section 4 for comparison of the Delft long-shore sediment transport results and our modelling results.

In order to better analyse the local generated waves at the Lung Mei beach, further wind records have been obtained from Tai Mei Tuk station. Those wind data are shown in Table 2.3. (see Figure 2.3 for the wind rose of this data) The original wind data were recorded at 55m high above the mean sea level and the wind speeds are daily averaged speeds. Those wind records are then converted to 10m high above the mean sea level and also converted to hourly mean speeds. Please note that the latest wind records have a dominant direction of 45°. This dominant wind direction is different from the dominant direction of 90° in Table 2.1, which is from the Delft Report.

Table 2.3 Probability of wind occurring in the given speed and direction sectors at Tai Mei Tuk (in %).

Wind Speed	**Wind direction [°N]**												
[m/s]	**0**	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**	**135**	**150**	**165**	**180**
<2.0	0	0	0.2	2.8	1.1	0.3	0.2	0.2	0.6	1.8	0.5	0.3	0
2.0 – 4.0	0	1.6	4.7	18.1	3.9	4	1.9	2.6	1.2	5.1	2.3	0.2	0.1
4.0 – 6.0	0.1	1.8	3.1	4.5	0.8	5.3	3.9	1.9	0.1	0.4	0.2	0	0
6.0 – 8.0	0	0.5	0.9	0.6	0.1	1.4	0.9	0.3	0	0	0	0	0
8.0 – 10.0	0	0.2	0.2	0.1	0	0.7	0.2	0	0	0	0	0	0
10.0 – 12.0	0	0	0	0.1	0	0	0.1	0	0	0	0	0	0
12.0 – 14.0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
Total	0.1	4.1	9.1	26.2	5.9	11.8	7.2	5	1.9	7.3	3	0.5	0.1

Wind Speed	**Wind direction [°N]**											
[m/s]	**195**	**210**	**225**	**240**	**255**	**270**	**285**	**300**	**315**	**330**	**345**	**Total**
<2.0	0	0	0	0.1	2.1	1	0	0	0	0	0	11.2
2.0 – 4.0	0.4	0.3	1.6	1	4.4	1.1	0	0	0	0	0	54.5
4.0 – 6.0	0	0.1	1.3	0.8	1.5	0.2	0	0	0	0	0	26
6.0 – 8.0	0	0	0.4	0.3	0.2	0	0	0	0	0	0	5.6
8.0 – 10.0	0	0	0	0	0	0	0	0	0	0	0	1.4
10.0 – 12.0	0	0	0	0	0	0	0	0	0	0	0	0.2
12.0 – 14.0	0	0	0	0	0	0	0	0	0	0	0	0.1
Total	0.4	0.4	3.3	2.2	8.2	2.3	0	0	0	0	0	99

Note: Wind data are recorded at Tai Mei Tuk station (January 2000 to July 2006).

The latest wind data in Table 2.3 were used to generate another set of local wave data. The hindcast modelling was carried out using the Jonswap method. The hindcasting results are shown in Table 2.4 (see Figure 2.4 for the wave rose of this data).

Table 2.4 Local wave conditions from wave hindcasting results for the proposed beach development

	Wind direction (deg. N)											
Wind speed	**90**			**105**			**120**			**135**		
[m/s]	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%
<2.0	0.02	0.60	0.2	0.02	0.65	0.2	0.02	0.65	0.6	0.05	1.09	1.8
2.0-4.0	0.04	0.76	1.9	0.05	0.82	2.6	0.05	0.82	1.2	0.11	1.37	5.1
4.0-6.0	0.07	0.87	3.9	0.07	0.94	1.9	0.07	0.94	0.1	0.16	1.57	0.4
6.0-8.0	0.09	0.96	0.9	0.10	1.03	0.3	0.10	1.03	0	0.21	1.73	0
8.0-10.0	0.11	1.03	0.2	0.12	1.11	0	0.12	1.11	0	0.26	1.87	0
10.0-12.0	0.13	1.09	0.1	0.15	1.18	0	0.15	1.18	0	0.32	1.98	0
12.0-14.0	0.15	1.15	0	0.17	1.25	0	0.17	1.25	0	0.37	2.09	0

	Wind direction (deg. N)											
Wind speed	**150**			**165**			**180**			**195**		
[m/s]	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%
<2.0	0.07	1.33	0.5	0.04	0.88	0.3	0.04	0.91	0	0.05	1.04	0
2.0-4.0	0.14	1.67	2.3	0.08	1.10	0.2	0.08	1.14	0.1	0.10	1.32	0.4
4.0-6.0	0.21	1.91	0.2	0.11	1.26	0	0.12	1.31	0	0.15	1.51	0
6.0-8.0	0.28	2.11	0	0.15	1.39	0	0.16	1.44	0	0.20	1.66	0
8.0-10.0	0.35	2.27	0	0.19	1.50	0	0.20	1.55	0	0.25	1.79	0
10.0-12.0	0.42	2.41	0	0.23	1.59	0	0.24	1.65	0	0.30	1.90	0
12.0-14.0	0.50	2.54	0	0.27	1.67	0	0.28	1.73	0	0.35	2.00	0

	Wind direction (deg. N)								
Wind speed (m/s)	**210**			**225**			**240**		
[m/s]	H_s	T_p	%	H_s	T_p	%	H_s	T_p	%
<2.0	0.04	0.96	0	0.05	1.00	0	0.05	1.05	0.1
2.0-4.0	0.09	1.21	0.3	0.09	1.26	1.6	0.10	1.32	1
4.0-6.0	0.13	1.38	0.1	0.14	1.44	1.3	0.15	1.51	0.8
6.0-8.0	0.17	1.52	0	0.18	1.58	0.4	0.20	1.66	0.3
8.0-10.0	0.22	1.64	0	0.23	1.71	0	0.25	1.79	0
10.0-12.0	0.26	1.74	0	0.28	1.81	0	0.30	1.91	0
12.0-14.0	0.30	1.83	0	0.32	1.91	0	0.35	2.01	0

Note: Wave conditions are calculated using Jonswap based on wind data of Tai Mei Tuk station (January 2000 to July 2006).

The wave data in Table 2.4 have been used for study of the long-shore sediment transport rate. Further comments are given in Section 4.

2.2 Extreme Wave Conditions

Extreme wind data are available from the Delft report as shown in Table 2.5. These extreme wind conditions are used as input data for hindcast modelling.

Table 2.5 Mean hourly wind speeds in Plover Cove for various return periods (in m/s).

Return	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**
5	14	16	19	16	15	15	13	10
10	16	18	22	20	18	18	15	11
20	18	21	24	24	20	22	18	12
50	20	24	28	28	24	25	21	14
100	22	26	30	30	26	28	23	16
200	24	28	32	34	29	30	25	17

Note: Wind data are retrieved from Appendix A12: Hydraulic Modelling Study Report of 128ML – Feasibility Study for Proposed Beach Improvement Works at Lung Mei Beach, Tai Po. (April 2001).

The extreme wave conditions are then generated and presented in Table 2.6. The fetch length from Figure 1.2 and the extreme wind speeds from Table 2.5 are used for hindcasting calculations.

Table 2.6 Extreme wave heights for the proposed beach development

		Wind direction (deg. N)										
Return period	**Wave height & period**	**90**	**105**	**120**	**135**	**150**	**165**	**180**	**195**	**210**	**225**	**240**
5	H_s	0.21	0.22	0.21	0.37	0.56	0.29	0.30	0.37	0.33	0.35	0.36
	T_p	1.28	1.36	1.33	2.09	2.63	1.73	1.77	2.04	1.87	0.95	2.02
10	H_s	0.24	0.26	0.25	0.42	0.68	0.35	0.36	0.45	0.39	0.42	0.42
	T_p	1.34	1.44	1.42	2.18	2.83	1.84	1.89	2.17	1.99	2.07	2.14
20	H_s	0.26	0.29	0.29	0.48	0.80	0.41	0.40	0.48	0.49	0.51	0.51
	T_p	1.38	1.49	1.49	2.27	2.98	1.93	1.95	2.22	2.15	2.22	2.28
50	H_s	0.30	0.34	0.34	0.53	0.94	0.48	0.48	0.59	0.55	0.58	0.59
	T_p	1.45	1.57	1.57	2.35	3.15	2.04	2.07	2.38	2.23	2.31	2.39
100	H_s	0.33	0.37	0.37	0.58	1.02	0.52	0.52	0.63	0.62	0.65	0.66
	T_p	1.49	1.61	1.61	2.43	3.22	2.09	2.13	2.43	2.32	2.40	2.48
200	H_s	0.35	0.4	0.41	0.63	1.14	0.58	0.58	0.70	0.66	0.69	0.71
	T_p	1.52	1.65	1.67	2.50	3.35	2.18	2.21	2.54	2.37	2.46	2.54

Note: Wave conditions are calculated using Jonswap based on wind data presented in Appendix A12: Hydraulic Modelling Study Report of 128ML – Feasibility Study for Proposed Beach Improvement Works at Lung Mei Beach, Tai Po. (April 2001).

The extreme wave conditions in Table 2.6 are compared with the extreme wave conditions in the Delft report (Table 4.6). It shows that the maximum extreme wave height is from 150° for both our results and Delft's results. The actual extreme wave condition from Delft's work is very close to our result. For 1 in 100 years return period, the extreme wave height is 1.00m and the wave period is 3.07s in the Deft report, while our modelling work shows an extreme wave height of 1.02m and wave period of 3.22s. Therefore the design wave condition of 1 in 100 years return period recommended in the Delft Report is potentially acceptable.

Further extreme wind data are obtained from Port Works Design Manual for Waglan Island Station (1975-1999) and are converted to Plover Cove using the same coefficient of 0.675 as in the Delft Report. The latest extreme wind data are then shown in Table 2.7.

Table 2.7 Extreme mean hourly wind speeds in Plover Cove for various return periods (in m/s).

Return Period	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**
5	16	17	18	17	16	15	12	9
10	18	20	21	20	19	18	15	11
20	21	22	24	25	22	22	17	13
50	25	27	28	30	28	27	20	16
100	28	30	30	34	30	30	22	17
200	31	32	33	37	34	33	25	18

Note: Wind data are obtained from Port Works Design Manual for Waglan Island Station (1975-1999)

The extreme wave conditions were calculated using the hindcasting method and are presented in Table 2.8. The fetch length from Figure 1.2 and the extreme wind speeds from Table 2.7 were used for the hindcasting calculations.

Table 2.8 Extreme wave heights for the proposed beach development for various return periods

		Wind direction (deg. N)										
Return period	**Wave height & period**	**90**	**105**	**120**	**135**	**150**	**165**	**180**	**195**	**210**	**225**	**240**
5	H_s	0.20	0.22	0.21	0.45	0.58	0.30	0.31	0.39	0.32	0.34	0.35
	T_p	1.26	1.35	1.34	2.22	2.68	1.75	1.79	2.08	1.86	1.95	2.00
10	H_s	0.23	0.25	0.25	0.53	0.70	0.37	0.38	0.47	0.39	0.42	0.43
	T_p	1.32	1.42	1.42	2.36	2.85	1.87	1.92	2.22	1.99	2.08	2.14
20	H_s	0.26	0.29	0.30	0.66	0.85	0.44	0.45	0.56	0.46	0.50	0.50
	T_p	1.37	1.49	1.50	2.53	3.04	1.98	2.02	2.34	2.11	2.20	2.26
50	H_s	0.31	0.35	0.36	0.80	1.04	0.54	0.55	0.69	0.58	0.62	0.61
	T_p	1.46	1.59	1.60	2.70	3.25	2.12	2.18	2.51	2.27	2.37	2.42
100	H_s	0.33	0.38	0.40	0.89	1.15	0.60	0.61	0.75	0.66	0.70	0.69
	T_p	1.49	1.63	1.65	2.80	3.36	2.19	2.24	2.59	2.37	2.47	2.52
200	H_s	0.36	0.42	0.44	0.98	1.27	0.66	0.67	0.84	0.71	0.76	0.76
	T_p	1.54	1.68	1.71	2.89	3.48	2.27	2.32	2.68	2.43	2.54	2.60

Note: Wave conditions are calculated using Jonswap based on wind records taken at Waglan Island Station.

The extreme wave conditions in Table 2.8 are also compared with the extreme wave conditions in the Delft report (Table 4.6). It again shows that the maximum extreme wave height is from 150° for both our results and Delft's results. For 1 in 100 years return period, the extreme wave height is 1.00m and the wave period is 3.07s from the Delft Report, while our modelling work shows an extreme wave height of 1.15m and wave period of 3.36s. Please note that our results are based on the latest wind data, at Waglan Island from the Port Works Design Manual, Part 1.

3. CROSS-SHORE MODELLING

3.1 Background

Mathematical modelling has been used to simulate and predict the littoral processes occurring along the beach profiles in the proposed development area. Our sediment transport model COSMOS-2D has been used in this project for the littoral transport study. The model has been applied to locations on the proposed Lung Mei beach. The purpose of this modelling is to determine the distribution of littoral drift across the beach area. This is important when considering the possible erosion / accretion due to wave-driven beach sediment movement. The modelling results determine the stability of the proposed beach.

3.2 Description of COSMOS

COSMOS-2D is a two-dimensional vertical plane sediment transport model, built to simulate the wave transformation and sediment transport along a cross-shore beach profile (ie normal to the shoreline). The model is formulated to include both suspended and bed sediment loads under the action of the oscillatory flow associated with breaking waves on a beach. Details of the model can be found in Nairn and Southgate (1993). The model assumes a straight coastline with parallel depth contours, and is intended for investigation of cross-shore beach stability under specified wave conditions.

The initial cross-shore profile and time series of wave height and direction are specified by the user, and the model determines wave, current and sediment transport parameters at each grid point. The model was developed jointly by Halcrow, HR and Imperial College. A detailed description of COSMOS-2D is presented in Appendix A.

COSMOS-2D includes the following physical processes:

(a) Wave transformation by refraction (by depth variations and currents), shoaling, Doppler shifting, bottom-friction and wave breaking. For random waves, a Battjes and Janssen (1978) framework is used for determining the distribution of wave height and the fraction of time that waves are breaking at any point.

(b) Wave set-up determined from the gradient of wave radiation stress.

(c) Driving forces for long-shore wave-induced currents, determined directly from the spatial rate of wave energy dissipation.

(d) Long-shore currents from pressure-driven tidal fortes and wave-induced forces, and the interaction between the two types of current.

(e) Cross-shore undertow velocities, using a three-layer model of the vertical distribution of cross-shore currents.

(f) Transition zone effects (the transition zone is the distance between where a wave starts to break and where turbulence becomes fully developed).

(g) Cross-shore and long-shore sediment transport rates using an 'energetics' approach.

(h) Seabed level changes due to cross-shore sediment transport using a Lax-Wendroff scheme.

(i) Down-cutting of a cohesive profile due to abrasion by a covering layer of sand.

The model can be run for a single wave and tidal condition or for a long sequence of wave/tidal conditions at specified time increments.

3.3 Model Set-up and Results

The objective of the COSMOS-2D model application is to assess the cross-shore stability of the beaches under extreme wave conditions. Eight beach profiles were examined: three profiles from the surveyed bathymetry, one profile from the planned beach (Delft Report), two design construction profiles (Halcrow) and two design equilibrium profiles (Halcrow). The planned beach data are taken from the Delft report. In order to verify Delft's cross-shore modelling results and also investigate the beach stability, a wave condition of 1 in 50 years return period was used. It is standard practice to use the 1 in 50 years return period wave condition for the STORM wave condition to study the cross-shore beach response, as opposed to the 1 in 100 year return period that is used for the structural design of the groynes.

Wave conditions of Hs=1.04m and Tp=3.25s, representing a 1 in 50 year storm, were applied in conjunction with a storm surge level of +4.15mPD, which is taken from the Delft Report for 1 in 50 years return period and we have checked that this figure is reasonable The sediment sizes used for the modelling were 0.2mm, 0.25mm, 0.3mm and 0.5mm.

Figures A3.1 to A3.8 in Appendix A present model results for the eight beach profiles with sediment size D_{50} of 0.2mm. Profiles A, B and C, as shown on Figure A3.0, represent existing beach profiles and these three profiles show no significant changes during the storm events modelled. However, 'Design Profile D' and 'Design Profile E' are typical design profiles, which could be applied to anywhere in the proposed bathing beach between the two groynes. The overall results imply that the existing beach profile is stable. However, Figure A3.4 in Appendix A shows that the planned profile will be susceptible to storm attack. The beach will be eroded above bed level 2.8mPD. Nevertheless, the amount of erosion is unlikely to be significant due to the wave heights in this area being relatively small. The results shown in Figure A3.4 are compared with the cross-shore modelling results in the Delft Report (Figure A3.33). The wave condition used in the Delft Report is different from the wave condition used in this study - the present wave condition being based on the latest extreme wind data. The wave height used in the Delft Report was 0.9m and the wave period was 3.0s, while the wave height used in the present study is 1.04m and the wave period is 3.25s. Considering that the wave height in the Delft Report is lower than the wave height in this study, it is expected that the Delft cross-shore modelling profile has less erosion/accretion compared to our modelling output. The present modelling study indicates that the planned cross-shore beach is reasonably stable and the conclusion from the Delft report is also acceptable.

With the same wave and water level conditions, the COSMOS-2D was used with different sediment sizes. Figures A3.9 to A3.32 in Appendix A show the modelling results for D_{50}s of 0.25mm, 0.3mm and 0.5mm. As expected, the beach is more stable with coarser sediment grain sizes. In general, there is no significant problem with cross-shore sediment movement under storm wave conditions.

3.4 Option Development Model set-up and Results.

Subsequent to the Working Paper 2.5 - Wave and Sediment Modelling Report (Rev. 1) being presented to CEDD in October 2006, we had been requested to further investigate another scenario whereby the design wave return period was reduced and as such the reclamation area was also reduced.

Following the work undertaking in section 3.3 and the development of a beach design, changes were made to assumptions and design standards to offer savings to beach recharge quantities. Therefore further COSMOS-2D modelling was required to assess the storm response upon a new design construction profile (Halcrow) and a design equilibrium profile (Halcrow). The design wave condition was reduced from a 1 in 50 years return period to a 1 in 20 years return period.

Wave conditions of Hs=0.8m and Tp=2.98s, representing a 1 in 20 year storm were applied in conjunction with a storm surge level of +3.80mPD. The sediment sizes used for the modelling were focused upon 0.4mm as this had been identified as the most probable sediment size used, however sediment size runs for 0.2mm, 0.25mm, 0.3mm and 0.5mm were also undertaken.

Figures 3.41 to 3.50 are the output results undertaken for the further beach development options. Figures 3.47 and 3.48 represent the storm response on a constructed profile and an equilibrium profile respectively for a grain size of 0.4mm. The plots continue to show that the beach development will still be prone to wave attack with erosion occurring between the +2.9mPD and the +4.0mPD levels with a maximum erosion value of 0.48m. However, the amount of erosion is unlikely to be significant due to the wave heights in this area being relatively small. The other plots use the same wave and water level conditions, but utilise different sediment sizes. As expected and concluded in section 3.3 the beach is more stable with coarser sediment grain sizes and a maximum erosion value of 0.7m. However due to the already insignificant beach responses the savings offered between using different grain size has little impact upon the profile design. In general, there is no significant problem with cross-shore movement under storm conditions.

4. LONG-SHORE MODELLING

4.1 Long-Shore Sediment Transport

The Halcrow Beach Plan Shape Model (BPSM) is a numerical model, which uses recent advances in along-shore beach sediment transport theory to predict the longer term evolution of the beach in response to wave action. The model simulates the development of the plan shape of a single beach contour. The nearshore wave conditions are used in repetitive calculations to give estimates of alongshore sediment drift. The way in which drift rates vary along the coast is then used to compute changes in beach plan shape over time. Iteration between derivation of drift rates and re-aligning the coast provides a realistic response. The Excel sheet version of BPSM is a simplified model which can be used for a given point at the beach using the wind data from the hindcasting wave conditions. This model was used to simulate the effects of wave action based on the wave frequency table. The model provides predictions of the potential long-shore sediment transport. However, in real situation, the beach will be active and will respond to the wave direction on a daily basis. Nevertheless, all numerical models can only simulate the beach responses in a long term, say on a yearly basis. In this way the model takes into account of the seasonal changes of the beach and the final modelling results are based on wave data of the past several years, which will determine the beach orientation.

Calculation of longshore drift rates for given sediment, shoreline and wave data is achieved by application of an empirical formula derived by Kamphuis (1991). Comparisons in the literature have shown the Kamphuis formulation of the alongshore bulk transport formula to give the most accurate prediction, (Schoones and Theon 1996). Recent developments in the theory of coastal processes have included the effects of sediment grain size, beach slope and wave period, among other parameters. A constant sediment size of 200 microns (D_{50}) is assumed, together with a sediment density of 2500 kg/m^3 and a porosity of 0.35. This information is taken from Delft's Report. The beach slope (perpendicular to the coastline) used was 0.067 (i.e. the average of slopes 1 in 12 and 1 in 20), calculated from the planned beach at Lung Mei from the Delft Report.

The long-shore sediment transport modelling determines the beach orientation and the annual long-shore sediment transport rate. The Delft study indicates that the equilibrium orientation of the beach is 130°N, and it concludes that a range of the equilibrium angle between 120° and 150°N seems reasonable. According to the present study, it has been found that the equilibrium angle of the beach is about 138°N. Observation of the present coastline and contours at the Lung Mei from the Admiralty Chart 4128 shows that the orientation of the existing contour is about 150°N to 160°N. Therefore, we suggest that a beach orientation of 140°N to 150°N should be assumed.

The net annual long-shore drift rate can be estimated from the long-shore sediment transport modelling. If the existing beach orientation of 160°N is used as the input data to our model, the annual net drift rate is likely to be 127m^3/yr from the East to the

West. The Delft study shows that the annual net drift rate should be in the range of 10 to 100 m^3/yr. Our long-shore drift calculation therefore indicates that Delft's range of annual net drift rate at 10 to 100 m^3/yr is reasonable.

The calculation of long-shore sediment transport is based on the wave data presented in Table 2.2. Although the dominant wave direction from the Delft Report is different from our dominant wave direction, the resultant long-shore sediment transport rates are in the same order and the net sediment drift directions are the same.

As discussed in Section 3.4 above, we investigated the long shore sediment transportation for a different scenario and had carried out further long-shore sediment modelling using the latest wind and wave data. Table 2.4 shows the wave hindcasting results based on the latest wind data obtained from Tai Mei Tuk station. Those wave data were used as input for the long-shore sediment modelling. The modelling results indicate that the annual net drift rate is likely to be 70m^3/yr from the East to the West, and the equilibrium angle of the beach is about 143°N. Considering the long-shore sediment modelling using both wave data sets as described, it can be concluded that the annual net drift rate is likely to be in the order of 10m^3/yr to 150m^3/yr from the East to the West, and the equilibrium angle of the beach is between 140°N and 150°N.

5. CONCLUSIONS

The modelling work in Delft's Report has been reviewed. Halcrow's in-house models have been used to verify the Delft work independently. The main conclusions are as follows.

- Wave hindcasting results from Delft's Report have been compared with our modelling results using the same wind data set. The maximum wave height of normal wave conditions from the Delft work is 0.24m, which is slightly lower than our result of 0.30m. The maximum wave period of normal wave conditions from the Delft work is 1.75s, which is also slightly lower than our result of 2.15s. The differences in the normal wave conditions calculated by Delft and Halcrow are not significant.

- Using the latest wind data from Tai Mei Tuk station, our wave hindcasting results show that the maximum wave height of normal wave conditions is 0.21m, and the maximum wave period of normal wave conditions is 1.91s. Again the differences between the normal wave conditions calculated by Delft and Halcrow are not significant.

- Using the same extreme wind data set, comparison of the extreme wave conditions indicates that the maximum extreme wave height is from 150° for both Halcrow and Delft results. For a 1 in 100 year return period, the extreme wave height is 1.00m and the wave period is 3.07s according to Delft's results, while our modelling work indicates an extreme wave height of 1.02m and wave period of 3.22s. Based on these results, the extreme wave conditions calculated by Delft and Halcrow are very similar.

- Using extreme wind data from Port Works Design Manual for Waglan Island Station (1975-1999), converted to Plover Cove using the same coefficient in the Delft Report, our modelling work shows an extreme wave height of 1.15m and wave period of 3.36s. Our results are based on the latest wind data. It is therefore concluded that Halcrow's design wave condition of 1 in 100 years return period should be used for groyne design purposes (i.e. extreme wave height of 1.15m and wave period of 3.36s).

- The cross-shore modelling results in the Delft Report (Figure A3.33 in Appendix A) were compared with our cross-shore modelling output (Figure A3.4 in Appendix A) using the same sediment grain size. The wave conditions used in the Delft Report are different from the wave conditions used in this study (which are based on the latest extreme wind data). Considering the wave height in the Delft Report is lower than the wave height in this study, it is expected that Delft's cross-shore modelling profile would show less erosion/accretion than our modelling output. The present modelling study indicates that the planned cross-shore beach is reasonably stable and the conclusion from the Delft report is therefore acceptable.

- The cross-shore modelling was also carried out using different sediment sizes of 0.25mm, 0.3mm and 0.5mm. This has shown that the beach is more stable with coarser sediment grain size. In general, there is no significant problem with cross-shore sediment movement under storm wave conditions.

- The Delft long-shore modelling study indicates that the equilibrium orientation of the beach is 130°N, and it concludes that a range of the equilibrium angle between 120° and 150°N seems reasonable. According to the present study, the equilibrium angle of the beach is about 138°N based on the same wind data that Delft has used, or 143°N based on the latest wind data from Tai Mei Tuk station. Observation of the present coastline and contours at the Lung Mei from the Admiralty Chart 4128 shows that the orientation of the existing contour is about 150°N to 160°N. Therefore we suggest a beach orientation of 140°N to 150°N should be assumed. Therefore, the angle of the beach groynes for this assignment is aligned at an angle of 145°N, similar to that shown on Figure 3.0.

- From the present study it has been found that the annual net drift rate is likely to be 127m^3/yr from the East to the West based on the same wind data that Delft used, or 70m^3/yr based on the latest wind data from Tai Mei Tuk station. The Delft study shows that the annual net drift rate should be in a range of 10 to 100m^3/yr. Our long-shore drift calculation indicates that the range of annual net drift rate at 10 to 100 m^3/yr presented in Delft Report is reasonable. The actual annual net drift rate is likely to be in a range of 10 to 150 m^3/yr, which is in accordance to this study.

- Both the Delft study and Halcrow study show that the net drift of the sediment is not significant (10 to 100 cubic metres per year), which is mainly due to the wave heights being so small at the Lung Mei beach. Therefore, it is not necessary to consider the mitigation measure in accordance with both studies. If the sediment size D_{50} is increased from 0.2mm to 0.25mm, 0.3mm and 0.5mm, respectively, the orientation of the beach will not be changed according to the model results, but the net drift rate will be lower than 10 to 100 cubic metres per year. The consequence is that the beach should be more stable if coarser sands are used. In other words, the sediment transport and siltation under the influence of environmental forces during the operational phases will be minimal.

- Notwithstanding the above, where we demonstrated that Delft's work in the Feasibility Study was in order. However, due to subsequent discussions with CEDD on December 2006 and the requirement to reduce the reclamation area, further runs were undertaken to develop the design profile further including the latest development footprint. This was done using a 1 in 20 years return period as agreed with CEDD. The 1 in 20 years return period has an Hs=0.8m and a Tp=2.98 and incorporated a water level of +3.8mPD. The models were run for the 0.2mm, 0.25mm, 0.3mm and 0.5mm sediment grain sizes as before but a further run was undertaken investigating a 0.4mm sediment grain size. The conclusions drawn previously have not been significantly affected by changes made to the wave, water level and beach slope conditions. That is, the annual net drift rate is likely to be in the order of 10m^3/yr to 150m^3/yr from the East to the West, and the equilibrium angle of the beach is between 140°N and 150°N. As such, the angle of the beach groynes for this assignment is aligned at an angle of 145°N, similar to that shown on Figure 3.0.

6. REFERENCES

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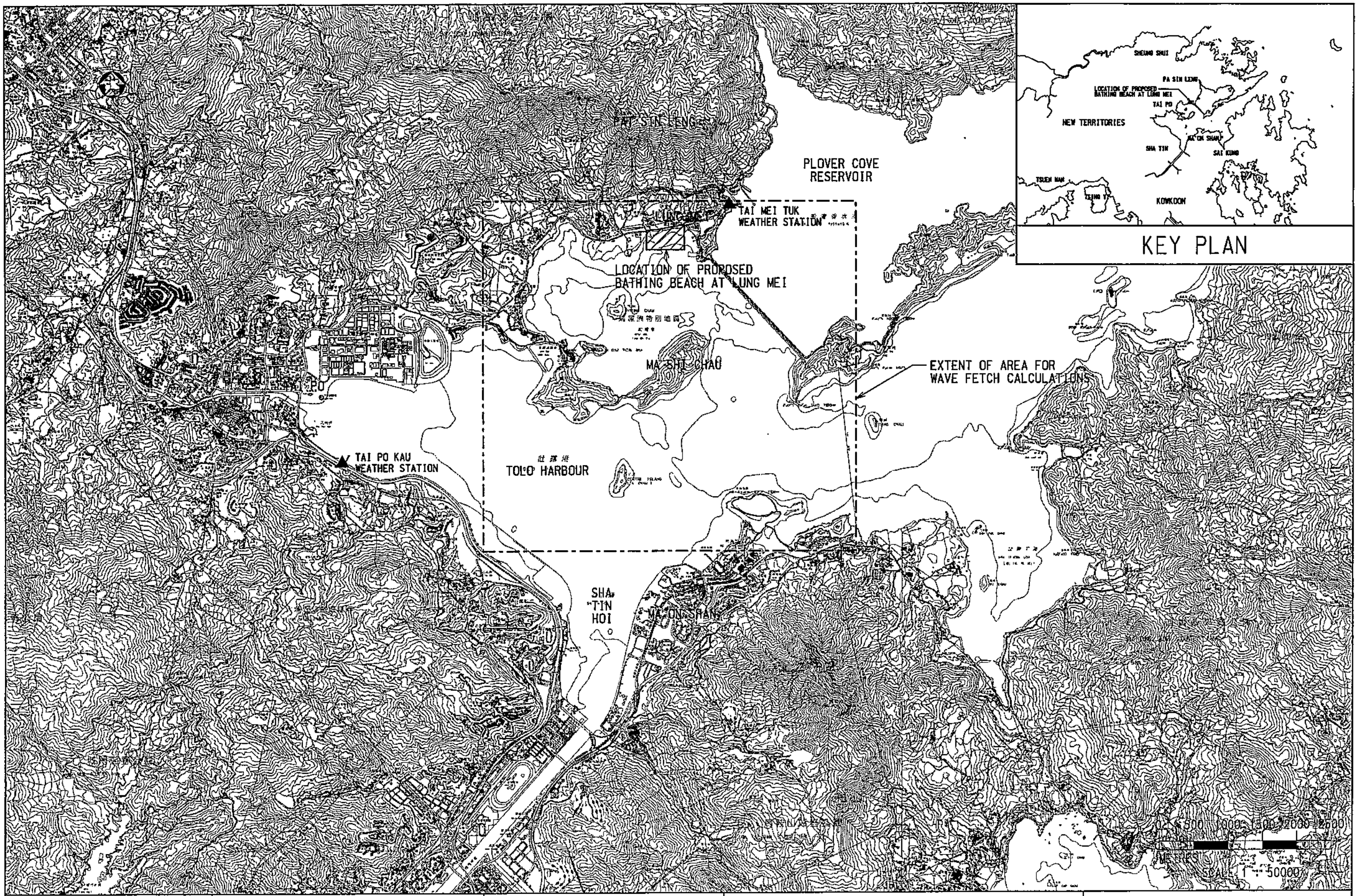
Figures



CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer

Halcrow

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ERM Environment Resources Management as sub-consultant

Agreement No. : CE 59/2005 (EP)

Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

WORKING PAPER 2.5 - WAVE AND SEDIMENT MODELLING REPORT

Figure Title: LOCATION PLAN OF STUDY AREA

FIGURE 1.1

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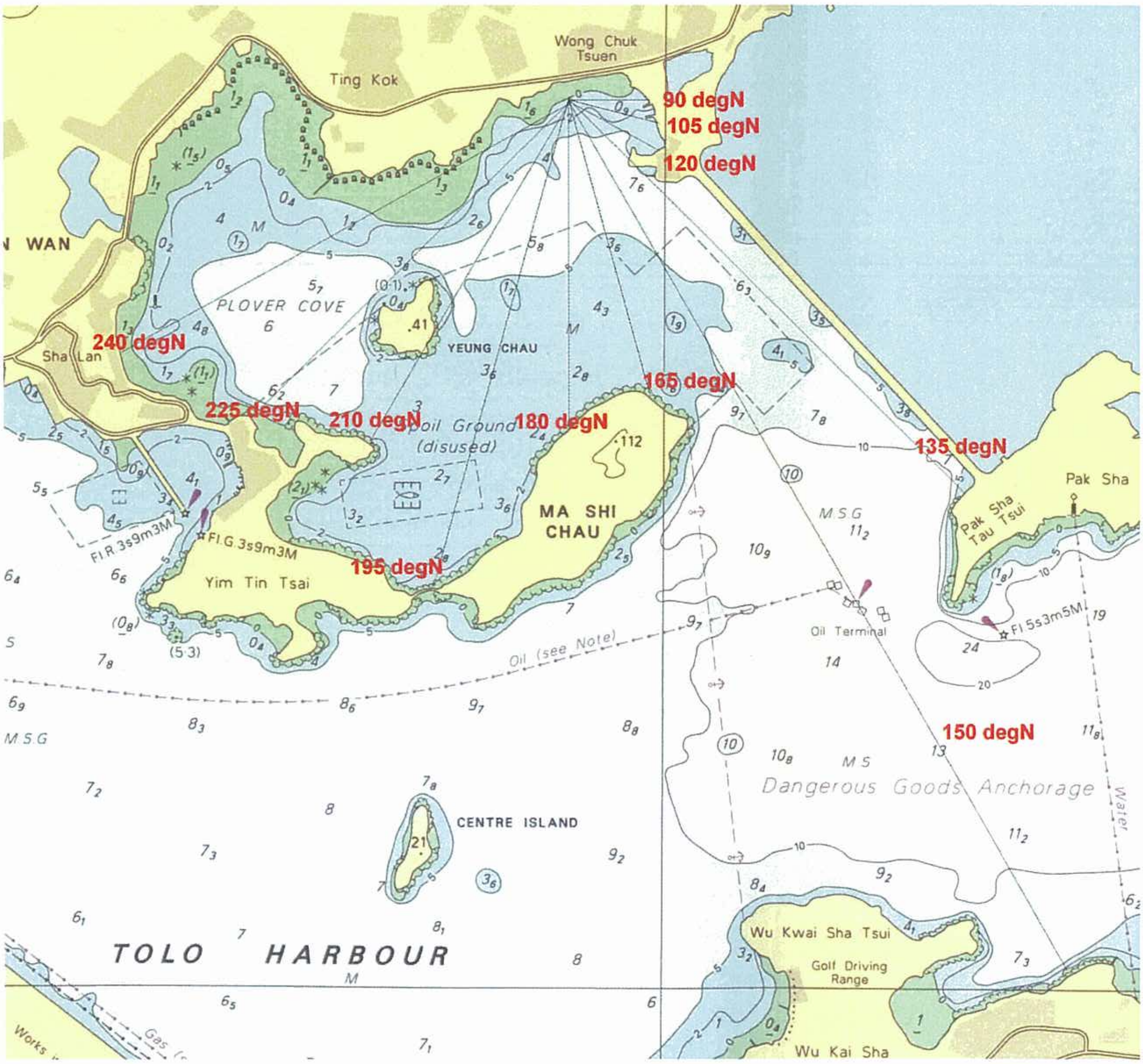

Figure 1.2: Extent of area for wave fetch length calculations; fetch lengths given at 15° increments (from Admiralty Chart 4128, Mirs Bay, Hong Kong).

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DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

FIGURE 1.2

Client
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DEPARTMENT

Consulting Engineer
Halcrow
Halcrow China Ltd.

ERM
Environmental
Resources Management
as sub-consultant

WORKING PAPER 2.5
- WAVE AND SEDIMENT
MODELLING REPORT

Wind Rose Diagram at Tai Po Kau
Data from Jan 1988 – Oct 1998

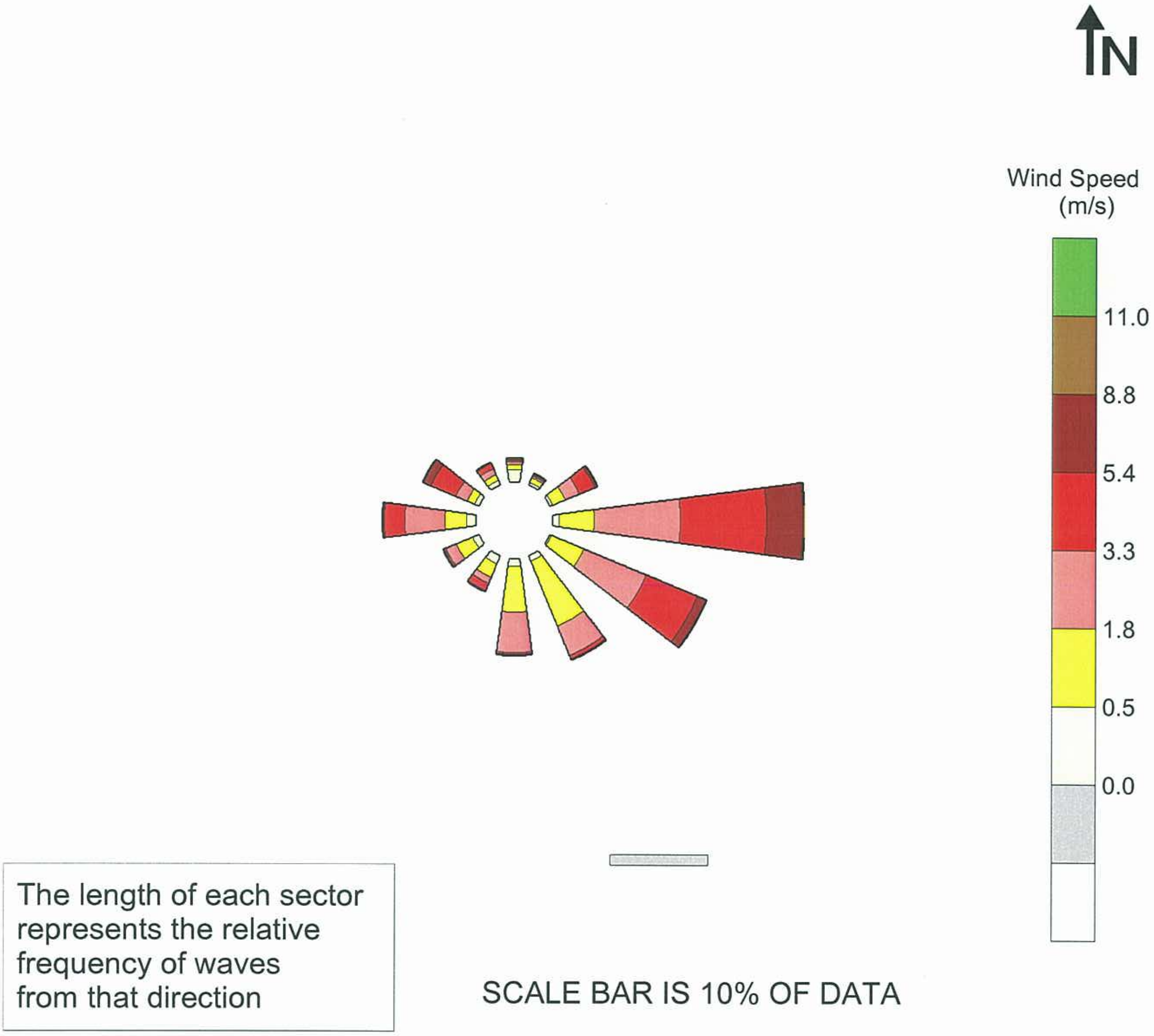
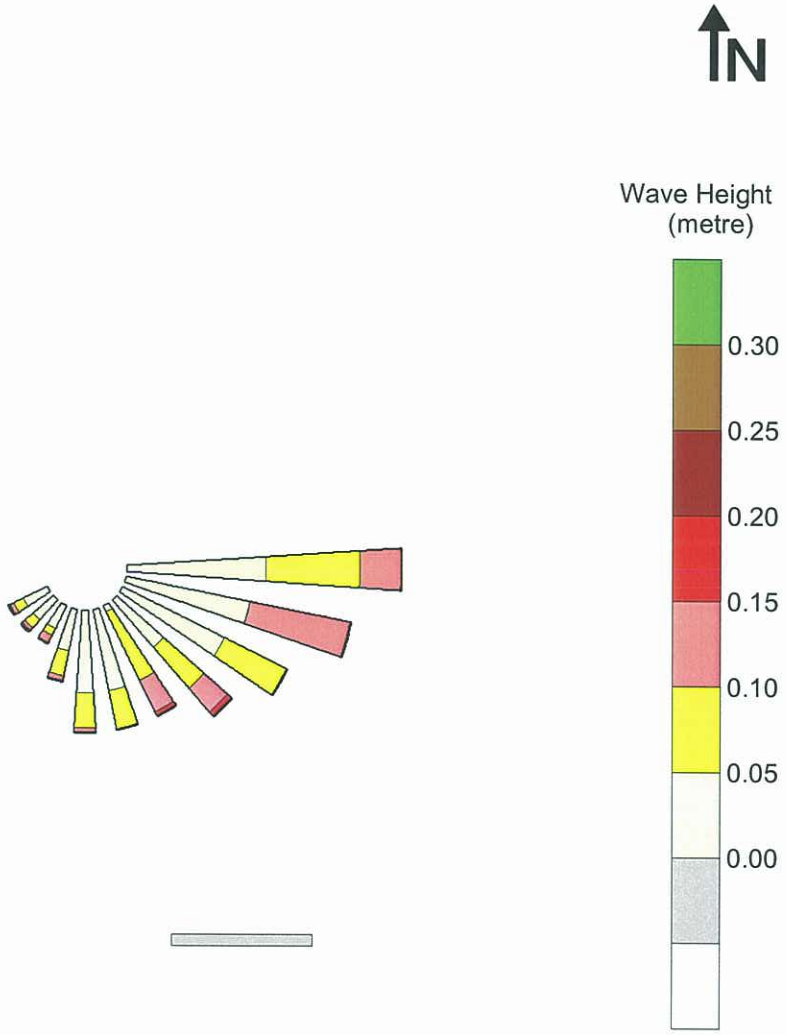


Figure 2.1: Wind Rose Diagram at Tai Po Kau.

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 2.1**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	WORKING PAPER 2.5 - WAVE AND SEDIMENT MODELLING REPORT

Hindcast Wave Rose at Tai Po Kau
Data from 1987 – 2003



The length of each sector represents the relative frequency of waves from that direction

SCALE BAR IS 10% OF DATA

Figure 2.2: Wave Rose Diagram at Tai Po Kau.

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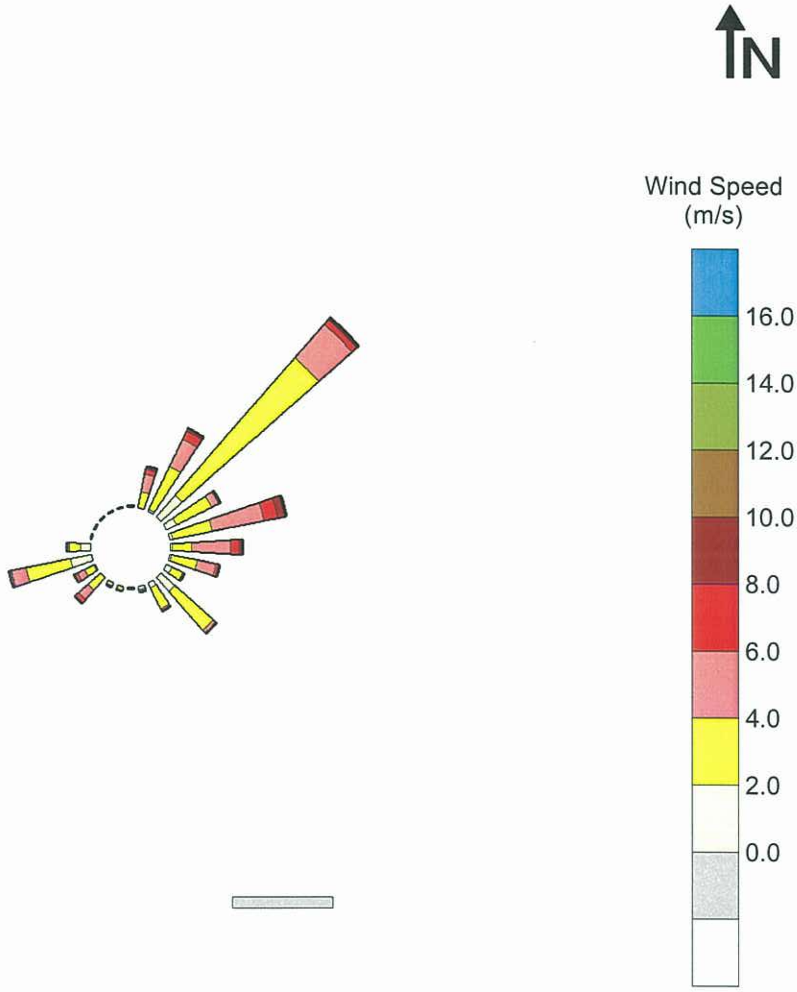
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	WORKING PAPER 2.5 - WAVE AND SEDIMENT MODELLING REPORT

Wind Rose Diagram at Tai Mei Tuk

Data from Jan 2000 – May 2006



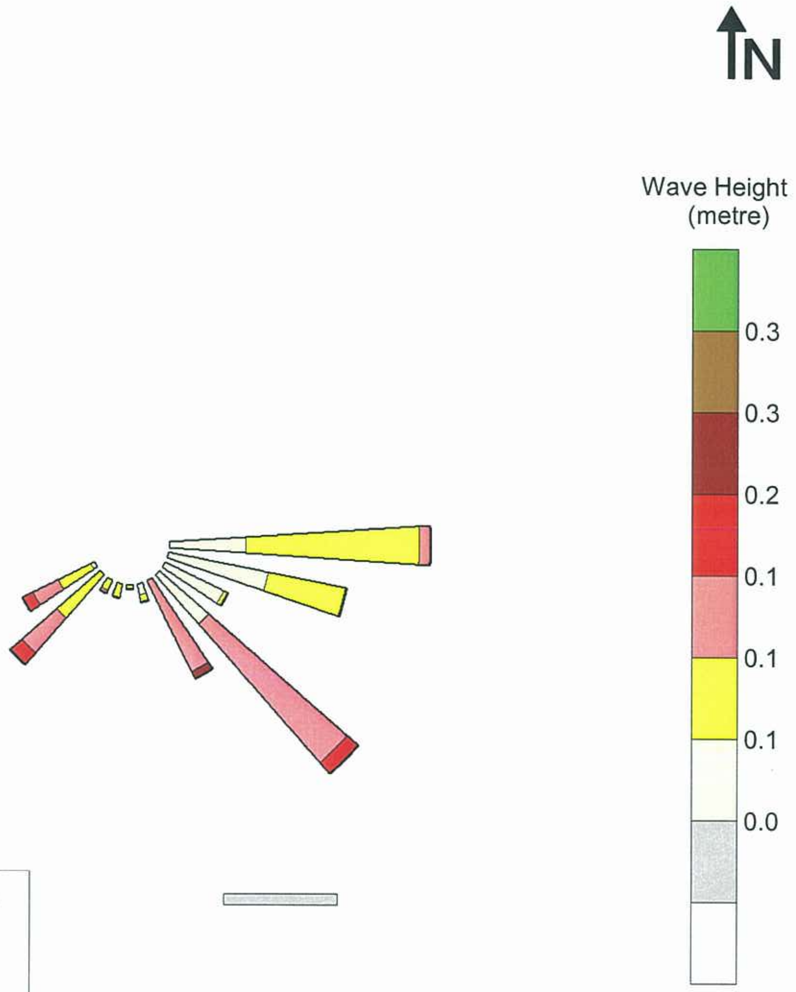
The length of each sector represents the relative frequency of waves from that direction

SCALE BAR IS 10% OF DATA

Figure 2.3: Wind Rose Diagram at Tai Mei Tuk.

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE 2.3**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	WORKING PAPER 2.5 - WAVE AND SEDIMENT MODELLING REPORT

Hindcast Wave Rose at Tai Mei Tuk
Data from Jan 2000 – May 2006



The length of each sector represents the relative frequency of waves from that direction

SCALE BAR IS 10% OF DATA

Figure 2.4: Wave Rose Diagram at Tai Mei Tuk.

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FIGURE 2.4

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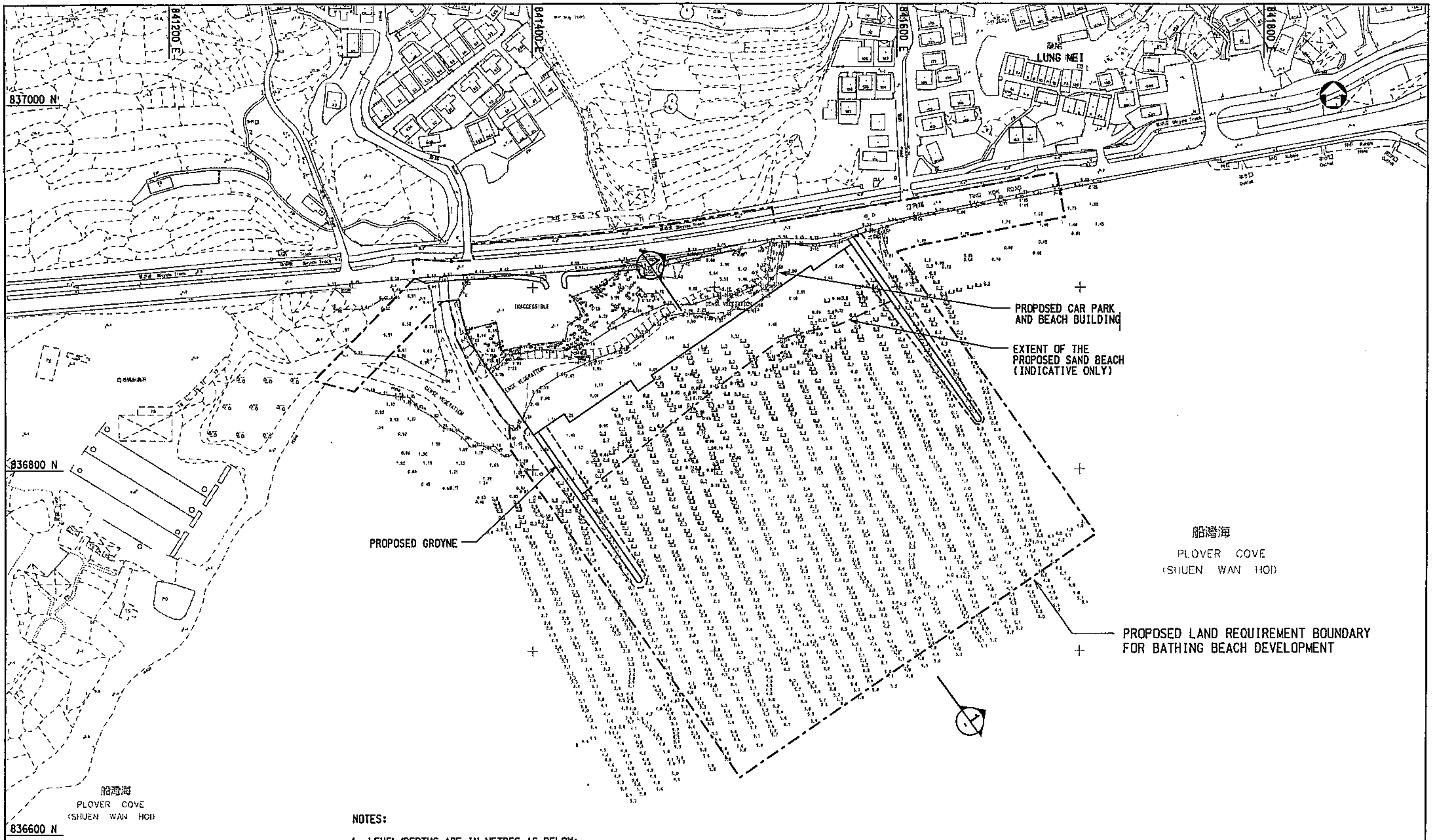
MODELLING REPORT



LEGEND :

(1)——(1) TYPICAL PROFILE OF EXISTING LUNG MEI BEACH

NOTES:

1. LEVEL/DEPTHS ARE IN METRES AS BELOW:-

SOUNDINGS:	SPOT LEVELS:
BELOW CD: 2.3	ABOVE CD: 2.34
ABOVE CD: 1.2	BELOW CD: -1.23

2. FOR MODEL ANALYSES AT THE TYPICAL PROFILE, REFER TO FIGURES 3.41 TO 3.50

0 20 40 60 80 100
METRES
SCALE 1 : 2000

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Figure Title: PLAN OF EXISTING LUNG MEI BEACH

FIGURE 3.0

Checked	Scale	Rev.
PS	1: 2000 @ A3	1
Designed	Drawn	Date
YC	PF	05/10/2006

philipF
e:\proj\CALBDS\Figure\WP2_5\Fig3_0_1_WP2_5.dgn
02/03/2007

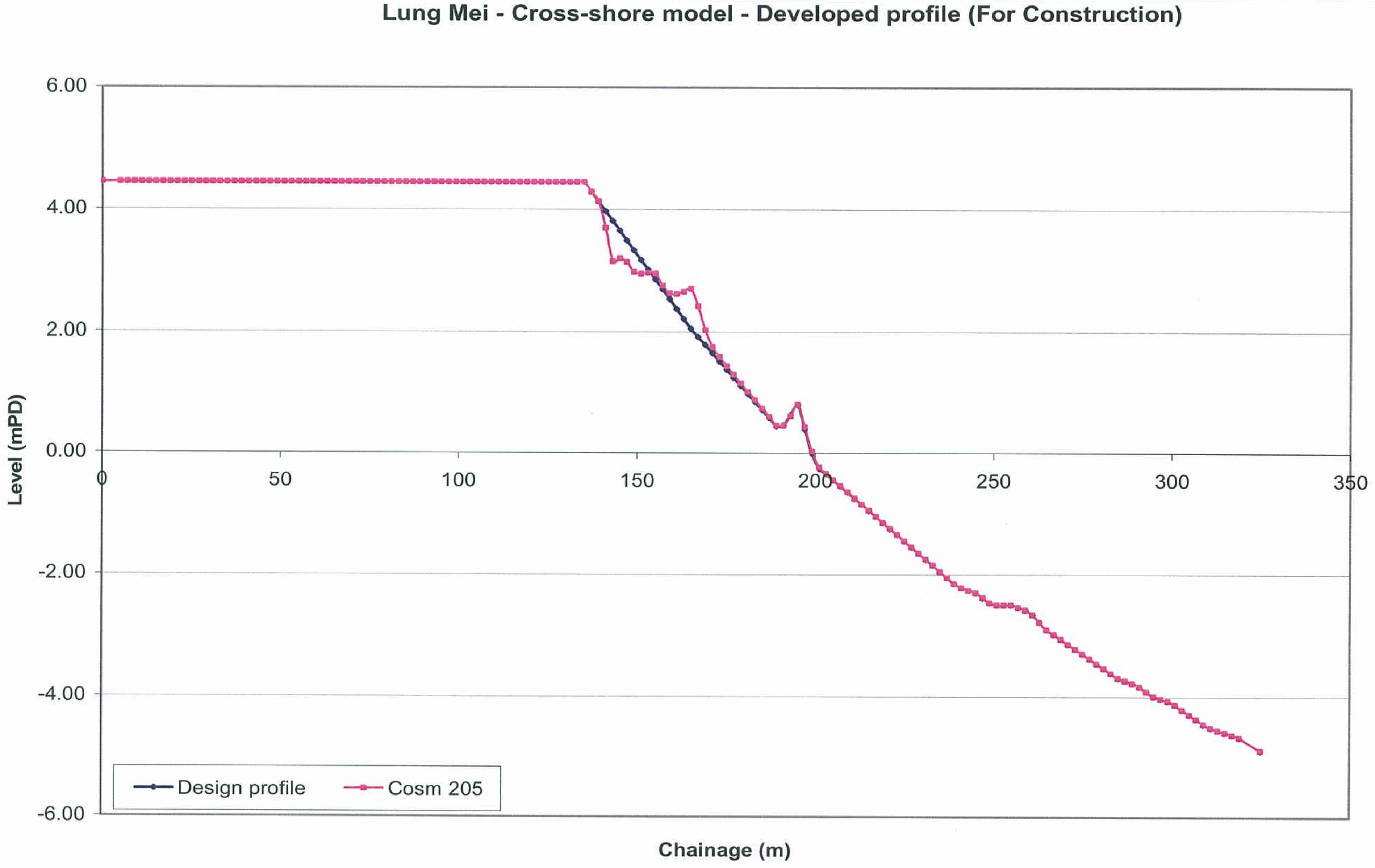

Figure 3.41: Cross-shore modelling results using COSMOS model for further developed design profile as constructed (0.2mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

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				Checked PS	Scale -	Rev. 1
				Designed TF	Drawn -	Date 04/09/2006

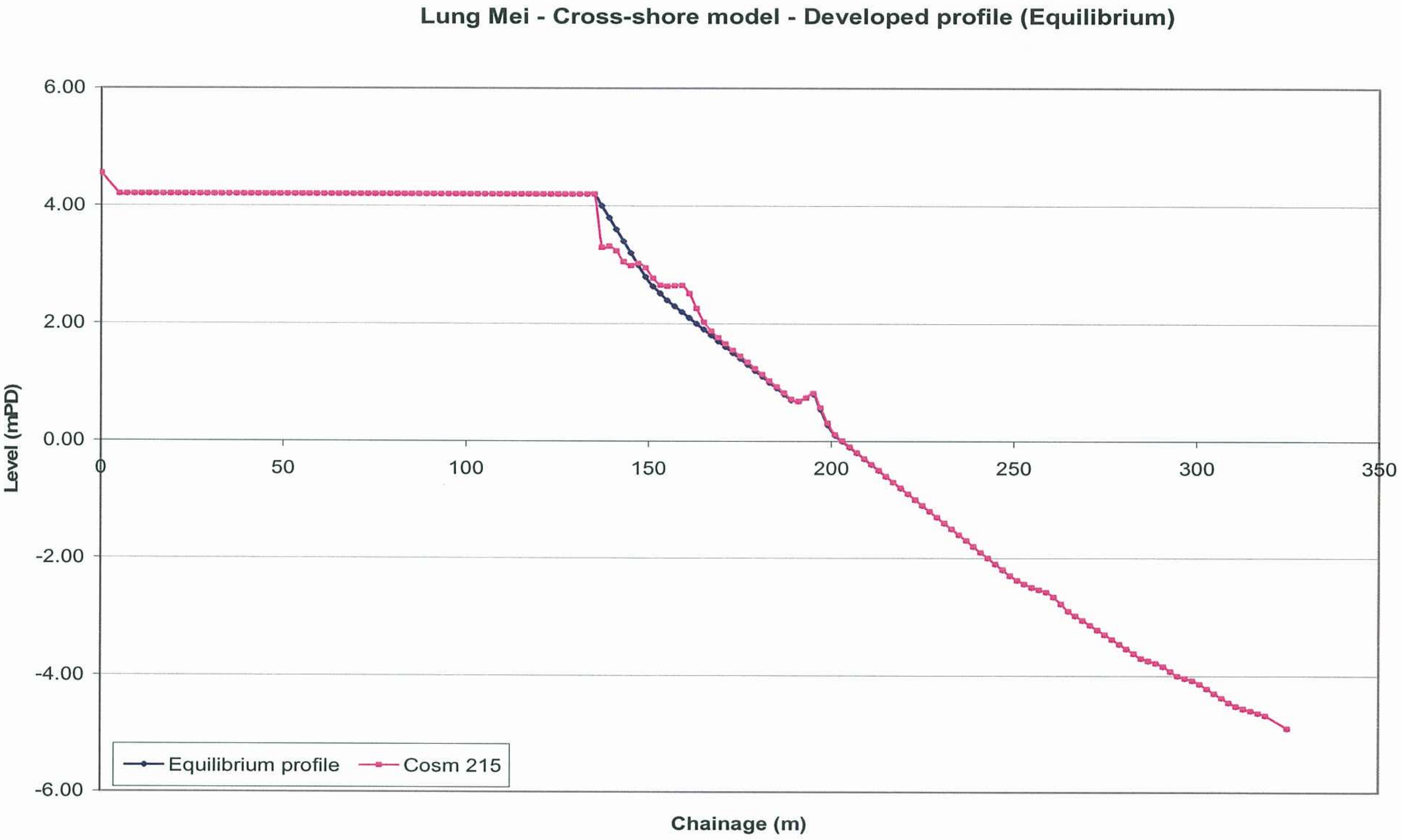

Figure 3.42: Cross-shore modelling results using COSMOS model for further developed design profile in equilibrium (0.2mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	Agreement No.: CE 59/2005(EP) Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	WORKING PAPER 2.5 WAVE AND SEDIMENT MODELLING REPORT	Figure 3.42 Checked: PS Scale: - Rev.: 1 Designed: TF Drawn: - Date: 04/09/2006

Figure 3.43: Cross-shore modelling results using COSMOS model for further developed design profile as constructed (0.25mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	Agreement No.: CE 59/2005(EP) Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	WORKING PAPER 2.5 WAVE AND SEDIMENT MODELLING REPORT	**Figure 3.43** Checked PS Scale - Rev. 1 Designed TF Drawn - Date 04/09/2006

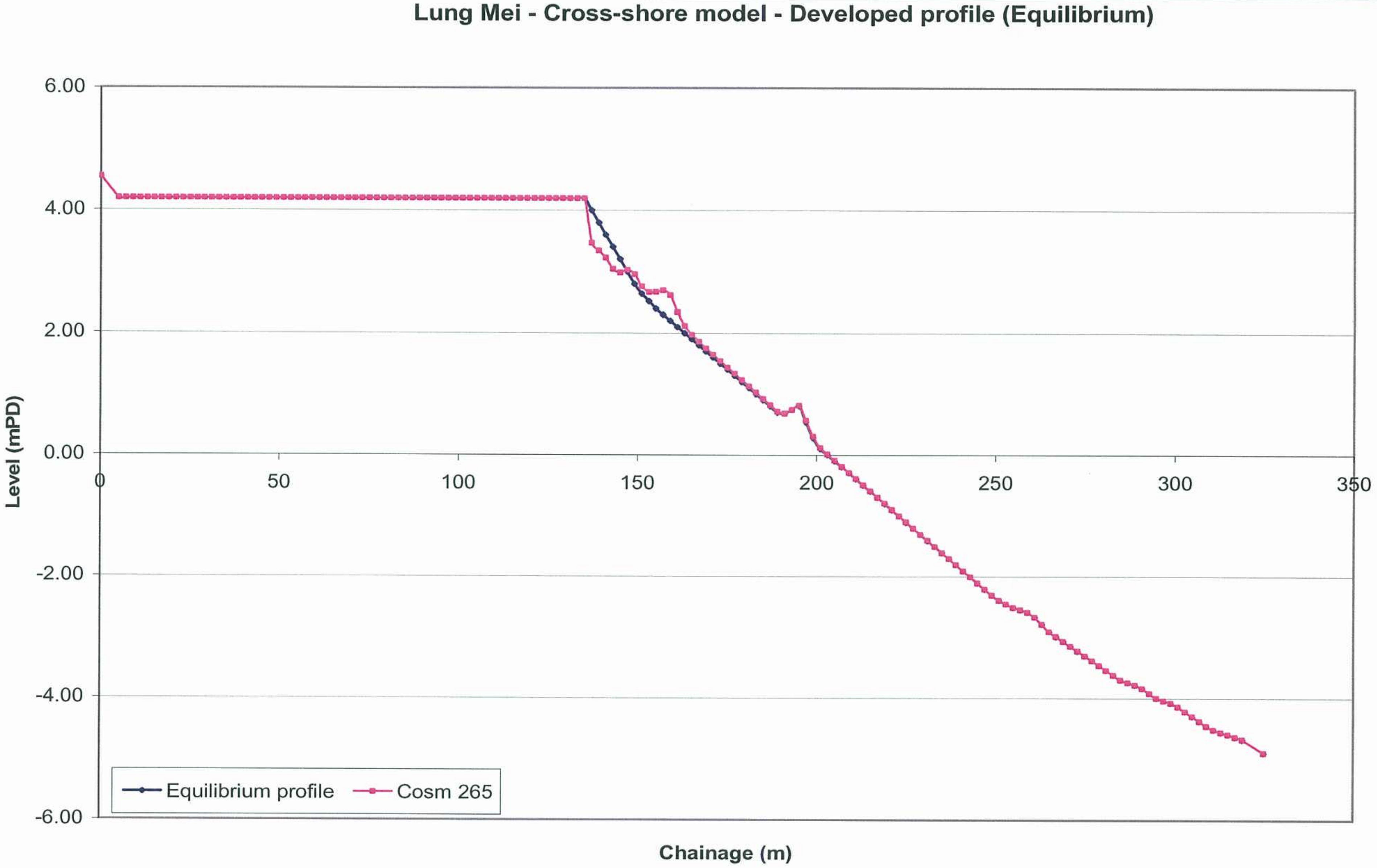

Figure 3.44: Cross-shore modelling results using COSMOS model for further developed design profile in equilibrium (0.25mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

Client	Consulting Engineer	Agreement No.: CE 59/2005(EP)		Figure 3.44		
CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	WORKING PAPER 2.5 WAVE AND SEDIMENT MODELLING REPORT	Checked PS	Scale -	Rev. 1
				Designed TF	Drawn -	Date 04/09/2006

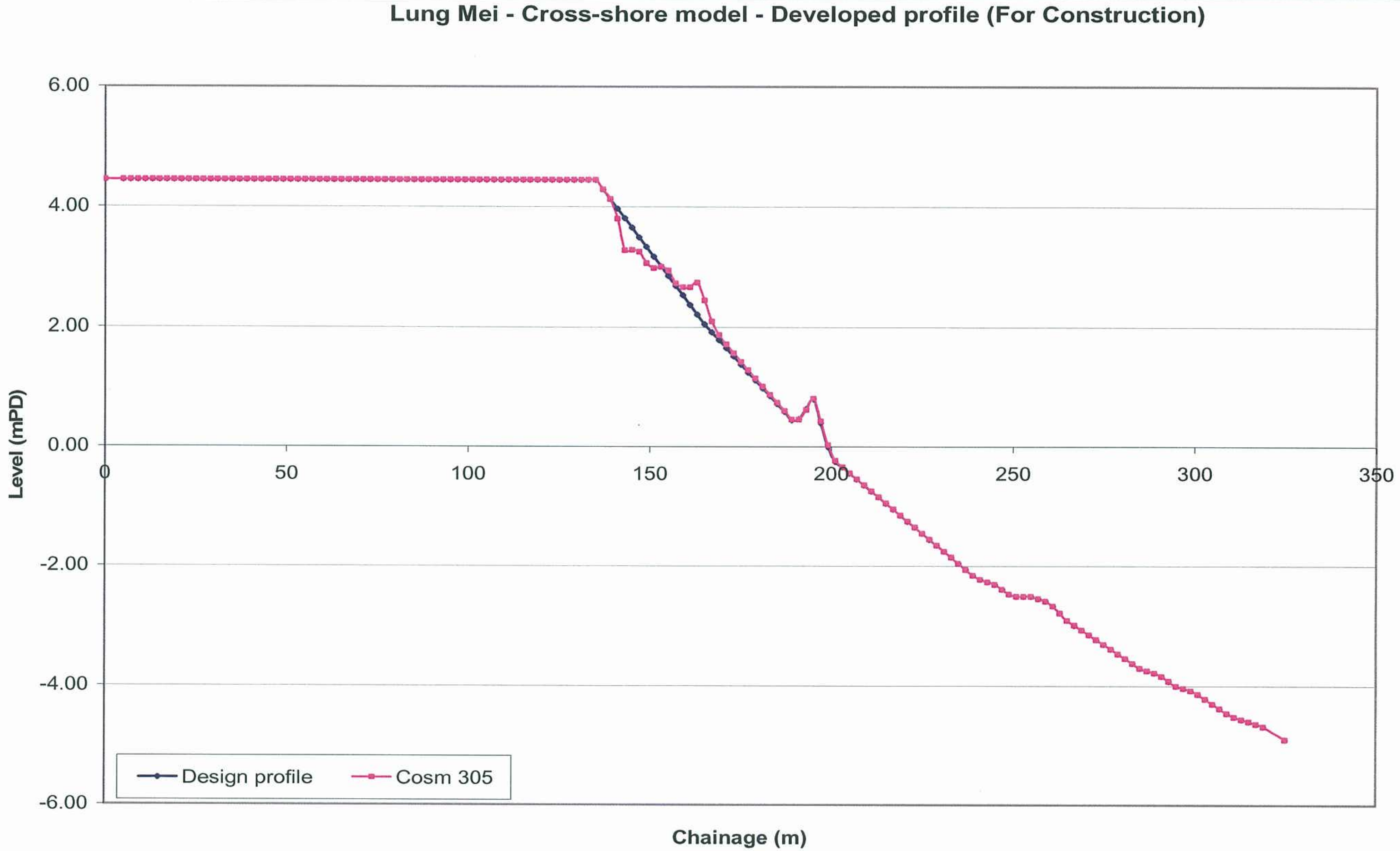

Figure 3.45: Cross-shore modelling results using COSMOS model for further developed design profile as constructed (0.3mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

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Figure 3.45

Checked	Scale	Rev.
PS	-	1
Designed	**Drawn**	**Date**
TF	-	04/09/2006

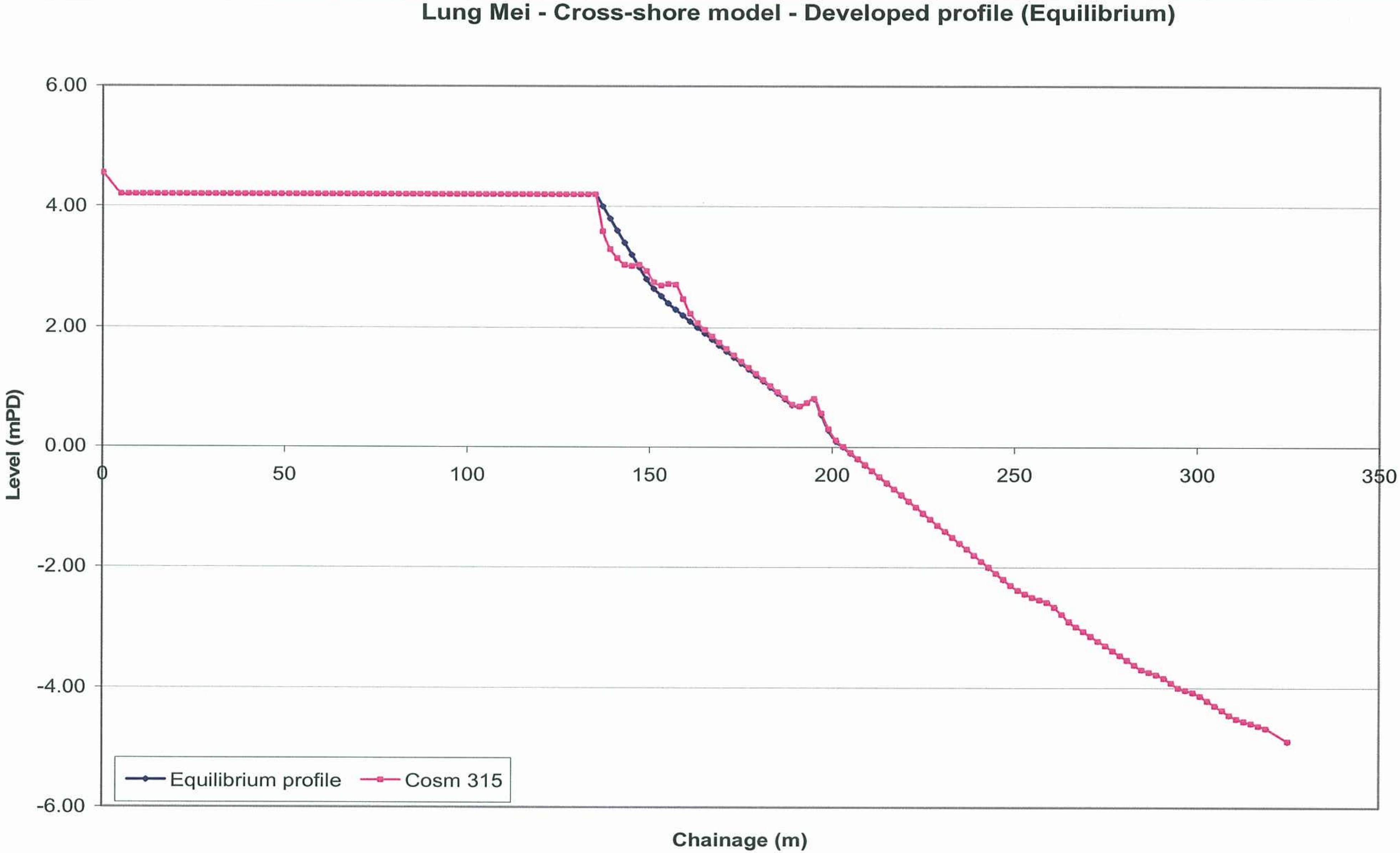

Figure 3.46: Cross-shore modelling results using COSMOS model for further developed design profile in equilibrium (0.3mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	Agreement No.: CE 59/2005(EP) Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	WORKING PAPER 2.5 WAVE AND SEDIMENT MODELLING REPORT	Figure 3.46 Checked PS Designed TF	Scale - Drawn - Rev. 1 Date 04/09/2006

Figure 3.47: Cross-shore modelling results using COSMOS model for further developed design profile as constructed (0.4mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	Agreement No.: CE 59/2005(EP) Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	WORKING PAPER 2.5 WAVE AND SEDIMENT MODELLING REPORT	Figure 3.47 Checked PS Scale - Rev. 1 Designed TF Drawn - Date 04/09/2006

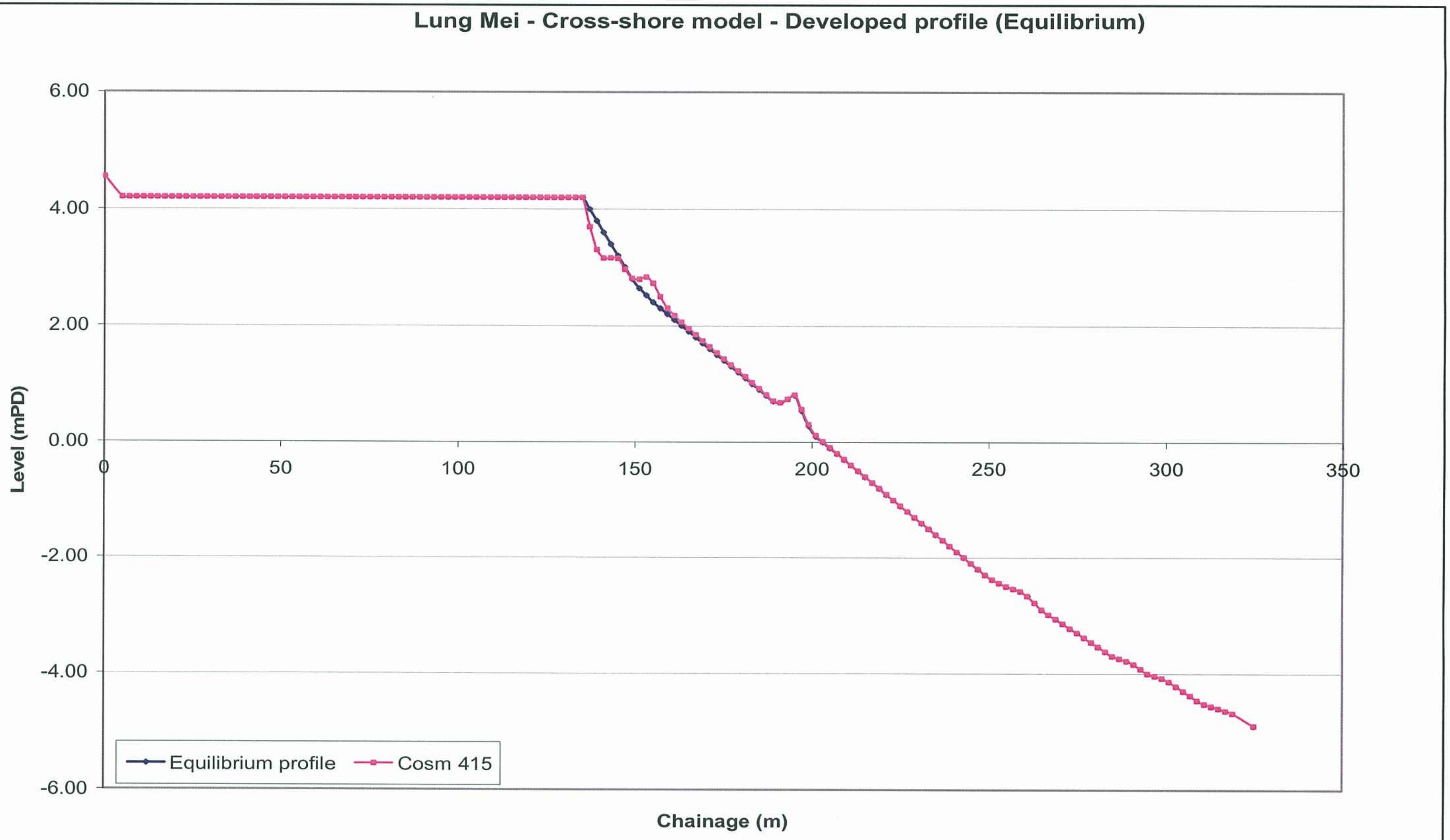

Figure 3.48: Cross-shore modelling results using COSMOS model for further developed design profile in equilibrium (0.4mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

Client

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DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

WORKING PAPER 2.5
WAVE AND SEDIMENT MODELLING REPORT

Figure 3.48

Checked	Scale	Rev.
PS	-	1
Designed	**Drawn**	**Date**
TF	-	04/09/2006

Figure 3.49: Cross-shore modelling results using COSMOS model for further developed design profile as constructed (0.5mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

Client	Consulting Engineer	Agreement No.: CE 59/2005(EP)		Figure 3.49		
CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	WORKING PAPER 2.5 WAVE AND SEDIMENT MODELLING REPORT	Checked PS	Scale -	Rev. 1
				Designed TF	Drawn -	Date 04/09/2006

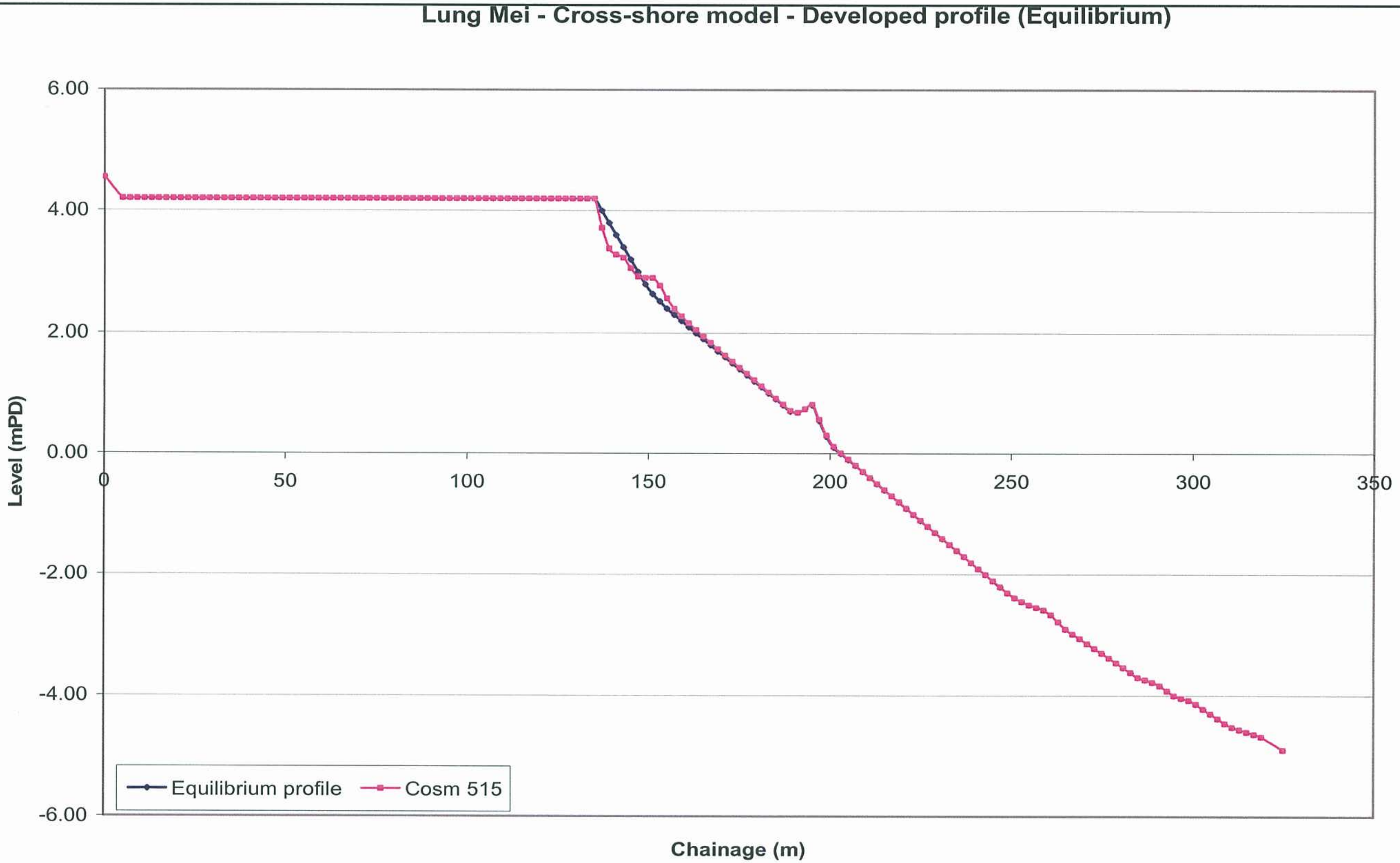

Figure 3.50: Cross-shore modelling results using COSMOS model for further developed design profile in equilibrium (0.5mm)

Note: At a typical profile of the existing Lung Mei Beach as shown on Figure 3.0

Client	Consulting Engineer	Agreement No.: CE 59/2005(EP)		Figure 3.50		
CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	WORKING PAPER 2.5 WAVE AND SEDIMENT MODELLING REPORT	Checked PS Designed TF	Scale - Drawn -	Rev. 1 Date 04/09/2006

Appendix C

Proposed Sequencing of Works

Appendix C1

Proposed and Alternative Construction Sequences

Appendix C1 – Proposed and Alternative Construction Sequences

The following are anticipated sequencing of works for the bathing beach development, together with the alternative sequencing of works (the changes in italics) and its environmental benefits and dis-benefits.

Anticipated Sequencing of Works	Environmental Benefits/Dis-Benefits	Alternative Sequencing of Works	Environmental Benefits/Dis-Benefits
Site Formation for Car Park & Beach Building Area			
– Site Clearance – Site formation for the car park and beach building area, including excavation/dredging for foundations for the seawall/retaining wall. – Construction of the seawall / retaining walls – Backfilling for car park only, leaving the existing ground for beach buildings – Handover the beach building area to ArchSD for their contractor to construct the building. – Landscaping	The backfilling works will not be carried out for the beach building area, which will not create unnecessary plant noise and dust nuisance. This will create time for other construction works.	– Site Clearance – Site formation for the car park and beach building area, including excavation and dredging for foundations for the seawall/retaining wall. – Construction of the seawall / retaining walls – *Backfilling for car park and building area* – *Handover the beach building area to ArchSD for their contractor to construct the building, who will need to excavate for their foundation.* – Landscaping	The need to backfill and then later excavate the backfilled area for the construction of the building foundations will create extra plant noise and dust control. This will also be extra time consuming for the contractor. Therefore, this alternative was not considered.
Road Widening, Roadworks, Utilities, Drainage and Sewerage Works			
– Temporary traffic management in different stages – Utilities detection to avoid damage during excavation – Excavation works and/or sheet piling for road drainage, sewerage and utilities works – Drainage and sewerage diversion works – Construct manholes, pipelines and utilities works concurrently – Backfilling of trenches – Milling or excavation of existing road – Construction of roadworks	The works have been sequenced to minimise public nuisance as well as limiting the excavation works to avoid extensive excavation as well as abortive excavation. Therefore, common trenches should be arranged for the works.	– Temporary traffic management in different stages – Utilities detection to avoid damage during excavation – Excavation works and/or sheet piling for road drainage, sewerage and utilities works – Drainage and sewerage diversion works – *Construct manholes, pipelines and utilities works individually* – Backfilling of trenches – Milling or excavation of existing road – Construction of roadworks	To carry out the excavation trenches for the each individual elements of the work will end up with abortive excavation works. Therefore, this would create more dust and plant noise due to more excavation. The construction duration will also be lengthened, creating a nuisance to the public. As such, this sequencing of works is not preferred.

Anticipated Sequencing of Works	Environmental Benefits/Dis-Benefits	Alternative Sequencing of Works	Environmental Benefits/Dis-Benefits
Groyne Construction, Dredging and Sand Filling			
– Site clearance – Carry out initial land survey onshore and echo or chain sounding survey on the existing seabed profile offshore – Install silt curtain – Carry out dredging for groyne and seabed – Construct west groyne and east groyne – Carry out sand filling offshore – Landscaping	The sequence of work is to ensure that the sand filling dispersion will be minimised.	– Site clearance – Carry out initial land survey onshore and echo or chain sounding survey on the existing seabed profile offshore – Install silt curtain – Carry out dredging for groyne and seabed – *Carry out sand filling offshore* – *Construct west groyne and east groyne* – Landscaping	To carry out the sand filling and groynes concurrently will create more sand dispersion and therefore would be environmental disbenefit. Therefore, this alternative was not considered.

Appendix C2

Proposed Construction Sequences

Appendix C2 – Proposed Construction Sequences

The following are anticipated sequencing of works for the bathing beach development, which include the construction plants.

1. *Construction of Ramp, Staircase, Vertical Seawalls, Retaining Walls, and their Foundations*

The following sequencing of works is anticipated:

Vertical seawalls and retaining walls will be constructed with concrete blocks and therefore the final location will be open cut by excavators. The concrete block will be precast and brought to site by lorries and then placed on site with a mobile crane. Backfilling of void be carried out by lorries with backfill, excavator and vibratory roller. However, as for the other structures, the following sequencing of works is anticipated:

- Open cut excavation will be also be adopted for the construction of the foundations for other structures;
- Exposed temporary sloping surface will be covered by plastic sheet or similar for protection against rainfall / surface infiltration;
- A crane will be required for lifting construction materials in place;
- Timber sawing machine, reinforcement bar bender, electrical drills, diesel generator, water pumps and concreting vibratory pokers will be required for the construction of the structures;
- Concreting of structures;
- Backfilling of void by excavator; and
- Compaction and leveling of fill by roller compactor or vibration compactor.

2. *Construction of Beach Buildings and their Foundations*

The following sequencing of works is anticipated:

- It is anticipated that raft foundation will be adopted for the superstructure foundation. The construction of foundation will involve excavator, water pump, timber sawing machine, reinforcement bar bender, electrical drill, diesel generator and concreting vibration compactor.
- A crane will be required for lifting material E&M plants or concrete into the required site locations; and
- Falseworks, timber sawing machine, reinforcement bar bender, electrical drill, diesel generator and concreting vibration compactor will be required for the construction of the superstructure.
- Concreting of structures with concrete lorry mixers and vibratory pokers
- Removal and disposal of formwork.

3. *Construction of paving area for car park*

The following sequencing of works is anticipated:

- Excavators will be required for excavation of area above future site formation level;
- Area below future site formation to be filled by truck and leveling by excavator;
- A roller compactor and vibration compactor will be required for the compaction of the backfilling material and sub-base for the construction of the car park pavement; and
- Concreting of paved area of car park using concrete lorry mixers and vibratory poker.

4. *Road Pavement Construction (this work will be carried out concurrently or in stages with the construction works for utilities, watermain, drainage and sewerage)*

- Excavator to excavate to design level;
- The formation will be compacted by a roller compactor;
- The sub-base will be laid and compacted by roller compactor;
- The road base will be laid in two layers by a paver/ leveler.
- Each layer will be placed and compacted by a smooth vibratory tandem three wheeled steel wheeled roller and follow by a smooth non vibrating pneumatic tyre-roller in longitudinal direction.
- The edge area i.e. bitumen laid adjacent to kerbs, covers, frames or other street furniture will be compacted using suitable hand held mechanical compaction plant;
- The remaining bituminous layers, the base course, regulating course and wearing course will be laid initially using the steel wheeled roller then followed by a smooth wheeled non vibratory roller.

4.1 Construction of New Sewage Pipeline and Manholes

- Carry out cable detection to locate all existing utilities;
- Construct trial pits using pneumatic breaker with a diesel generator break up the existing pavement. Then, hand digs using hand tools to locate alignment of utilities;
- Implement Temporary Traffic Arrangement along the new sewer pipes;
- Install sheet pile to stabilize the trench using backhoe with silent piler;
- Further excavation by excavator and expose existing sewage pipeline and manhole and the connection points;

- Construct the manholes and section of sewage pipeline using a crane, backhoe; timber sawing machines, reinforcement bar benders, electrical drill, diesel generator, and concreting vibratory pokers and concrete lorry mixers;
- Backfill trench using excavator and vibratory roller;
- Remove sheet piles and reinstated the existing road. Silent piler to remove the sheet piles.

4.2 *Construction of New Drainage Pipeline Gullies*

- Carry out cable detection to locate all existing utilities;
- Construct trial pits using electrical drill (two to three numbers) with a diesel generator (two numbers) to break up the existing pavement. Then, hand digs using hand tools to locate alignment of utilities;
- Implement Temporary Traffic Arrangement along the new drainage pipes;
- Install sheet pile to stabilize the trench using backhoe (one to two numbers) with a low-noise hydraulic hammer machine (one to two number) or vibration hammer (one or three numbers);
- Further excavation by one to two backhoes (excavator) and expose existing drainage pipeline and connection points;
- Construct the gullies and drain pipes using a crane (one number) or backhoe (one to two numbers);
- Backfill trench using backhoe (one to two numbers) and compactor (one to two numbers).

4.3 *Laying of Watermains and Utilities*

- Carry out cable detection to locate all existing utilities;
- Construct trial pits using pneumatic breaker with diesel generators to break up the existing pavement. Then, hand digs using hand tools to locate alignment of utilities;
- Implement Temporary Traffic Arrangement along the new drainage pipes;
- Excavation by excavator to founding level;
- Construct the cross road ducts by hand or watermain by use of excavator;
- Backfill trench using backhoe and vibratory roller.

5. Construction of Western Box Culvert

- Construction of the western box culvert will be carried out during dry season.
- Temporary drainage systems will be established, as appropriate, such as perimeter cut-off drains, pumping and sedimentation control for proper discharge of the collected runoff to the designated discharge points approved by EPD;
- Water flow at the existing culvert will be temporarily diverted by sand bags and the collected water will be pumped and properly discharged. Therefore, works area will be isolated from the existing water flow to avoid any contamination on the stream;
- Install sheet pile to stabilise the two banks next vertical wing walls using backhoe with a silent piler;
- Saw cutting machine will be used to cut line for demarcating the area of existing concrete to be demolished;
- Pneumatic breakers, electric drill, diesel generator and electrical water pump will be used during the demolition and preparation of the concrete slab surfaces;
- Drill lifting holes by electronic drill to hang the panels to be demolished and hang up the walls by crane;
- Break the existing concrete until rebar have been exposed. Then, cutting of all rebars by saw cutting machine;
- Lift the panels safely to the level ground away from the existing river and further demolish the panels by backhoe with concrete breaker head;
- Removal of existing concrete debris by excavator;
- Further excavation by excavator to form the formation level of the box culvert; Excavated material to move to stockpile area by truck;
- The existing concrete surface of the culvert shall be repaired to receive new culvert movement joints. Install a movement joint at the interface between existing culvert and the new culvert.
- The culvert bottom slab, as well as their vertical walls, is anticipated to be cast in situ by concrete lorry mixer;
- A crane will be required as well as timber sawing machine, reinforcement bar bender, electrical drill, diesel generator, and concreting vibration pokers;
- After erecting falseworks, formwork and fixing rebar, the culvert top slab can be cast in situ. It is anticipated to be cast in situ by concrete lorry mixer and vibratory poker;
- Divert the water flow to the new culvert by removal of sand bags;
- Remove sheet piles and reinstated the existing slope profiles using silent piler and excavator.

6. *Construction of Western Drainage Open Channel*

- Carry out cable detection to confirm no utilities running along the channel banks;
- Install sheet pile to stabilise the trench using excavator and silent piler;
- Install silt curtain at the outlet of the open channel prior to carrying out of excavation works for construction of the channel banks near the outlet;
- Excavate to proposed level using excavator. Excavated material to be transported by trucks to stockpile area;
- Compact the design formation level with a vibratory roller;
- Transport rockfill and gabion cage by trucks;
- Install gabion blocks layer by layer and amour rock by crane;
- Construct rubble bedding by excavator and manually;
- Backfill the back of gabion walls by excavator and compact the fill material with vibratory roller;
- Remove sheet piles by silent piler and slope reinstatement by excavator and vibratory roller;
- Remove silt curtain at the channel outlet.

7. *Construction of Modification Works on Existing Box Culvert*

- The proposed modification works on the existing eastern box culvert will be carried out during dry season.
- Establish temporary drainage systems, as appropriate, such as perimeter cut-off drains, pumping and sedimentation control for proper discharge of the collected runoff to the designated discharge points approved by EPD;
- A temporary barrier will be formed by sand bags and the collected water will be pumped and properly discharged;
- Prepare the surface of concrete bottom slab for the new concrete infilling with plants of electrical drills, diesel generators and electrical water pumps;
- Install a movement joint at the interface between existing culvert and the proposed eastern box culvert;
- Erect steel formwork using hand tools at low tide;
- Concreting with concrete lorry mixers and vibration pokers;
- Remove formwork.

8. *Construction of 90m long Eastern Box Culvert*

- The existing one tonne bermstones, pell mell rubble in front of existing seawall Type 1 and 4 will be maintained;
- Carry out preloading on the existing ground with settlement monitoring;
- Remove the surcharge and install temporary support for the existing vertical seawall if necessary;
- Install silt curtain as precaution measures around the works area and carry out excavation works up to the designed formation level of the proposed box culvert during low tide;
- Layering geotextile onto the seabed;
- Place bermstone, pell mell rubble, levelling stone and pre-cast blocks underneath the proposed box culvert by excavator;
- The base slab of the proposed box culvert will be formed by precast panel segments of about 5m wide off site or in a separate location of the site area. It can be delivered by land transport and place above the level stones stage by stage. A crane will be required during precast segment erection stage.
- Timber sawing machines, reinforcement bar benders, electrical drill, diesel generator, and concreting vibratory pokers and concrete lorry mixers will be required for the construction of the proposed box culvert with the cast in-situ side walls and top slab;
- Installation/construction of the connection segment to the existing box culvert will be carried out during dry season.
- Concrete topping/screeding will be laid to form required culvert gradient profile using vibratory pokers and trowels;
- The planter wall will be also cast in situ. A crane, concrete lorry mixers and vibratory pokers will be required during concreting of the planter;
- Divert water flow to the new box culvert by removal of sand bags and pumping facilities;
- Backfill the box culvert and planter wall to the designed level by excavator and roller;
- Remove silt curtain.

9. *Groyne Construction:*

- Erect the benchmarks and the temporary tide gauges and checked by the land surveyors;
- Carry out initial land survey onshore and echo or chain sounding survey on the existing seabed profile offshore;
- Install silt curtain;
- Carry out dredging down to the proposed founding level of the groyne using excavators on land above low water mark and grab dredger and derrick lighter on sea (below average low water mark).
- Check the dredged profile and condition of dredged trench bottom by echo sounding and by divers respectively;
- On landward (above average low water mark). Laying geotextile onto the dredged trench, carry out grab placing of rock fill to the dredged trench as well as end tipping and placing of rock armour using trucks and excavators.
- On seaward (below average low water mark) Laying geotextile onto the dredged trench, carry out grab placing of rock fill to the dredged trench as well as grab placing of rock armour by derrick barge with derrick lighter;
- Carry out land survey of the as-built profile of the rock fill layer;
- Environmental monitoring and audit to be carried out regularly during dredging and armour rock filling;

10. *Dredging and Sand Filling:*

- Install the agreed environmental monitoring stations and carry out monitoring and audit regularly during dredging and sand filling;
- Carry out dredging onshore by excavators and offshore by grab dredger with derrick lighter and the dredging area should be protected with movable type silt curtain;
- Check the dredged profile and condition of dredged trench bottom by echo sounding and by divers respectively;
- Install standing type silt curtain to cover the whole area with sandfilling works;
- Carry out sand filling offshore by a backfilling barge (sand filling via a set of conveyor belt on barge (can be pelican barge), which is extended to the sand filling area offshore); and on land, leveling of sand beach by bulldozer and backhoe.

Appendix D

Noise Assessment Supporting Information

Appendix D1

Photographs showing the NSRs

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer

Halcrow
Halcrow China Ltd.

ERM Environmental Resources Management as sub-consultant

Agreement No.: CE 59/2005(EP)

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPENDIX D1 – FIGURE 1

Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

Figure Title: PHOTOGRAPHS OF NOISE SENSITIVE RECEIVERS

Checked -	Scale AS SHOWN	Rev. 0
Designed -	Drawn KK	Date 17/05/2007

N1 - No.165A Lung Mei

N2 - No.103 Lung Mei, N2a - No.101 Lung Me

N3 - No.70 Lo Tsz Tin

N4 - No.79 Lo Tsz Tin

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Agreement No.: CE 59/2005(EP)

Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title: PHOTOGRAPHS OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS

APPENDIX D1 – FIGURE 2

Checked -
Scale AS SHOWN
Rev. 0
Designed -
Drawn KK
Date 17/05/2007

Appendix D2

Construction Programme for Noise Assessment

Appendix D2 - Preliminary Construction Programme

		2008			2009												2010											
ID	Task	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	**Construction Works on Land**																											
1a	site Formation, construction of seawall, ramp, staircase, retaining walls, sump tanks for grey water system and superstructure foundation			■	■	■	■	■	■	■																		
1b	road widening at Ting Kok Road			■	■	■	■	■	■	■																		
2	**Car Park Paving**										■	■	■															
3	**Building Works**																											
3a	piling works										■																	
3b	foundation and tanking											■	■	■														
3c	superstructure														■	■	■	■										
3d	building finishes & internal fitting-out																		■	■	■	■	■	■	■	■	■	
4	**Dredging of Groynes**															■	■											
5	**Rock filling of Groynes**																	■	■	■								
6	**Box Culvert Construction**																											
6a	construction of gabion channel						■	■	■	■	■																	
6b	construction of western culvert											■	■	■														
6c	construction of eastern culvert														■													
6d	construction of 90m box culvert															■	■	■	■	■	■	■						
7	**Sand Filling**																			■	■	■	■					

Appendix D3

Construction Plant Inventory

Appendix D3 Construction Plant Inventory

ID	Activities	Plant	CNP/BS5228 ref.	No. of PME	% of operating time	SWL	Correction, dB(A)			SWL, dB(A)
							Operating time	No. of Plant	Barrier(3)	
1	**Construction Works on Land**									
1a	*site Formation, construction of seawall, ramp, staircase, retaining walls, sump tanks for grey water system and superstructure foundation*									
	- construction of seawall & retaining wall	Mobile crane	CNP 048	1	80	112	-1	0	0	111
		Excavator	CNP 081	1	80	112	-1	0	0	111
		Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
									Sub-Total SWL	*115*
	- backfilling	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
		Excavator	CNP 081	2	80	112	-1	3	0	114
		Roller, vibratory	CNP 186	1	50	108	-3	0	0	105
									Sub-Total SWL	*116*
	- construction of ramp, staircase, sump tanks for grey water system and superstructure foundation	Timber sawing machine	CNP 201	2	50	108	-3	3	0	108
		Bar bender and cutter (electric)	CNP 021	3	50	90	-3	5	0	92
		Electrical drill	CNP 065	5	50	98	-3	7	0	102
		Diesel generator	CNP 102	1	100	100	0	0	0	100
		Water pumps (electric)	CNP 281	2	100	88	0	3	0	91
		Vibratory Poker (electric)	--(1)	3	80	102	-1	5	0	106
		Concrete lorry mixers	CNP 044	1	80	109	-1	0	0	108
									Sub-Total SWL	*113*
									MAXIMUM SWL FOR WORK ID 1a =	*116*
1b	*road widening at Ting Kok Road*									
	- breaking existing road surface	Excavator	CNP 081	2	100	112	0	3	0	115
									Sub-Total SWL	*115*
	- drainage channel construction	Silent Piler	--(2)	1	80	100	-1	0	0	99
		Excavator	CNP 081	1	80	112	-1	0	0	111
		Mobile crane	CNP 048	1	80	112	-1	0	0	111
									Sub-Total SWL	*114*
	- manhole construction	Electrical drill	CNP 065	2	50	98	-3	3	0	98
		Diesel generator	CNP 102	2	100	100	0	3	0	103
		Timber sawing machine	CNP 201	1	50	108	-3	0	0	105
		Bar bender and cutter (electric)	CNP 021	1	50	90	-3	0	0	87
									Sub-Total SWL	*108*
	- concreting work	Concrete lorry mixers	CNP 044	1	80	109	-1	0	0	108
		Vibratory Poker (electric)	--(1)	2	80	102	-1	3	0	104
									Sub-Total SWL	*109*
	- backfilling and road formation	Compactor, vibratory	CNP 050	1	50	105	-3	0	0	102
		Road roller	CNP 185	1	50	108	-3	0	0	105
		Excavator	CNP 081	1	80	112	-1	0	0	111
									Sub-Total SWL	*112*
									MAXIMUM SWL FOR WORK ID 1b =	*115*
2	**Car Park Paving**									
	- backfilling	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
		Excavator	CNP 081	2	80	112	-1	3	0	114
		Roller, vibratory	CNP 186	1	50	108	-3	0	0	105
									Sub-Total SWL	*116*
	- concreting work	Concrete lorry mixers	CNP 044	1	80	109	-1	0	0	108
		Vibratory Poker (electric)	--(1)	2	80	102	-1	3	0	104
									Sub-Total SWL	*109*
									MAXIMUM SWL FOR WORK ID 2 =	*116*
3	**Building Works**									
3a	*piling works*	Silent piler	--(2)	2	80	100	-1	3	0	102
		Excavator	CNP 081	1	80	112	-1	0	0	111
									MAXIMUM SWL FOR WORK ID 3a =	*112*
3b	*foundation and tanking*									
		Mobile crane	CNP 048	1	80	112	-1	0	0	111
		Excavator	CNP 081	1	80	112	-1	0	0	111
		Timber sawing machine	CNP 201	2	50	108	-3	3	0	108
		Bar bender and cutter (electric)	CNP 021	3	50	90	-3	5	0	92
		Electrical drill	CNP 065	5	50	98	-3	7	0	102
		Diesel generator	CNP 102	1	100	100	0	0	0	100
		Water pumps (electric)	CNP 281	2	100	88	0	3	0	91
									Sub-Total SWL	*113*
									MAXIMUM SWL FOR WORK ID 3b =	*113*

Appendix D3 Construction Plant Inventory

					% of		Correction, dB(A)			
ID	**Activities**	**Plant**	**CNP/BS5228 ref.**	**No. of PME**	**operating time**	**SWL**	**Operating time**	**No. of Plant**	**Barrier(3)**	**SWL, dB(A)**
3c	*superstructure*									
	- superstructure work	Mobile crane	CNP 048	1	80	112	-1	0	0	111
		Timber sawing machine	CNP 201	3	50	108	-3	5	0	110
		Bar bender and cutter (electric)	CNP 021	3	50	90	-3	5	0	92
		Electrical drill	CNP 065	6	50	98	-3	8	0	103
		Diesel generator	CNP 102	1	100	100	0	0	0	100
									Sub-Total SWL	***114***
	- concreting work	Concrete lorry mixers	CNP 044	1	80	109	-1	0	0	108
		Vibratory Poker (electric)	--(1)	5	80	102	-1	7	0	108
									Sub-Total SWL	***111***
									MAXIMUM SWL FOR WORK ID 3c =	***114***
3d	*building finishes & internal fitting-out*	Mobile crane	CNP 048	1	80	112	-1	0	0	111
		Timber sawing machine	CNP 201	1	50	108	-3	0	0	105
		Electrical drill	CNP 065	6	50	98	-3	8	0	103
		Diesel generator	CNP 102	1	100	100	0	0	0	100
									TOTAL SWL FOR WORK ID 3d =	***113***
4	**Dredging of Groynes**	Excavator	CNP 081	2	80	112	-1	3	0	114
		Grab Dredger	CNP 063	1	100	112	0	0	0	112
		Derrick lighter	CNP 061	1	100	104	0	0	0	104
									TOTAL SWL FOR WORK ID 4 =	***116***
5	**Rock filling of Groynes**	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
		Excavator	CNP 081	2	80	112	-1	3	0	114
		Derrick lighter	CNP 061	2	80	104	-1	3	0	106
									TOTAL SWL FOR WORK ID 5 =	***116***
6	**Box Culvert Construction**									
6a	*construction of gabion channel*									
	- excavation & leveling work	Silent piler	--(2)	1	80	100	-1	0	0	99
		Excavator	CNP 081	2	80	112	-1	3	0	114
		Vibration compactor	CNP 186	1	50	108	-3	0	0	105
									Sub-Total SWL	***115***
	- placing of gabion blocks	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	1	80	105	-1	0	0	104
		Mobile crane	CNP 048	1	80	112	-1	0	0	111
									Sub-Total SWL	***112***
	- backfilling work	Vibratory compactor	CNP 050	1	50	105	-3	0	0	102
		Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	1	80	105	-1	0	0	104
		Excavator	CNP 081	2	80	112	-1	3	0	114
									Sub-Total SWL	***115***
									MAXIMUM SWL FOR WORK ID 6a =	***115***
6b	*construction of western culvert*									
	- excavation work	Silent piler	--(2)	1	80	100	-1	0	0	99
		Excavator	CNP 081	1	80	112	-1	0	0	111
									Sub-Total SWL	***111***
	- construction of culvert	Timber sawing machine	CNP 201	1	50	108	-3	0	0	105
		Electrical drill	CNP 065	2	50	98	-3	3	0	98
		Diesel generator	CNP 102	2	100	100	0	3	0	103
		Water pumps (electric)	CNP 281	1	100	88	0	0	0	88
		Mobile crane	CNP 048	1	80	112	-1	0	0	111
									Sub-Total SWL	***113***
	- demolition of existing culvert	Pneumatic Breaker	CNP 027	1	80	122	-1	0	0	121
		Excavator	CNP 081	1	80	112	-1	0	0	111
									Sub-Total SWL	***121***

Appendix D3 Construction Plant Inventory

ID	Activities	Plant	CNP/BS5228 ref.	No. of PME	% of operating time	SWL	Correction, dB(A) Operating time	No. of Plant	Barrier(3)	SWL, dB(A)
	- construction of culvert top slab	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
		Concrete lorry mixers	CNP 044	1	80	109	-1	0	0	108
		Timber sawing machine	CNP 201	2	50	108	-3	3	0	108
		Bar bender and cutter (electric)	CNP 021	2	50	90	-3	3	0	90
		Vibratory Poker (electric)	--(1)	2	80	102	-1	3	0	104
								Sub-Total SWL		***114***
	- slope reinstatement	Excavator	CNP 081	1	80	112	-1	0	0	111
								Sub-Total SWL		***111***
					MAXIMUM SWL FOR WORK ID 6b =					***121***
6c	*construction of eastern culvert*									
	-preparation of concrete slab surface	Electrical drill	CNP 065	2	50	98	-3	3	0	98
		Diesel generator	CNP 102	2	100	100	0	3	0	103
		Water pumps (electric)	CNP 281	2	100	88	0	3	0	91
								Sub-Total SWL		***104***
	- concreting work	Concrete lorry mixers	CNP 044	1	80	109	-1	0	0	108
		Vibratory Poker (electric)	--(1)	1	80	102	-1	0	0	101
								Sub-Total SWL		***109***
					MAXIMUM SWL FOR WORK ID 6c =					***109***
6d	*construction of 90m box culvert*									
	- excavation work	Excavator	CNP 081	1	80	112	-1	0	0	111
								Sub-Total SWL		***111***
	- erection of precast panel segment	Mobile crane	CNP 048	1	80	112	-1	0	0	111
								Sub-Total SWL		***111***
	- construction of top and bottom slab	Timber sawing machine	CNP 201	1	50	108	-3	0	0	105
		Bar bender and cutter (electric)	CNP 021	1	50	90	-3	0	0	87
		Electrical drill	CNP 065	2	50	98	-3	3	0	98
		Diesel generator	CNP 102	2	100	100	0	3	0	103
								Sub-Total SWL		***108***
	- concreting work	Vibratory Poker (electric)	--(1)	2	80	102	-1	3	0	104
		Concrete lorry mixers	CNP 044	1	80	109	-1	0	0	108
								Sub-Total SWL		***109***
	-screeding work	Concrete mixer	CNP 045	1	80	96	-1	0	0	95
		Diesel generator	CNP 102	2	100	100	0	3	0	103
								Sub-Total SWL		***104***
	- backfilling	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	1	80	105	-1	0	0	104
		Vibratory compactor	CNP 050	1	50	105	-3	0	0	102
								Sub-Total SWL		***106***
					MAXIMUM SWL FOR WORK ID 6d =					***111***
7	**Sand Filling**	Pelican barge	CNP 061	1	100	104	0	0	0	104
		Excavator	CNP 081	2	80	112	-1	3	0	114
		Backhoe	CNP 081	2	80	112	-1	3	0	114
					MAXIMUM SWL FOR WORK ID 7 =					***117***

Remarks

(1) SWL refer to the document prepared by the Noise Control Authority (http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf)

(3) Reference was made to MTRC Contract C4420 Tsim Sha Tsui Station Modification, Variation of Environmental Permit, Noise assessment of GIKEN silent piler system.

(4) Barrier attenuation is obtained from site hoarding or movable noise barrier.

Appendix D4

Construction Noise Assessment (Unmitigated Scenario)

Appendix D4 - Construction Noise Assessment - Unmitigated Scenario

NSR: *N1, Village House - No.165A Lung Mei*

Distance from NSR to Notional Source Position			*Correction Factor*								
Distance from NSR to Work Site ID 1	*106*	*m*	Distance Attenuation =	*-49*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 2	*176*	*m*	Distance Attenuation =	*-53*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 3	*118*	*m*	Distance Attenuation =	*-49*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 4	*124*	*m*	Distance Attenuation =	*-50*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 5	*68*	*m*	Distance Attenuation =	*-45*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6a & 6b	*290*	*m*	Distance Attenuation =	*-57*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6c & 6d	*29*	*m*	Distance Attenuation =	*-37*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 7	*124*	*m*	Distance Attenuation =	*-50*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	*Construction Works on Land*																											
1a	site Formation, construction of seawall	0	0	116	116	116	116	116	115.6	115.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	115	115	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*118*	*118*	*118*	*118*	*118*	*118*	*118*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2	*Car Park Paving*	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**66**	**66**	**66**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3	*Building Works*																											
3a	piling works	0	0	0	0	0	0	0	0	0	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	113	113	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	114	114	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	113	113	113	113	113	113	113	113	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*112*	*113*	*113*	*113*	*114*	*114*	*114*	*114*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**65**	**67**	**67**	**67**	**68**	**68**	**68**	**68**	**66**	**66**	**66**	**66**	**66**	**66**	**66**	**66**	**66**	**0**
4	*Dredging of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**70**	**70**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5	*Rock filling of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**74**	**74**	**74**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6	*Box Culvert Construction*																											
6a	construction of gabion channel	0	0	0	0	0	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**60**	**60**	**60**	**60**	**60**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	121	121	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**67**	**67**	**67**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	109	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**75**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	111	111	111	111	111	111	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**0**	**0**	**0**	**0**	**0**	**0**
7	*Sand Filling*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117	117	117	117	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*117*	*117*	*117*	*117*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**70**	**70**	**70**	**70**	**0**	**0**	**0**	**0**	**0**
OVERALL NOISE LEVEL AT NSR (dB(A))		**0**	**0**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**69**	**71**	**71**	**70**	**75**	**78**	**78**	**79**	**79**	**79**	**78**	**78**	**72**	**66**	**66**	**66**	**66**	**0**

Appendix D4 - Construction Noise Assessment - Unmitigated Scenario

NSR: *N2, Village House - No.103 Lung Mei*

Distance from NSR to Notional Source Position			*Correction Factor*								
Distance from NSR to Work Site ID 1	80	m	Distance Attenuation =	-46	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 2	128	m	Distance Attenuation =	-50	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 3	94	m	Distance Attenuation =	-47	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 4	135	m	Distance Attenuation =	-51	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 5	90	m	Distance Attenuation =	-47	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6a & 6b	246	m	Distance Attenuation =	-56	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6c & 6d	70	m	Distance Attenuation =	-45	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 7	135	m	Distance Attenuation =	-51	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	*Construction Works on Land*																											
1a	site Formation, construction of seawall	0	0	116	116	116	116	116	115.6	115.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	115	115	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*118*	*118*	*118*	*118*	*118*	*118*	*118*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2	*Car Park Paving*	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**68**	**68**	**68**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3	*Building Works*																											
3a	piling works	0	0	0	0	0	0	0	0	0	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	113	113	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	114	114	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	113	113	113	113	113	113	113	113	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*112*	*113*	*113*	*113*	*114*	*114*	*114*	*114*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**67**	**69**	**69**	**69**	**70**	**70**	**70**	**70**	**68**	**68**	**68**	**68**	**68**	**68**	**68**	**68**	**68**	**0**
4	*Dredging of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**69**	**69**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5	*Rock filling of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**72**	**72**	**72**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6	*Box Culvert Construction*																											
6a	construction of gabion channel	0	0	0	0	0	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**62**	**62**	**62**	**62**	**62**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	121	121	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**69**	**69**	**69**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	109	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**67**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	111	111	111	111	111	111	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**69**	**69**	**69**	**69**	**69**	**69**	**69**	**0**	**0**	**0**	**0**	**0**	**0**
7	*Sand Filling*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117	117	117	117	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*117*	*117*	*117*	*117*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**70**	**70**	**70**	**70**	**0**	**0**	**0**	**0**	**0**
	OVERALL NOISE LEVEL AT NSR (dB(A))	**0**	**0**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**71**	**73**	**73**	**72**	**71**	**74**	**74**	**75**	**75**	**76**	**74**	**74**	**72**	**68**	**68**	**68**	**68**	**0**

Appendix D4 - Construction Noise Assessment - Unmitigated Scenario

NSR: *N2a, House - No.101 Lung Mei*

Distance from NSR to Notional Source Position			*Correction Factor*								
Distance from NSR to Work Site ID 1	77	m	Distance Attenuation =	-46	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 2	140	m	Distance Attenuation =	-51	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 3	89	m	Distance Attenuation =	-47	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 4	122	m	Distance Attenuation =	-50	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 5	90	m	Distance Attenuation =	-47	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6a & 6b	261	m	Distance Attenuation =	-56	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6c & 6d	55	m	Distance Attenuation =	-43	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 7	122	m	Distance Attenuation =	-50	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	*Construction Works on Land*																											
1a	site Formation, construction of seawall	0	0	116	116	116	116	116	115.6	115.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	115	115	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	0	0	118	118	118	118	118	118	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	76	76	76	76	76	76	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	*Car Park Paving*	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	68	68	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	*Building Works*																											
3a	piling works	0	0	0	0	0	0	0	0	0	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	113	113	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	114	114	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	113	113	113	113	113	113	113	113	0
	Total SWL	0	0	0	0	0	0	0	0	0	112	113	113	113	114	114	114	114	113	113	113	113	113	113	113	113	113	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	68	69	69	69	70	70	70	70	69	69	69	69	69	69	69	69	69	0
4	*Dredging of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	70	0	0	0	0	0	0	0	0	0	0	0
5	*Rock filling of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0
	Total SWL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	72	72	0	0	0	0	0	0	0	0
6	*Box Culvert Construction*																											
6a	construction of gabion channel	0	0	0	0	0	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	61	61	61	61	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	121	121	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	68	68	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	109	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	69	0	0	0	0	0	0	0	0	0	0	0	0	0
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	111	111	111	111	111	111	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71	71	71	71	71	71	71	0	0	0	0	0	0
7	*Sand Filling*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117	117	117	117	0	0	0	0	0
	Total SWL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117	117	117	117	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71	71	71	71	0	0	0	0	0
OVERALL NOISE LEVEL AT NSR (dB(A))		0	0	76	76	76	76	76	76	76	71	73	73	72	73	75	75	76	75	77	75	75	73	69	69	69	69	0

Appendix D4 - Construction Noise Assessment - Unmitigated Scenario

NSR: *N3, Village House - No.70 Lo Tsz Tin*

Distance from NSR to Notional Source Position			*Correction Factor*								
Distance from NSR to Work Site ID 1	122	m	Distance Attenuation =	-50	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 2	85	m	Distance Attenuation =	-47	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 3	70	m	Distance Attenuation =	-45	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 4	167	m	Distance Attenuation =	-52	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 5	172	m	Distance Attenuation =	-53	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6a & 6b	106	m	Distance Attenuation =	-49	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6c & 6d	212	m	Distance Attenuation =	-55	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 7	167	m	Distance Attenuation =	-52	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	*Construction Works on Land*																											
1a	site Formation, construction of seawall	0	0	116	116	116	116	116	115.6	115.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	115	115	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*118*	*118*	*118*	*118*	*118*	*118*	*118*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2	*Car Park Paving*	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**72**	**72**	**72**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3	*Building Works*																											
3a	piling works	0	0	0	0	0	0	0	0	0	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	113	113	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	114	114	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	113	113	113	113	113	113	113	113	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*112*	*113*	*113*	*113*	*114*	*114*	*114*	*114*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**70**	**71**	**71**	**71**	**72**	**72**	**72**	**72**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**0**
4	*Dredging of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**67**	**67**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5	*Rock filling of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**66**	**66**	**66**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6	*Box Culvert Construction*																											
6a	construction of gabion channel	0	0	0	0	0	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**69**	**69**	**69**	**69**	**69**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	121	121	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**76**	**76**	**76**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	109	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**57**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	111	111	111	111	111	111	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**0**	**0**	**0**	**0**	**0**	**0**
7	*Sand Filling*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117	117	117	117	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*117*	*117*	*117*	*117*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**68**	**68**	**68**	**68**	**0**	**0**	**0**	**0**	**0**
OVERALL NOISE LEVEL AT NSR (dB(A))		**0**	**0**	**72**	**72**	**72**	**74**	**74**	**74**	**74**	**75**	**78**	**78**	**77**	**72**	**73**	**73**	**73**	**72**	**74**	**73**	**73**	**73**	**71**	**71**	**71**	**71**	**0**

Appendix D4 - Construction Noise Assessment - Unmitigated Scenario

NSR: *N4, Village House - No.79 Lo Tsz Tin*

Distance from NSR to Notional Source Position			*Correction Factor*								
Distance from NSR to Work Site ID 1	*135*	*m*	Distance Attenuation =	*-51*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 2	*135*	*m*	Distance Attenuation =	*-51*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 3	*106*	*m*	Distance Attenuation =	*-49*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 4	*225*	*m*	Distance Attenuation =	*-55*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 5	*180*	*m*	Distance Attenuation =	*-53*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6a & 6b	*68*	*m*	Distance Attenuation =	*-45*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6c & 6d	*322*	*m*	Distance Attenuation =	*-58*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 7	*225*	*m*	Distance Attenuation =	*-55*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	*Construction Works on Land*																											
1a	site Formation, construction of seawall	0	0	116	116	116	116	116	115.6	115.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	115	115	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*118*	*118*	*118*	*118*	*118*	*118*	*118*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2	*Car Park Paving*	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**68**	**68**	**68**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3	*Building Works*																											
3a	piling works	0	0	0	0	0	0	0	0	0	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	113	113	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	114	114	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	113	113	113	113	113	113	113	113	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*112*	*113*	*113*	*113*	*114*	*114*	*114*	*114*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**66**	**68**	**68**	**68**	**69**	**69**	**69**	**69**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**0**
4	*Dredging of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**64**	**64**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5	*Rock filling of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	116	116	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*116*	*116*	*116*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**66**	**66**	**66**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6	*Box Culvert Construction*																											
6a	construction of gabion channel	0	0	0	0	0	115	115	115	115	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**73**	**73**	**73**	**73**	**73**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	121	121	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**80**	**80**	**80**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	109	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**54**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	111	111	111	111	111	111	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**56**	**56**	**56**	**56**	**56**	**56**	**56**	**0**	**0**	**0**	**0**	**0**	**0**
7	*Sand Filling*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117	117	117	117	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*117*	*117*	*117*	*117*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**65**	**65**	**65**	**65**	**0**	**0**	**0**	**0**	**0**
OVERALL NOISE LEVEL AT NSR (dB(A))		**0**	**0**	**71**	**71**	**71**	**75**	**75**	**75**	**75**	**75**	**80**	**80**	**80**	**69**	**70**	**70**	**70**	**70**	**71**	**70**	**70**	**69**	**67**	**67**	**67**	**67**	**0**

Appendix D5

Construction Noise Assessment (Mitigated Scenario)

Appendix D5 Construction Plant Inventory - Mitigated Scenario

							Correction, dB(A)			
ID	Activities	Plant	CNP/BS5228 ref.	No. of PME	% of operating time	SWL, dB(A)	Operating time	No. of Plant	Barrier(3)	SWL, dB(A)
1	**Construction Works on Land**									
1a	*site Formation, construction of seawall, ramp, staircase, retaining walls, sump tanks for grey water system and superstructure foundation*									
	- construction of seawall & retaining wall	Mobile crane	--(2)	1	80	107	-1	0	-5	101
		Excavator	BS TC3-97	1	80	105	-1	0	-5	99
		Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
									Sub-Total SWL	***110***
	- backfilling	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
		Excavator	BS TC3-97	2	80	105	-1	3	-5	102
		Roller, vibratory	CNP 186	1	50	108	-3	0	0	105
									Sub-Total SWL	***111***
	- construction of ramp, staircase, sump tanks for grey water system and superstructure foundation	Timber sawing machine	CNP 201	2	50	108	-3	3	-5	103
		Bar bender and cutter (electric)	CNP 021	3	50	90	-3	5	0	92
		Electrical drill	CNP 065	5	50	98	-3	7	0	102
		Diesel generator	CNP 102	1	100	100	0	0	0	100
		Water pumps (electric)	CNP 281	2	100	88	0	3	0	91
		Vibratory Poker (electric)	--(1)	3	80	102	-1	5	0	106
		Concrete lorry mixers	BS TC6-23	1	80	100	-1	0	-5	94
									Sub-Total SWL	***109***
						MAXIMUM SWL FOR WORK ID 1a =				***111***
1b	*road widening at Ting Kok Road*									
	- breaking existing road surface	Excavator	BS TC3-97	2	100	105	0	3	-5	103
									Sub-Total SWL	***103***
	- drainage channel construction	Silent Piler	--(3)	1	80	100	-1	0	0	99
		Excavator	BS TC3-97	1	80	105	-1	0	-5	99
		Mobile crane	--(2)	1	80	107	-1	0	-5	101
									Sub-Total SWL	***105***
	- manhole construction	Electrical drill	CNP 065	2	50	98	-3	3	0	98
		Diesel generator	CNP 102	2	100	100	0	3	0	103
		Timber sawing machine	CNP 201	1	50	108	-3	0	-5	100
		Bar bender and cutter (electric)	CNP 021	1	50	90	-3	0	0	87
									Sub-Total SWL	***106***
	- concreting work	Concrete lorry mixers	BS TC6-23	1	80	100	-1	0	0	99
		Vibratory Poker (electric)	--(1)	2	80	102	-1	3	0	104
									Sub-Total SWL	***105***
	- backfilling and road formation	Compactor, vibratory	CNP 050	1	50	105	-3	0	0	102
		Road roller	CNP 185	1	50	108	-3	0	0	105
		Excavator	BS TC3-97	1	80	105	-1	0	-5	99
									Sub-Total SWL	***107***
						MAXIMUM SWL FOR WORK ID 1b =				***107***
2	**Car Park Paving**									
	- backfilling	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
		Excavator	BS TC3-97	2	80	105	-1	3	-5	102
		Roller, vibratory	CNP 186	1	50	108	-3	0	0	105
									Sub-Total SWL	***111***
	- concreting work	Concrete lorry mixers	BS TC6-23	1	80	100	-1	0	0	99
		Vibratory Poker (electric)	--(1)	2	80	102	-1	3	0	104
									Sub-Total SWL	***105***
						MAXIMUM SWL FOR WORK ID 2 =				***111***
3	**Building Works**									
3a	*piling works*	Silent piler	--(3)	2	80	100	-1	3	0	102
		Excavator	BS TC3-97	1	80	105	-1	0	0	104
						MAXIMUM SWL FOR WORK ID 3a =				***106***
3b	*foundation and tanking*									
		Mobile crane	--(2)	1	80	107	-1	0	-5	101
		Excavator	BS TC3-97	1	80	105	-1	0	-5	99
		Timber sawing machine	CNP 201	2	50	108	-3	3	-5	103
		Bar bender and cutter (electric)	CNP 021	3	50	90	-3	5	0	92
		Electrical drill	CNP 065	5	50	98	-3	7	0	102
		Diesel generator	CNP 102	1	100	100	0	0	0	100
		Water pumps (electric)	CNP 281	2	100	88	0	3	0	91
									Sub-Total SWL	***108***
						MAXIMUM SWL FOR WORK ID 3b =				***108***

Appendix D5 Construction Plant Inventory - Mitigated Scenario

ID	Activities	Plant	CNP/BS5228 ref.	No. of PME	% of operating time	SWL, dB(A)	Correction, dB(A)			SWL, dB(A)
							Operating time	No. of Plant	Barrier(3)	
3c	*superstructure*									
	- superstructure work	Mobile crane	--(2)	1	80	107	-1	0	-5	101
		Timber sawing machine	CNP 201	3	50	108	-3	5	-5	105
		Bar bender and cutter (electric)	CNP 021	3	50	90	-3	5	0	92
		Electrical drill	CNP 065	6	50	98	-3	8	0	103
		Diesel generator	CNP 102	1	100	100	0	0	0	100
									Sub-Total SWL	***109***
	- concreting work	Concrete lorry mixers	BS TC6-23	1	80	100	-1	0	0	99
		Vibratory Poker (electric)	--(1)	5	80	102	-1	7	0	108
									Sub-Total SWL	***109***
									MAXIMUM SWL FOR WORK ID 3c =	***109***
3d	*building finishes & internal fitting-out*	Mobile crane	--(2)	1	80	107	-1	0	-5	101
		Timber sawing machine	CNP 201	1	50	108	-3	0	0	105
		Electrical drill	CNP 065	6	50	98	-3	8	0	103
		Diesel generator	CNP 102	1	100	100	0	0	0	100
									TOTAL SWL FOR WORK ID 3d =	***109***
4	**Dredging of Groynes**	Excavator	BS TC3-97	2	80	105	-1	3	0	107
		Grab Dredger	CNP 063	1	100	112	0	0	0	112
		Derrick lighter	CNP 061	1	100	104	0	0	0	104
									TOTAL SWL FOR WORK ID 4 =	***114***
5	**Rock filling of Groynes**	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
		Excavator	BS TC3-97	2	80	105	-1	3	-5	102
		Derrick lighter	CNP 061	2	80	104	-1	3	-5	101
									TOTAL SWL FOR WORK ID 5 =	***110***
6	**Box Culvert Construction**									
6a	*construction of gabion channel*									
	- excavation & leveling work	Silent piler	--(3)	1	80	100	-1	0	0	99
		Excavator	BS TC3-97	2	80	105	-1	3	0	107
		Vibration compactor	CNP 186	1	50	108	-3	0	0	105
									Sub-Total SWL	***110***
	- placing of gabion blocks	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	1	80	105	-1	0	0	104
		Mobile crane	--(2)	1	80	107	-1	0	0	106
									Sub-Total SWL	***108***
	- backfilling work	Vibratory compactor	CNP 050	1	50	105	-3	0	0	102
		Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	1	80	105	-1	0	0	104
		Excavator	BS TC3-97	2	80	105	-1	3	-5	102
									Sub-Total SWL	***108***
									MAXIMUM SWL FOR WORK ID 6a =	***110***
6b	*construction of western culvert*									
	- excavation work	Silent piler	--(3)	1	80	100	-1	0	0	99
		Excavator	BS TC3-97	1	80	105	-1	0	0	104
									Sub-Total SWL	***105***
	- construction of culvert	Timber sawing machine	CNP 201	1	50	108	-3	0	0	105
		Electrical drill	CNP 065	2	50	98	-3	3	0	98
		Diesel generator	CNP 102	2	100	100	0	3	0	103
		Water pumps (electric)	CNP 281	1	100	88	0	0	0	88
		Mobile crane	CNP 048	1	80	107	-1	0	-5	101
									Sub-Total SWL	***109***
	- demolition of existing culvert	Pneumatic Breaker	BS TC2-10	1	80	110	-1	0	0	109
		Excavator	BS TC3-97	1	80	105	-1	0	-5	99
									Sub-Total SWL	***109***

Appendix D5 Construction Plant Inventory - Mitigated Scenario

ID	Activities	Plant	CNP/BS5228 ref.	No. of PME	% of operating time	SWL, dB(A)	Correction, dB(A)			SWL, dB(A)
							Operating time	No. of Plant	Barrier(3)	
	- construction of culvert top slab	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	3	80	105	-1	5	0	109
		Concrete lorry mixers	BS TC6-23	1	80	100	-1	0	-5	94
		Timber sawing machine	CNP 201	2	50	108	-3	3	0	108
		Bar bender and cutter (electric)	CNP 021	2	50	90	-3	3	0	90
		Vibratory Poker (electric)	--(1)	2	80	102	-1	3	0	104
									Sub-Total SWL	*112*
	- slope reinstatement	Excavator	BS TC3-97	1	80	105	-1	0	0	104
									Sub-Total SWL	*104*
					MAXIMUM SWL FOR WORK ID 6b =					*112*
6c	*construction of eastern culvert*									
	-preparation of concrete slab surface	Electrical drill	CNP 065	2	50	98	-3	3	0	98
		Diesel generator	CNP 102	2	100	100	0	3	0	103
		Water pumps (electric)	CNP 281	2	100	88	0	3	0	91
									Sub-Total SWL	*104*
	- concreting work	Concrete lorry mixers	BS TC6-23	1	80	100	-1	0	-5	94
		Vibratory Poker (electric)	--(1)	1	80	102	-1	0	0	101
									Sub-Total SWL	*102*
					MAXIMUM SWL FOR WORK ID 6c =					*104*
6d	*construction of 90m box culvert*									
	- excavation work	Excavator	BS TC3-97	1	80	105	-1	0	-5	99
									Sub-Total SWL	*99*
	- erection of precast panel segment	Mobile crane	--(2)	1	80	107	-1	0	-5	101
									Sub-Total SWL	*101*
	- construction of top and bottom slab	Timber sawing machine	CNP 201	1	50	108	-3	0	-5	100
		Bar bender and cutter (electric)	CNP 021	1	50	90	-3	0	-5	82
		Electrical drill	CNP 065	2	50	98	-3	3	-5	93
		Diesel generator	CNP 102	2	100	100	0	3	-5	98
									Sub-Total SWL	*103*
	- concreting work	Vibratory Poker (electric)	--(1)	2	80	102	-1	3	-5	99
		Concrete lorry mixers	CNP 044	1	80	100	-1	0	-5	94
									Sub-Total SWL	*100*
	-screeding work	Concrete mixer	CNP 045	1	80	96	-1	0	-5	90
		Diesel generator	CNP 102	2	100	100	0	3	-5	98
									Sub-Total SWL	*99*
	- backfilling	Lorry, 5.5ton<gross vehicle weight<38ton	--(1)	1	80	105	-1	0	-5	99
		Vibratory compactor	CNP 050	1	50	105	-3	0	-5	97
									Sub-Total SWL	*101*
					MAXIMUM SWL FOR WORK ID 6d =					*103*
7	**Sand Filling**	Pelican barge	CNP 061	1	100	104	0	0	0	104
		Excavator	BS TC3-97	2	80	105	-1	3	-5	102
		Tracked Loader	BS TC3-16	2	80	104	-1	3	0	106
					MAXIMUM SWL FOR WORK ID 7 =					*109*

Remarks

(1) SWL refer to the document prepared by the Noise Control Authority (http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf)

(2) SWL refer to data base of quality powered mechanical equipment prepared by the Noise Control Authority (http://www.epd.gov.hk/cgi-bin/npg/qpme/search_gen.pl?lang=eng&st=sim&smtype=0)

(3) Reference was made to MTRC Contract C4420 Tsim Sha Tsui Station Modification, Variation of Environmental Permit, Noise assessment of GIKEN silent piler system.

(4) Barrier attenuation is obtained from site hoarding or movable noise barrier.

Appendix D5 - Construction Noise Assessment - Mitigated Scenario

NSR: *N1, Village House - No.165A Lung Mei*

Distance from NSR to Notional Source Position			***Correction Factor***								
Distance from NSR to Work Site ID 1	*106*	*m*	Distance Attenuation =	*-49*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 2	*176*	*m*	Distance Attenuation =	*-53*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 3	*118*	*m*	Distance Attenuation =	*-49*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 4	*124*	*m*	Distance Attenuation =	*-50*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 5	*68*	*m*	Distance Attenuation =	*-45*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6a & 6b	*290*	*m*	Distance Attenuation =	*-57*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6c & 6d	*29*	*m*	Distance Attenuation =	*-37*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 7	*124*	*m*	Distance Attenuation =	*-50*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	***Construction Works on Land***																											
1a	site Formation, construction of seawall	0	0	111	111	111	111	111	110.9	110.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	107	107	107	107	107	107	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2	***Car Park Paving***	0	0	0	0	0	0	0	0	0	111	111	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*111*	*111*	*111*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**61**	**61**	**61**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3	***Building Works***																											
3a	piling works	0	0	0	0	0	0	0	0	0	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	108	108	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	109	109	109	109	109	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*106*	*108*	*108*	*108*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**60**	**61**	**61**	**61**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**0**
4	***Dredging of Groynes***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*114*	*114*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**67**	**67**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5	***Rock filling of Groynes***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110	110	110	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*110*	*110*	*110*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**69**	**69**	**69**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6	***Box Culvert Construction***																											
6a	construction of gabion channel	0	0	0	0	0	110	110	110	110	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**55**	**55**	**55**	**55**	**55**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	112	112	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**58**	**58**	**58**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	104	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**70**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103	103	103	103	103	103	103	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**68**	**68**	**68**	**68**	**68**	**68**	**68**	**0**	**0**	**0**	**0**	**0**	**0**
7	***Sand Filling***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*109*	*109*	*109*	*109*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**62**	**62**	**62**	**62**	**0**	**0**	**0**	**0**	**0**
OVERALL NOISE LEVEL AT NSR (dB(A))		**0**	**0**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**64**	**65**	**65**	**63**	**71**	**71**	**71**	**72**	**72**	**72**	**70**	**70**	**65**	**62**	**62**	**62**	**62**	**0**

Appendix D5 - Construction Noise Assessment - Mitigated Scenario

NSR: *N2, Village House - No.103 Lung Mei*

Distance from NSR to Notional Source Position				*Correction Factor*								
Distance from NSR to Work Site ID 1	*80*	*m*		Distance Attenuation =	*-46*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 2	*128*	*m*		Distance Attenuation =	*-50*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 3	*94*	*m*		Distance Attenuation =	*-47*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 4	*135*	*m*		Distance Attenuation =	*-51*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 5	*90*	*m*		Distance Attenuation =	*-47*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6a & 6b	*246*	*m*		Distance Attenuation =	*-56*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6c & 6d	*70*	*m*		Distance Attenuation =	*-45*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 7	*135*	*m*		Distance Attenuation =	*-51*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	*Construction Works on Land*																											
1a	site Formation, construction of seawall	0	0	111	111	111	111	111	110.9	110.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	107	107	107	107	107	107	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**69**	**69**	**69**	**69**	**69**	**69**	**69**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2	*Car Park Paving*	0	0	0	0	0	0	0	0	0	111	111	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*111*	*111*	*111*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**64**	**64**	**64**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3	*Building Works*																											
3a	piling works	0	0	0	0	0	0	0	0	0	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	108	108	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	109	109	109	109	109	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*106*	*108*	*108*	*108*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**62**	**63**	**63**	**63**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**0**
4	*Dredging of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*114*	*114*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**66**	**66**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5	*Rock filling of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110	110	110	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*110*	*110*	*110*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**66**	**66**	**66**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6	*Box Culvert Construction*																											
6a	construction of gabion channel	0	0	0	0	0	110	110	110	110	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**57**	**57**	**57**	**57**	**57**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	112	112	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**59**	**59**	**59**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	104	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**63**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103	103	103	103	103	103	103	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**0**	**0**	**0**	**0**	**0**	**0**
7	*Sand Filling*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*109*	*109*	*109*	*109*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**61**	**61**	**61**	**61**	**0**	**0**	**0**	**0**	**0**
OVERALL NOISE LEVEL AT NSR (dB(A))		**0**	**0**	**69**	**69**	**69**	**70**	**70**	**70**	**70**	**66**	**67**	**67**	**65**	**66**	**69**	**69**	**69**	**69**	**70**	**67**	**67**	**66**	**64**	**64**	**64**	**64**	**0**

Appendix D5 - Construction Noise Assessment - Mitigated Scenario

NSR: *N2a, House - No.101 Lung Mei*

Distance from NSR to Notional Source Position			*Correction Factor*								
Distance from NSR to Work Site ID 1	77	m	Distance Attenuation =	-46	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 2	140	m	Distance Attenuation =	-51	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 3	89	m	Distance Attenuation =	-47	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 4	122	m	Distance Attenuation =	-50	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 5	90	m	Distance Attenuation =	-47	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6a & 6b	261	m	Distance Attenuation =	-56	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6c & 6d	55	m	Distance Attenuation =	-43	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 7	122	m	Distance Attenuation =	-50	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	*Construction Works on Land*																											
1a	site Formation, construction of seawall	0	0	111	111	111	111	111	110.9	110.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	107	107	107	107	107	107	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	0	0	70	70	70	70	70	70	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	*Car Park Paving*	0	0	0	0	0	0	0	0	0	111	111	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*111*	*111*	*111*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	63	63	63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	*Building Works*																											
3a	piling works	0	0	0	0	0	0	0	0	0	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	108	108	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	109	109	109	109	109	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*106*	*108*	*108*	*108*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*0*
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	62	64	64	64	65	65	65	65	65	65	65	65	65	65	65	65	65	0
4	*Dredging of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*114*	*114*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	67	0	0	0	0	0	0	0	0	0	0	0
5	*Rock filling of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110	110	110	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*110*	*110*	*110*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	66	66	0	0	0	0	0	0	0	0
6	*Box Culvert Construction*																											
6a	construction of gabion channel	0	0	0	0	0	110	110	110	110	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	56	56	56	56	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	112	112	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	59	59	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	104	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	65	0	0	0	0	0	0	0	0	0	0	0	0	0
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103	103	103	103	103	103	103	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	63	63	63	63	63	63	0	0	0	0	0	0
7	*Sand Filling*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*109*	*109*	*109*	*109*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	62	62	62	0	0	0	0	0
OVERALL NOISE LEVEL AT NSR (dB(A))		0	0	70	70	70	70	70	70	70	66	67	67	65	68	70	70	70	70	70	68	68	67	65	65	65	65	0

Appendix D5 - Construction Noise Assessment - Mitigated Scenario

NSR: *N3, Village House - No.70 Lo Tsz Tin*

Distance from NSR to Notional Source Position			*Correction Factor*								
Distance from NSR to Work Site ID 1	122	m	Distance Attenuation =	-50	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 2	85	m	Distance Attenuation =	-47	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 3	70	m	Distance Attenuation =	-45	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 4	167	m	Distance Attenuation =	-52	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 5	172	m	Distance Attenuation =	-53	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6a & 6b	106	m	Distance Attenuation =	-49	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 6c & 6d	212	m	Distance Attenuation =	-55	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)
Distance from NSR to Work Site ID 7	167	m	Distance Attenuation =	-52	dB(A)	Facade =	3	dB(A)	Barrier Correction =	0	dB(A)

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	*Construction Works on Land*																											
1a	site Formation, construction of seawall	0	0	111	111	111	111	111	110.9	110.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	107	107	107	107	107	107	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	0	0	113	113	113	113	113	113	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	66	66	66	66	66	66	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	*Car Park Paving*	0	0	0	0	0	0	0	0	0	111	111	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	0	0	0	0	0	0	0	0	0	111	111	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	67	67	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	*Building Works*																											
3a	piling works	0	0	0	0	0	0	0	0	0	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	108	108	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	109	109	109	109	109	0
	Total SWL	0	0	0	0	0	0	0	0	0	106	108	108	108	109	109	109	109	109	109	109	109	109	109	109	109	109	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	64	66	66	66	67	67	67	67	67	67	67	67	67	67	67	67	67	0
4	*Dredging of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64	64	0	0	0	0	0	0	0	0	0	0	0
5	*Rock filling of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110	110	110	0	0	0	0	0	0	0	0
	Total SWL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110	110	110	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	60	60	0	0	0	0	0	0	0	0
6	*Box Culvert Construction*																											
6a	construction of gabion channel	0	0	0	0	0	110	110	110	110	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	64	64	64	64	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	112	112	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	67	67	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	104	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103	103	103	103	103	103	103	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	51	51	51	51	51	51	0	0	0	0	0	0
7	*Sand Filling*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0
	Total SWL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0
	Noise Level at NSR (dB(A))	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	60	60	60	0	0	0	0	0
OVERALL NOISE LEVEL AT NSR (dB(A))		0	0	66	66	66	68	68	68	68	70	71	71	69	67	69	69	68	68	68	68	68	68	67	67	67	67	0

Appendix D5 - Construction Noise Assessment - Mitigated Scenario

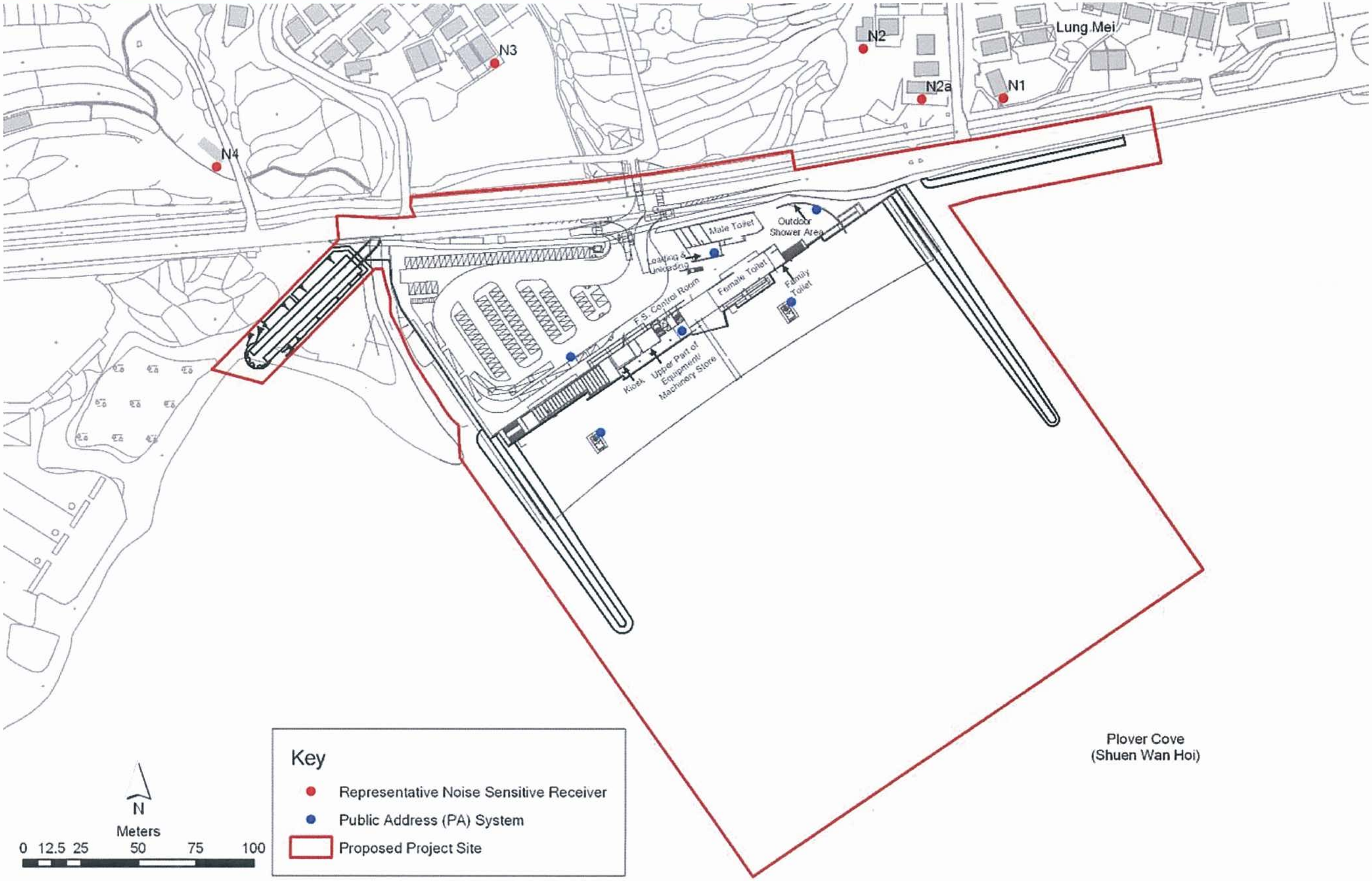
NSR: *N4, Village House - No.79 Lo Tsz Tin*

Distance from NSR to Notional Source Position			*Correction Factor*								
Distance from NSR to Work Site ID 1	*135*	*m*	Distance Attenuation =	*-51*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 2	*135*	*m*	Distance Attenuation =	*-51*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 3	*106*	*m*	Distance Attenuation =	*-49*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 4	*225*	*m*	Distance Attenuation =	*-55*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 5	*180*	*m*	Distance Attenuation =	*-53*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6a & 6b	*68*	*m*	Distance Attenuation =	*-45*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 6c & 6d	*322*	*m*	Distance Attenuation =	*-58*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*
Distance from NSR to Work Site ID 7	*225*	*m*	Distance Attenuation =	*-55*	*dB(A)*	Facade =	*3*	*dB(A)*	Barrier Correction =	*0*	*dB(A)*

Construction Item		2008			2009												2010											
ID	Activity	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	*Construction Works on Land*																											
1a	site Formation, construction of seawall	0	0	111	111	111	111	111	110.9	110.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	road widening at Ting Kok Road	0	0	107	107	107	107	107	107	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*113*	*113*	*113*	*113*	*113*	*113*	*113*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**65**	**65**	**65**	**65**	**65**	**65**	**65**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2	*Car Park Paving*	0	0	0	0	0	0	0	0	0	111	111	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*111*	*111*	*111*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**63**	**63**	**63**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3	*Building Works*																											
3a	piling works	0	0	0	0	0	0	0	0	0	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3b	foundation and tanking	0	0	0	0	0	0	0	0	0	0	108	108	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3c	superstructure	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0	0	0	0	0	0
3d	building finishes & internal fitting-out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	109	109	109	109	109	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*106*	*108*	*108*	*108*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*109*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**61**	**62**	**62**	**62**	**63**	**63**	**63**	**63**	**63**	**63**	**63**	**63**	**63**	**63**	**63**	**63**	**63**	**0**
4	*Dredging of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	114	0	0	0	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*114*	*114*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**62**	**62**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5	*Rock filling of Groynes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110	110	110	0	0	0	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*110*	*110*	*110*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**60**	**60**	**60**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6	*Box Culvert Construction*																											
6a	construction of gabion channel	0	0	0	0	0	110	110	110	110	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**68**	**68**	**68**	**68**	**68**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6b	construction of western culvert	0	0	0	0	0	0	0	0	0	0	112	112	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**71**	**71**	**71**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6c	construction of eastern culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	104	0	0	0	0	0	0	0	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**49**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6d	construction of 90m box culvert	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103	103	103	103	103	103	103	0	0	0	0	0	0
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**48**	**48**	**48**	**48**	**48**	**48**	**48**	**0**	**0**	**0**	**0**	**0**	**0**
7	*Sand Filling*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	109	109	109	0	0	0	0	0
	Total SWL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*109*	*109*	*109*	*109*	*0*	*0*	*0*	*0*	*0*
	Noise Level at NSR (dB(A))	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**57**	**57**	**57**	**57**	**0**	**0**	**0**	**0**	**0**
OVERALL NOISE LEVEL AT NSR (dB(A))		**0**	**0**	**65**	**65**	**65**	**70**	**70**	**70**	**70**	**70**	**72**	**72**	**71**	**63**	**66**	**66**	**65**	**65**	**66**	**64**	**64**	**64**	**63**	**63**	**63**	**63**	**0**

Appendix D6

Operational Noise Assessment



Client

CIVIL ENGINEERING
AND DEVELOPMENT
DEPARTMENT

Consulting Engineer

Halcrow
Halcrow China Ltd.

Environmental
Resources
Management
ERM as sub-consultant

Agreement No.: CE 59/2005(EP)

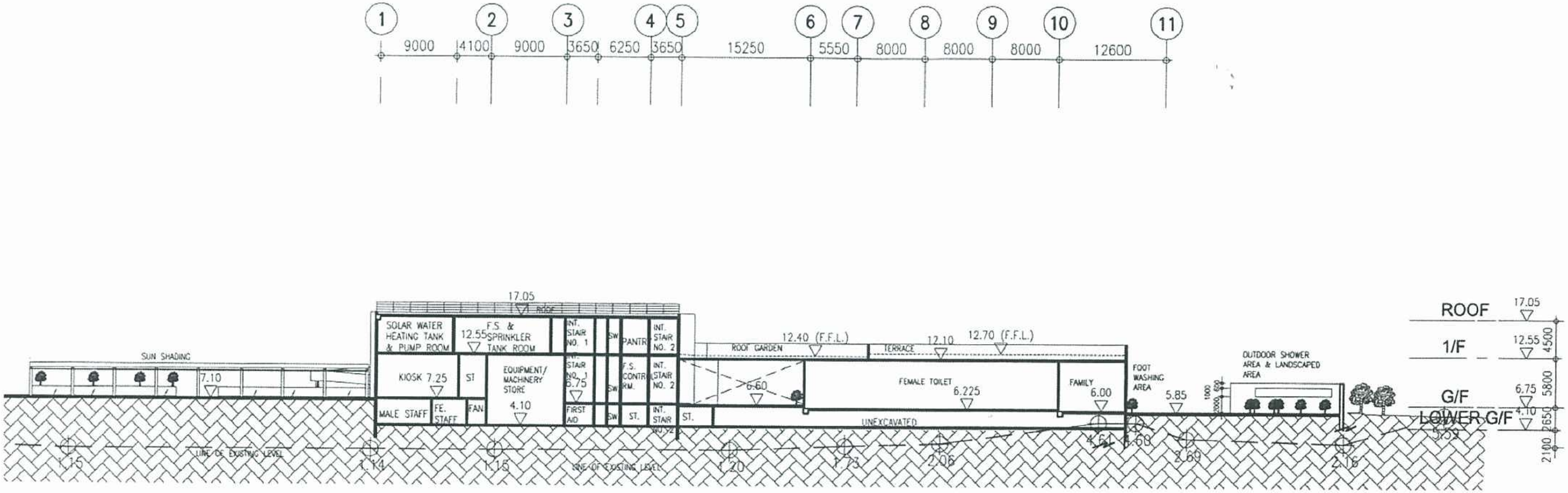
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPENDIX D6 - FIGURE 1

Project Title:
DEVELOPMENT OF A BATHING
BEACH AT LUNG MEI, TAI PO

Figure Title:
PRELIMINARY LAYOUT PLAN

Checked -	Scale AS SHOWN	Rev. 3
Designed -	Drawn KK	Date 06/07/2007



Client

CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer

Halcrow China Ltd.

Environmental Resources Management as sub-consultant

Agreement No.: CE 59/2005(EP)

Project Title:

DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:

SECTION A - A

APPENDIX D6 - FIGURE 2

Checked	Scale	Rev.
PS	AS SHOWN	2
Designed	**Drawn**	**Date**
-	KK	06/07/2007

Appendix D6 Operational Noise Assessment

NSR: *N1, Village House - No.165A Lung Mei*

Location	Plant Item	Reference	No. of Plant	SWL, dB(A)	Distance to the source, m	Correction, dB(A)					Corrected Noise Level, dB(A)
						No. of plant	Distance	Operating Period[2]	Barrier[3]	Facade	
Lift Machine Room	Mechanical fan	-[1]	1	88	160	0	-52	0	0	3	39
Plant Room	Mechanical fan	-[1]	1	88	180	0	-53	0	0	3	38
	Pump	-[1]	3	92	180	5	-53	0	-10	3	37
Water Tank & Pump Room	Mechanical fan	-[1]	1	88	160	0	-52	0	0	3	39
	Pump	-[1]	3	92	160	5	-52	0	-10	3	38
Generator Room	Mechanical fan	-[1]	1	88	160	0	-52	0	0	3	39
	Generator	CNP 101	1	100	160	0	-52	0	-10	3	41
Pump & Sump Tank Room	Mechanical fan	-[1]	1	88	100	0	-48	0	0	3	43
	Pump	-[1]	3	92	100	5	-48	0	-10	3	42
Car Park	Loudspeaker cluster	-[1]	1	100	218	0	-55	-9	0	3	39
Bathing beach (safeguard lookout)	Loudspeaker cluster	-[1]	1	100	222	0	-55	-9	0	3	39
	Loudspeaker cluster	-[1]	1	100	126	0	-50	-9	0	3	44
Facility building	Loudspeaker cluster	-[1]	1	98	95	0	-48	-9	0	3	45
	Loudspeaker cluster	-[1]	1	98	142	0	-51	-9	0	3	41
	Loudspeaker cluster	-[1]	1	98	167	0	-52	-9	-5	3	35
						Predicted Operational Noise Level at the NSR					52

NSR: *N2, Village House - No.103 Lung Mei*

Location	Plant Item	Reference	No. of Plant	SWL, dB(A)	Distance to the source, m	Correction, dB(A)					Corrected Noise Level, dB(A)
						No. of plant	Distance	Operating Period[2]	Barrier[3]	Facade	
Lift Machine Room	Mechanical fan	-[1]	1	88	132	0	-50	0	0	3	41
Plant Room	Mechanical fan	-[1]	1	88	152	0	-52	0	0	3	39
	Pump	-[1]	3	92	152	5	-52	0	-10	3	38
Water Tank & Pump Room	Mechanical fan	-[1]	1	88	132	0	-50	0	0	3	41
	Pump	-[1]	3	92	132	5	-50	0	-10	3	39
Generator Room	Mechanical fan	-[1]	1	88	132	0	-50	0	0	3	41
	Generator	CNP 101	1	100	132	0	-50	0	-10	3	43
Pump & Sump Tank Room	Mechanical fan	-[1]	1	88	78	0	-46	0	0	3	45
	Pump	-[1]	3	92	78	5	-46	0	-10	3	44
Car Park	Loudspeaker cluster	-[1]	1	100	186	0	-53	-9	0	3	41
Bathing beach (safeguard lookout)	Loudspeaker cluster	-[1]	1	100	197	0	-54	-9	-5	3	35
	Loudspeaker cluster	-[1]	1	100	110	0	-49	-9	-5	3	40
Facility building	Loudspeaker cluster	-[1]	1	98	74	0	-45	-9	0	3	47
	Loudspeaker cluster	-[1]	1	98	107	0	-49	-9	-5	3	39
	Loudspeaker cluster	-[1]	1	98	142	0	-51	-9	-5	3	36
						Predicted Operational Noise Level at the NSR					53

NSR: *N2a, House - No.101 Lung Mei*

Location	Plant Item	Reference	No. of Plant	SWL, dB(A)	Distance to the source, m	Correction, dB(A)					Corrected Noise Level, dB(A)
						No. of plant	Distance	Operating Period[2]	Barrier[3]	Facade	
Lift Machine Room	Mechanical fan	-[1]	1	88	147	0	-51	0	0	3	40
Plant Room	Mechanical fan	-[1]	1	88	158	0	-52	0	0	3	39
	Pump	-[1]	3	92	158	5	-52	0	-10	3	38
Water Tank & Pump Room	Mechanical fan	-[1]	1	88	147	0	-51	0	0	3	40
	Pump	-[1]	3	92	147	5	-51	0	-10	3	38
Generator Room	Mechanical fan	-[1]	1	88	147	0	-51	0	0	3	40
	Generator	CNP 101	1	100	147	0	-51	0	-10	3	42
Pump & Sump Tank Room	Mechanical fan	-[1]	1	88	64	0	-44	0	0	3	47
	Pump	-[1]	3	92	64	5	-44	0	-10	3	46
Car Park	Loudspeaker cluster	-[1]	1	100	184	0	-53	-9	0	3	41
Bathing beach (safeguard lookout)	Loudspeaker cluster	-[1]	1	100	196	0	-54	-9	-5	3	35
	Loudspeaker cluster	-[1]	1	100	102	0	-48	-9	-5	3	41
Facility building	Loudspeaker cluster	-[1]	1	98	64	0	-44	-9	0	3	48
	Loudspeaker cluster	-[1]	1	98	109	0	-49	-9	-5	3	39
	Loudspeaker cluster	-[1]	1	98	140	0	-51	-9	-5	3	36
						Predicted Operational Noise Level at the NSR					54

NSR: *N3, Village House - No.70 Lo Tsz Tin*

Location	Plant Item	Reference	No. of Plant	SWL, dB(A)	Distance to the source, m	Correction, dB(A)					Corrected Noise Level, dB(A)
						No. of plant	Distance	Operating Period[2]	Barrier[3]	Facade	
Lift Machine Room	Mechanical fan	-[1]	1	88	130	0	-50	0	0	3	41
Plant Room	Mechanical fan	-[1]	1	88	130	0	-50	0	0	3	41
	Pump	-[1]	3	92	130	5	-50	0	-10	3	40
Water Tank & Pump Room	Mechanical fan	-[1]	1	88	130	0	-50	0	0	3	41
	Pump	-[1]	3	92	130	5	-50	0	-10	3	40
Generator Room	Mechanical fan	-[1]	1	88	130	0	-50	0	0	3	41
	Generator	CNP 101	1	100	130	0	-50	0	-10	3	43
Pump & Sump Tank Room	Mechanical fan	-[1]	1	88	140	0	-51	0	0	3	40
	Pump	-[1]	3	92	140	5	-51	0	-10	3	39
Car Park	Loudspeaker cluster	-[1]	1	100	130	0	-50	-9	0	3	44
Bathing beach (safeguard lookout)	Loudspeaker cluster	-[1]	1	100	162	0	-52	-9	0	3	42
	Loudspeaker cluster	-[1]	1	100	162	0	-52	-9	-5	3	37
Facility building	Loudspeaker cluster	-[1]	1	98	152	0	-52	-9	0	3	41
	Loudspeaker cluster	-[1]	1	98	121	0	-50	-9	-5	3	38
	Loudspeaker cluster	-[1]	1	98	137	0	-51	-9	-5	3	37
						Predicted Operational Noise Level at the NSR					52

NSR: *N4, Village House - No.79 Lo Tsz Tin*

Location	Plant Item	Reference	No. of Plant	SWL, dB(A)	Distance to the source, m	Correction, dB(A)					Corrected Noise Level, dB(A)
						No. of plant	Distance	Operating Period[2]	Barrier[3]	Facade	
Lift Machine Room	Mechanical fan	-[1]	1	88	195	0	-54	0	0	3	37
Plant Room	Mechanical fan	-[1]	1	88	185	0	-53	0	0	3	38
	Pump	-[1]	3	92	185	5	-53	0	-10	3	36
Water Tank & Pump Room	Mechanical fan	-[1]	1	88	195	0	-54	0	0	3	37
	Pump	-[1]	3	92	195	5	-54	0	-10	3	36
Generator Room	Mechanical fan	-[1]	1	88	195	0	-54	0	0	3	37
	Generator	CNP 101	1	100	195	0	-54	0	-10	3	39
Pump & Sump Tank Room	Mechanical fan	-[1]	1	88	240	0	-56	0	0	3	35
	Pump	-[1]	3	92	240	5	-56	0	-10	3	34
Car Park	Loudspeaker cluster	-[1]	1	100	170	0	-53	-9	0	3	42
Bathing beach (safeguard lookout)	Loudspeaker cluster	-[1]	1	100	197	0	-54	-9	0	3	40
	Loudspeaker cluster	-[1]	1	100	251	0	-56	-9	-5	3	33
Facility building	Loudspeaker cluster	-[1]	1	98	258	0	-56	-9	-5	3	31
	Loudspeaker cluster	-[1]	1	98	213	0	-55	-9	-5	3	33
	Loudspeaker cluster	-[1]	1	98	208	0	-54	-9	-5	3	33
						Predicted Operational Noise Level at the NSR					49

Note:

(1) Maximun Sound Power Levels of the equipment will be specified in the Tender Specification

(2) The PA system will be used occasionally. According to the information provided by LCSD, the operating time of the PA system will be 4 minutes in every 30 minutes.

(3) Negative correction factor of 10dB(A) has been applied in the assessment for the equipment located within a building and 5dB(A) for the NSR with no direct line of sight to the equipment.

Appendix E

Water Quality Assessment Supporting Information

CONTENTS

LIST OF FIGURES

1 WATER QUALITY MODELLING

Water quality modelling has been employed to assess the water quality impacts to the nearby water and ecological sensitive receivers during the construction and operation phases of the Study. The activities during the construction phase include dredging for the proposed beach and groynes and eastern box culvert as well as sandfilling and the activities during the operation phase include the discharges in the vicinity of the project area and from sensitive receivers. This section presents information on the approach for the water quality modelling works for the construction and operation phases of the Study.

The modelling methodology was based on the following three focus areas, as follows:

- Model Selection;
- Input Data; and
- Scenarios.

1.1 Interpretation of the Requirements: Key Issues and Constraints

The objectives of the modelling exercise are to assess:

- Effects (Water Quality) of construction, which comprises the study of the dispersion of sediments released during dredging work required for the proposed beach development; and,
- Effects (Water Quality) of operation due to discharges from surrounding areas (with consideration on the pollution reduction due to the sewerage construction works at time of anticipated operation year).

The construction and operational effects have been studied by means of mathematical modelling using existing models that have been set up by WL | Delft Hydraulics (Delft) on behalf of the Environmental Protection Department (EPD) or approved by the EPD for use in environmental assessments.

1.2 Model Selection

1.2.1 Introduction

Plover Cove Model (PCM), a refinement of Tolo Harbour Model (THM) of the Delft 3D water quality (WAQ) and hydrodynamic suite of models were used to simulate effects on hydrodynamics and water quality. *Figures E1.1a* and *E1.1b* show the THM (with refined PCM) for the models during construction and operational phases respectively. PCM was a 2D model developed and used in the 'Feasibility Study for Proposed Beach Improvement Work at Lung Mei Beach'. The PCM had been verified in the feasibility study and this was upgraded to a 3D model for this assessment. The PCM as presented in Figures *E1.2a* and *E1.2b* focuses on the areas of the proposed beach. The model has the refined spatial extent of approximately 20 m in the Project Site fanning out to 50 – 100 m away from the Project Site. Validation of the model was conducted for this Study.

1.3 Coastline and Bathymetry

Hydrodynamic data have been obtained using coastline and bathymetry for a time horizon representative of the construction (assumed to be 2008) and operation (assumed to be 2010) of the proposed bathing beach.

The coastline and the bathymetry were revised to reflect the potential changes during the construction phase and operational phase of the Beach. No existing or planned future activity which might affect the coastline and bathymetry in the vicinity of the Beach is anticipated.

Details regarding the coastline and bathymetry to be used for the construction (assumed to be 2008) and operational (assumed to be 2010) phases assessment were agreed with EPD prior the commencement of modelling.

1.4 Vector Information

The velocities and directions of the flows for both dry and wet seasons during the construction and operation phases of the study area were assessed using the Delft3D-FLOW model. Water quality modelling was exercised using the results from the Delft3D-FLOW model.

1.5 Model Inputs

1.5.1 Hydrodynamics

All hydrodynamic scenarios were simulated for a spring-neap-cycle during the dry season and a spring-neap-cycle during the wet season. The simulated periods were:

- Dry season: simulation period from 8 February 03:30h to 23 February 03:30h, simulation period 15 days, time step 30 seconds.

- Wet season: simulation period from 15 July 03:30h to 1 August 03:30h, simulation period 17 days, time step 30 seconds.

Adequate spin-up has been provided for salinity and temperature by means of initial conditions files. Typical 15 days of both simulation periods were used as spin-up, and were not used for the assessments purpose.

The wind has been set to typical seasonally averaged values:

- Dry season: northeast, 5 m s^{-1}.
- Wet season: southwest, 5 m s^{-1}.

1.5.2 *Sediment Parameters*

For simulating sediment impacts the following general parameters were used:

- Settling velocity – 0.5 mm s^{-1}
- Critical shear stress for deposition – 0.2 N m^{-2}
- Critical shear stress for erosion – 0.3 N m^{-2}
- Minimum depth where deposition allowed – 0.1 m
- Resuspension rate – 30 g m^{-2} d^{-1}
- Wave calculation method – Tamminga
- Chezy calculation method – White/Colebrook
- Bottom roughness – 0.001 m (1)
- Fetch for wave driven erosion – 2000 m

The above parameters have been used to simulate the impacts from sediment plumes in Hong Kong associated with uncontaminated mud disposal into the Brothers MBA (2) and dredging for the Permanent Aviation Fuel Facility at Sha Chau (3). The critical shear stress values for erosion and deposition were determined by laboratory testing of a large sample of marine mud from Hong Kong as part of the original WAHMO studies associated with the new airport at Chek Lap Kok.

1.5.3 *Chlorophyll-a and E.Coli Modelling*

In the approved EIA study (ERM, 2003) (8), chlorophyll-*a* modelling was carried for Tolo Harbour and Mirs bay, i.e. the same region as covered by the current modelling. The study involved the impact of dredging for submarine gas pipelines on chlorophyll-*a*. As this modelling approach has already been accepted by the EPD, the same modelling approach is used to assess the impact of dredging for the Lung Mei beach development on chlorophyll-*a*.

The chlorophyll-*a* model was set up in the Delft3D-WAQ model. Delft3D-WAQ has been calibrated extensively in Hong Kong waters, including Tolo Harbour and Mirs Bay. Background pollution loadings and parameters settings, with exception of the loading at Shan Liu River and four drains in the vicinity of the Project Site which is discussed below, are unchanged from ERM (2003). Instead of annual simulations, a typical dry season month (February) and a typical wet season (July) were simulated. The simulations made use of initial conditions derived from the ERM (2003). Hence, the simulations were already close to equilibrium at the start. Subsequently, a spin-up time of 15 days (one spring-neap cycle) was used.

The simulated periods were:

- Dry season: simulation period from 23 February 03:30h to 10 March 03:30h, simulation period 15 days, time step 15 minutes.

- Wet season: simulation period from 30 July 03:30h to 14 August 03:30h, simulation period 15 days, time step 15 minutes.

In addition to the background pollution loadings included in ERM (2003), the four discharges at drains W3, W4, W5 and W6 near to Lung Mei were included. *E.Coli* concentrations in these discharges were derived from field measurements carried out during December 2006 to January 2007.

As no measurements were available for nutrients, organic matter, etc. for the discharges via drains W3 to W6, the loadings for these drains were estimated based on the nearest stream, Shan Liu Stream. EPD routinely conduct monitoring works at Shan Liu Stream, namely station TR4. The sampling location of TR4 is shown in *Figure E1.5a*. The sampling location is downstream of Ting Kok village. In other words, Shan Liu River collects the surface water and some unsewered sewage from Ting Kok village. This is highly similar to the catchment of Lung Mei and Tai Mei Tuk. Drains W3 to W6 mainly collect surface runoff as well as some unsewered sewage from villages in Lung Mei and Tai Mei Tuk. In this regard, the physical characteristics of the water in these drains would be highly similar to that at Shan Liu Stream. It is hence considered the EPD monitoring data collected at TR4 is representative of the drains W3-W6.

Table E1.1 presents the summary of EPD monitoring data at TR4 whereas *Table E1.2* shows the pollution inventories assumed in the model for drains W3 to W6. In *Table E1.2*, the baseline condition refers to the situation in which there is no Lung Mei bathing beach development and the village sewers are not connected to Drainage Services Department (DSD)'s new public sewerage system. The operation phase refers to the situation in which Lung Mei bathing beach development is in place. Three scenarios have been considered, ie 20%, 40% and 60% of village sewers are connected to DSD's new public sewerage system.

Table E1.1: EPD Routine Monitoring Data at TR4

Parameters	**Season**	
	Dry	**Wet**
Flow (cubic meter/s)	0.056	0.105
Dissolved Oxygen (%saturation)	89.417	91.021
Dissolved Oxygen (mg/L)	7.906	7.277
Water Temperature (deg.C)	21.383	26.706
pH	7.419	7.365
Turbidity (NTU)	16.804	5.650
Salinity (psu)	0.185	0.150
Total Suspended Solids (mg/L)	19.767	7.728
5-day Biochemical Oxygen Demand (mg/L)	1.889	1.450
Escherichia coli (cfu/100ml)	2715	3499
Ammonia-nitrogen (mg/L)	0.484	0.245
Nitrite-nitrogen (mg/L)	0.042	0.025
Nitrate-nitrogen (mg/L)	0.592	0.740
Total Kjeldahl nitrogen (mg/L)	0.686	0.409
Ortho-phosphate as phosphorus (mg/L)	0.113	0.093
Total phosphorus (mg/L)	0.166	0.126

Table E1.2: Pollution Inventory for Drains W3, W4, W5 and W6

Drain ID	Flow (a) (m^3/s)	Salinity (a) (psu)	ModTemp' (a) (d) (deg.C)	E coli' (a) (cfu/100ml)	OXY' (a) (e) (mg/l)	CBOD5' (a) (mg/l)	NO3' (a) (b) (mg/l)	NH4' (a) (b) (mg/l)	PO4' (a) (c) (mg/l)	AAP' (a) (c) (mg/l)	Si' (a) (mg/l)	DetN' (a) (b) (mg/l)	DetP' (a) (c) (mg/l)	IM1' (a) (f) (mg/l)
Dry season - Baseline														
W3	0.056	0.19	21.40	907	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W4	0.056	0.19	21.40	23360	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W5	0.056	0.19	21.40	5909	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W6	0.056	0.19	21.40	60	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
Wet season - Baseline														
W3	0.105	0.15	26.70	907	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W4	0.105	0.15	26.70	23360	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W5	0.105	0.15	26.70	5909	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W6	0.105	0.15	26.70	60	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
Dry season Operational - 60% connection rate														
W3	0.0224	0.19	21.40	907	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W4	0.0224	0.19	21.40	23360	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W5	0.0224	0.19	21.40	5909	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W6	0.0224	0.19	21.40	60	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
Wet season Operational - 60% connection rate														
W3	0.0714	0.15	26.70	907	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W4	0.0714	0.15	26.70	23360	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W5	0.0714	0.15	26.70	5909	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W6	0.0714	0.15	26.70	60	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
Dry season Operational - 40% connection rate														
W3	0.0336	0.19	21.40	907	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W4	0.0336	0.19	21.40	23360	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W5	0.0336	0.19	21.40	5909	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W6	0.0336	0.19	21.40	60	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80

Drain ID	**Flow (a) (m^3/s)**	**Salinity (a) (psu)**	**ModTemp' (a) (d) (deg.C)**	**E coli' (a) (cfu/100ml)**	**OXY' (a) (e) (mg/l)**	**CBOD5' (a) (mg/l)**	**NO3' (a) (b) (mg/l)**	**NH4' (a) (b) (mg/l)**	**PO4' (a) (c) (mg/l)**	**AAP' (a) (c) (mg/l)**	**Si' (a) (mg/l)**	**DetN' (a) (b) (mg/l)**	**DetP' (a) (c) (mg/l)**	**IM1' (a) (f) (mg/l)**
Wet season Operational - 40% connection rate														
W3	0.0826	0.15	26.70	907	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W4	0.0826	0.15	26.70	23360	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W5	0.0826	0.15	26.70	5909	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W6	0.0826	0.15	26.70	60	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
Dry season Operational - 20% connection rate														
W3	0.0448	0.19	21.40	907	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W4	0.0448	0.19	21.40	23360	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W5	0.0448	0.19	21.40	5909	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
W6	0.0448	0.19	21.40	60	7.90	1.90	0.63	0.48	0.11	0.03	2.00	0.20	0.02	19.80
Wet season Operational - 20% connection rate														
W3	0.0938	0.15	26.70	907	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W4	0.0938	0.15	26.70	23360	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W5	0.0938	0.15	26.70	5909	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70
W6	0.0938	0.15	26.70	60	7.30	1.50	0.77	0.24	0.09	0.01	2.00	0.17	0.02	7.70

Notes:

(a) All flows and concentrations are derived from EPD routine monitoring data for Shan Liu Stream, TR4, with exception of *E.coli* and Silicon (Si). *E.coli* concentrations at four drains are taken from field surveys data collected during December 2006 to January 2007. An estimated value of Si was used.

(b) Nitrogen species are composed as follows:

NO_3 = nitrates + nitrites

NH_4 = ammonia

DetN = Kjeldahl nitrogen - ammonia

(c) Phosphorus species are composed as follows:

PO_4 = phosphates

DetP = 0.02 (about 10% of Det N)

AAP = remaining part of total P

(d) ModTemp = modelled temperature

(e) OXY = dissolved oxygen

(f) IM1 = total suspended solids

1.6 Uncertainties in Assessment Methodologies

Uncertainties in the assessment of the impacts from suspended sediment plumes should be considered when drawing conclusions from the assessment. In carrying out the assessment, the worst case assumptions have been made in order to provide a conservative assessment of environmental impacts. These assumptions were as follows:

- The assessment was based on the peak dredging and filling rates. In reality, these will only occur for short period of time; and,
- The calculations of loss rates of sediment to suspension were based on conservative estimates for the types of plant and methods of working.

The conservative assumptions presented above allow a prudent approach to be applied to the water quality assessment.

The following uncertainties have not been included in the modelling assessment. However, their impacts related to water quality were assessed in the EIA.

- Ad hoc navigation of marine traffic;
- Near shore scouring of bottom sediment; and
- Access of marine barges back and forth the site.

1.7 Water Sensitive Receivers for Modelling

The Project Site is located in the Tolo Harbour, near Ting Kok SSSI & Coastal Protection Areas, Yim Tin Tsai East & West Fish Culture Zones, Sha Lan Non-gazetted Beach, Lung Mei & Yim Tin Tsai Mangroves, Pak Sha Tau coral, WSD Seawater Intakes for Tai Po Industrial Estate and Marine Science Laboratory (MSL) of Chinese University. *Table E1*.2 shows the identified water sensitive receivers (WSRs) (including ecological sensitive receivers) in the vicinity of the Beach (see Figure 6.1 in the EIA Report which illustrates the surrounding environment and the modelling output locations for the WSRs).

Table E1.2: Water Quality Modelling Output Locations in the Vicinity of the Beach

Sensitive Receiver	**Name**	**Water Quality Modelling Output Location**
Fisheries Resources		
Fish Culture Zone	Fish Culture Zone in Yim Tin Tsai East	SR1
	Fish Culture Zone in Yim Tin Tsai West	SR2
Marine Ecological Resources		
SSSI/Coastal Protection Area	Ting Kok SSSI, near Ting Kok	SR3
	Ting Kok SSSI, near Shuen Wan	SR4
Mangrove	Ting Kok	SR5
	Yim Tin Tsai, next to Yim Tin Tsai West Fish Culture Zone	SR6
Coral	Pak Sha Tau	SR7
Others		
Proposed Gazetted Beaches (used only for the operation phase)	Lung Mei, four corners and middle of proposed site	SR8 – SR12
Non-gazetted Beaches	Sha Lan	SR13
Seawater Intakes	MSL of Chinese University	SR14
	Tai Po Industrial Estate	SR15
Other Recreational Areas	Tai Mei Tuk Water Sports Centre	SR16
EPD Monitoring Stations	Tolo Harbour & Channel WCZ	TM3, TM5, TM6

2 CONSTRUCTION AND OPERATIONAL SCENARIOS

2.1 Construction Phase

The construction for the proposed beach will involve the followings:

- Dredging at the proposed beach area;
- Dredging at the two groynes; and
- Sandfilling at the proposed beach area.

Hence, the water quality model was used to assess the construction phase impacts. The WAQ model was used to directly simulate the following parameters:

- Suspended solids; and
- Sediment deposition.

It is assumed that the worst-case construction phase impacts will be at the commencement of dredging, if required, when there is no depression formed to trap sediments disturbed during works.

Based upon the results from above, the DO depletion and nutrients release were assessed (1). In addition to the modelling, results from the elutriate test were used to assess the impacts of the dredging for various parameters. Such assessment is presented in the EIA Report.

2.1.1 Dredging

The model was used to assess the impacts posed by dredging for groynes construction and the beach.

Assuming only dredging for the groynes and beach, the dredging volume has been estimated to be approximately 10,500 m^3 but a more conservative value of 12,000 m^3 was assumed in the model for assessment purpose. Dredging in the offshore area will be conducted by Closed Grab Dredger whereas Excavator will be used in the onshore area. Bulldozer will be used to profiling the deposited sand.

Dredging by Closed Grab Dredger

The type of dredgers used will depend on the geometry of the areas to be dredged, programme requirements and any constraints imposed by EPD on production rates. As the dredging is for the groynes and beach, it seems likely that the dredging would be undertaken using grab dredgers. Simulations and related assumptions for grab dredgers are discussed below.

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(1) By reviewing the results of SS elevations, SS impacts are found to be minimal. Hence DO depletion was calculated based on the SS to give most conservative results and potential nutrients release was predicted based on the modelling results and sediment sampling test results.

Closed grab dredgers will be utilised in the dredging works for the beach. Note that proper closed grabs (ie so-called "watertight" grabs) have not yet been used in Hong Kong so far. The limited measurement evidence suggests that conventional closed grabs do not significantly reduce the overall rate of sediment release but do tend to confine the sediment release to the near-bed zone which tends to reduce the distance over which it transported before settling. In order to be properly effective, highly specialised proprietary systems (such as the Cable Arm grab) need to be used in conjunction with washing tanks, silt screens and special operating methods. Such an approach would normally only be deemed necessary in the case of highly contaminated sediments.

Closed grab dredgers may release sediment into suspension by the following mechanisms:

- Impact of the grab on the seabed as it is lowered;
- Washing of sediment off the outside of the grab as it is raised through the water column and when it is lowered again after being emptied;
- Leakage of water from the grab as it is hauled above the water surface;
- Spillage of sediment from over-full grabs;
- Loss from grabs which cannot be fully closed due to the presence of debris;
- Release by splashing when loading barges by careless, inaccurate methods; and
- Disturbance of the seabed as the closed grab is removed.

There are two situations that the sediment release would occur as follows, however, these were not included in the model.

- In the transport of dredging materials, sediment may be lost through leakage from barges. However, dredging permits in Hong Kong include requirements that barges used for the transport of dredging materials have bottom-doors that are properly maintained and have tight-fitting seals in order to prevent leakage. Given this requirement, sediment release during transport is not proposed for modelling and its impact on water quality was not addressed under this Study.

- Sediment is also lost to the water column when discharging material at disposal sites. The amount that is lost depends on a large number of factors including material characteristics, the speed and manner in which it is discharged from the vessel, and the characteristics of the disposal sites. As impacts due to disposal operations at potential disposal sites have been assessed under separate studies, they were not addressed further in this document.

There are a few assumptions made in the sediment plume modelling simulations for grab dredging as listed in details below.

Working Time - Based on current Hong Kong working practice with grab dredgers a 12 hour (7am to 7pm) working day is typical for major dredging and sandfilling works. A seven-day working week is also typical for this sort of construction work in Hong Kong. However, it is anticipated that the construction work will not be conducted during Sundays and Public Holidays. The duration of the work will be dictated by the programme requirements of the development, which is anticipated to last for 2 months. For the simulation of the scenario, 8-working hour per day and 6-working day per week are assumed in the model.

Dredging Rate - Generally, a split-bottom barge could have a capacity of 900 m^3. A bulk factor of 1.3 would normally be applied, giving a dredging rate of 700 m^3 per barge. Assuming a 3 m^3 closed grab will be used and the above working time, the production rates for dredging marine mud will be approximately 31 m^3 hr^{-1} (12,000 m^3 ÷ 48 days ÷ 8 hours per day). For the modelling exercise, 31 m^3 hr^{-1} (0.009 m^3 s^{-1}), was assumed.

Loss Rate - For the assessment purpose, it is assumed that a typical grab size of 3 m^3 will be used for dredging operations. Loss rates have been taken from previously accepted EIAs in Hong Kong (4) (5) (6) and has been based on a review of world wide data on loss rates from dredging operations undertaken as part of assessing the impacts of dredging areas of Kellett Bank for mooring buoys (7). Although the Hebe Haven EIA used a loss rate of 0.5 kg s^{-1}, with considerations on other studies, the assessment concluded that for small size grab dredgers (up to 8 m^3) working in areas with significant amounts of debris on the seabed (such as in the vicinity of existing mooring buoys) that the loss rates would be 25 kg m^{-3} dredged, while the loss rate in areas where debris is less likely to hinder operations would be 17 kg m^{-3} dredged. The loss rate to be used is better to make reference to the geophysical surveys which will show whether there are significant quantities of debris in the vicinity of the dredging works. In order to look into the worst case, the higher loss rate, ie 25 kg m^{-3}, is adopted in this Study. The loss rate in kg s^{-1} was calculated based on the dredging rate as follows:

Loss Rate (kg s^{-1})

= Dredging Rate (m^3 s^{-1}) * Loss Rate (kg m^{-3})

= 0.009 m^3 s^{-1} * 25 kg m^{-3}

= **0.22 kg s^{-1}**

The average release rates will, in fact, be somewhat less than those indicated above. The instantaneous dredging (and loss) rates will also decrease as the depth increases. This is because the assumed dredging production rates are instantaneous rates that will not be maintained due to delays for breakdowns, maintenance, crew changes and time spent relocating the dredgers. The release rates that are to be modelled are, therefore, considered to represent conservative conditions that will not prevail for any great length of time.

Number of Plants - The number of dredgers in operation at any one time will depend on the programmed requirements of the port development. It is assumed that one dredger will be used at one time during the dredging work.

Trajectory of Dredging - In the model, it is assumed that the grab dredger will move anti-clockwise. In reality, the grab dredger is stationary at a location for some time before moving on to another location. In the model, it is assumed that the trajectory will be covered by one grab dredger in a 15-day spring-neap cycle.

Other Assumptions - The sediment loss during dredging by closed grab dredger is assumed to be continuous throughout the working time, ie 8 hours a day, 6 days per week. Besides, dredging of contaminated and uncontaminated mud is assumed to be conducted at the same rate. In addition, the spread of released sediment is assumed to take place uniformly over the water column.

From the finding of the Working Paper 2.5 – Wave and Sediment Modelling Report, the actual annual net drift rate is likely to be in a range of 10 to 150 m^3 yr^{-1}, and therefore, no maintenance dredging is anticipated during the operational stage of the Project.

2.1.2 *Sandfilling*

Sandfilling was assumed to be conducted without the groynes (see *Section 2.1.3* for details of the groynes) in the model. This will give more conservative results since in reality it will be conducted after the construction of the groynes. For the sandfilling at the beach area on land above the high water level, dozers will be used. It is anticipated that about 1/2 area of the sandfilling work will be conducted on land above the high water level, whereas approximately 1/2 area might be exposed to water during high water condition.

Number of Plants – One sandfilling barge will be used for sandfilling of sand materials onto the intertidal area of the proposed beach development works. The sand materials will be placed onto the sandfilling area via a conveyor belt installed on barge extends to the area. Onshore filling will be conducted by end-tipping.

Working Time – The marine works for sandfilling will be completed in 3 to 4 months. It is anticipated that the filling operation will last about 2 months and the marine transportation between the sand loading point and the Project site will take about 1 month.

Filling Rate – It is estimated that 37,500 m^3 of sandfilling material (sand) will be required for the project. However, in order simulate a worse scenario, the proposed allowable maximum filling rate is 1,000 m^3 day^{-1} with a continuous filling operation of 3 hrs per day.

Loss Rate – The sandfilling material (yellowish brown sand) will be imported from Shajao of Pearl River Delta and is primarily sand grains with D_{50} of 0.2 to 0.5mm. The fine particles (silt) content is anticipated to be less than 1%. Dry density is assumed to be 1,600 kg m^{-3}. By assuming 10% of sandfilling material will be lost to the water column, the loss rate is calculated as 0.15 kg s^{-1}, continuously released within 3 hours per day.

Location of Filling – Sandfilling will be conducted without two groynes. Sandfilling will be conducted within the same area as for dredging. This again would give conservative results since the design sandfilling area would not be beyond the groynes.

According to the Port Works Design Manual Part 5 Guide to Design of Beaches published by CEDD, the settling velocity of the proposed sand grains is much higher than that of the fine particles (mud) due to their significant size difference. Even when the sand grains are in suspension, they are still close to the seabed because of the relative high settling velocity.

It is considered that the modelling for the sandfilling is based on the conservative assumptions since the works will be carried out with the following conditions:

- Less than 1/2 of sandfilling will be exposed to water during high water level;
- Sandfilling will be conducted within the groynes;
- High settling velocity for the proposed sand grains;
- Only one sandfilling barge will be used for backfilling of sand materials onto the intertidal area of the proposed beach development works. The sand materials will be placed onto the sandfilling area via a conveyor belt installed on barge extends to the area; and
- Silt curtain will be provided around the proposed dredging extent as a precautionary measure during the sandfilling activities.

No near future filling work is anticipated during the operation phase of this Project. However, monitoring programme on the sand drift such as by conducting a hydrographic survey every year is proposed.

2.1.3 Groynes Structure

Prior to the sandfilling operations, two groynes will be built at the western and eastern edges of the bathing beach area. The cross-sections of the Western Groyne and Eastern Groyne are shown in *Figures E2.1a* and *E2.1b* respectively. These two groynes are inclined, ie the toes of the groynes are submerged in the water. This is circumvented by combining thin dams (closing off the whole water column) and so-called 'gate structures' that close off only part of the water column. The thin dam and gate structure is defined for the Western Groyne and Eastern Groyne as follows:

- For Eastern Groyne, use a thin dam for the first cell (the closest cell to the coast) and a gate structure closing the lower 50% and 25% of the water column for the second and third grid cells respectively; and
- For Western Groyne, use a thin dam for the first cell (the closest cell to the coast) and a gate structure closing the lower 50% of the water column for the second grid cell.

The above closure percentage of water column is estimated referring to the mean higher high water mark (MHHW), ie +2.0mPD.

2.2 Operation Phase

In order to determine whether the existing Lung Mei non-gazetted beach will comply with the WQOs to be proposed to become a gazetted beach, it is necessary to determine the relative change in *E. coli* level at the beach between pre-development and operation phases.

During the operation of the proposed beach, the sewage from the beach building will be connected to the public sewer and no sewage will be discharged onto the beach from the beach building. In addition, the wastewater from the upstream villages is estimated to be reduced by 60% after the sewerage construction works.

The modelling and assessment has assessed the *E. coli* level at the proposed beach and other WSRs during its operation in 2010, which would take into consideration on the pollution reduction from the sewerage construction works at the representative discharges in the vicinity of the Study Area. The 2010 model grid has incorporated the beach facilities to account for the latest coastline. No other modification to the coastline is anticipated in 2010.

The WAQ model was used to directly simulate the following parameters:

- *E. coli*; and
- Chlorophyll-*a*.

2.2.1 Input Parameter for E. coli

The *E. coli* level used in the model will be primarily based upon the field measurements and EPD's routine monitoring data for the current non-gazetted bathing beach at Lung Mei. A separate proposal 'Determination of Discharge Water Characteristics at Lung Mei Area' was also conducted to investigate the *E. coli* level from the key sources which would affect the project area. Water samples were collected at the representative discharge outlets and their upstream locations during different period of the days, to identify the *E. coli* levels. The pollution inventory is presented in *Table E1.1*.

3 RESIDUAL IMPACT

Residual impact for the dredging works during the construction phase and the operation phase has been determined based upon the results from the water quality modelling.

4 CUMULATIVE IMPACT

4.1 Potential Concurrent Projects

It is anticipated that no other potential concurrent marine projects will be carried out in Tolo Harbour near the Study Area during the construction phase. Therefore, assessment on the cumulative impacts as a result of concurrent projects will not be required.

5 REFERENCE

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Appendix E1

Figures

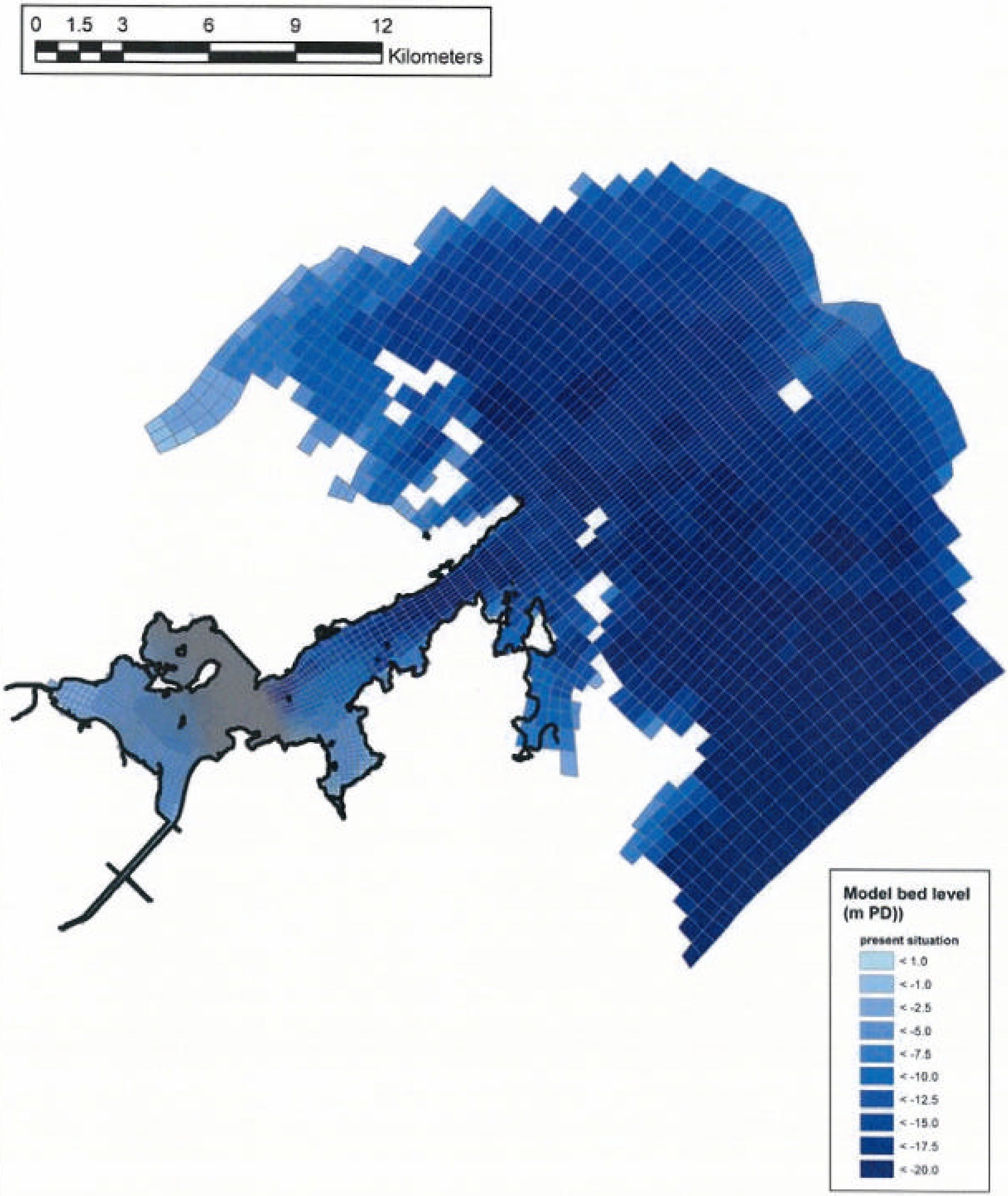


Figure E1.1a: THM Model Grid and Bathymetry (with refined PCM) for Tolo Harbour Area for Construction Phase in 2008.

Agreement No.: CE 59/2005(EP)

DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

FIGURE E1.1a

Client

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer

Halcrow
Halcrow China Ltd.

ERM Environmental Resources Management as sub-consultant

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

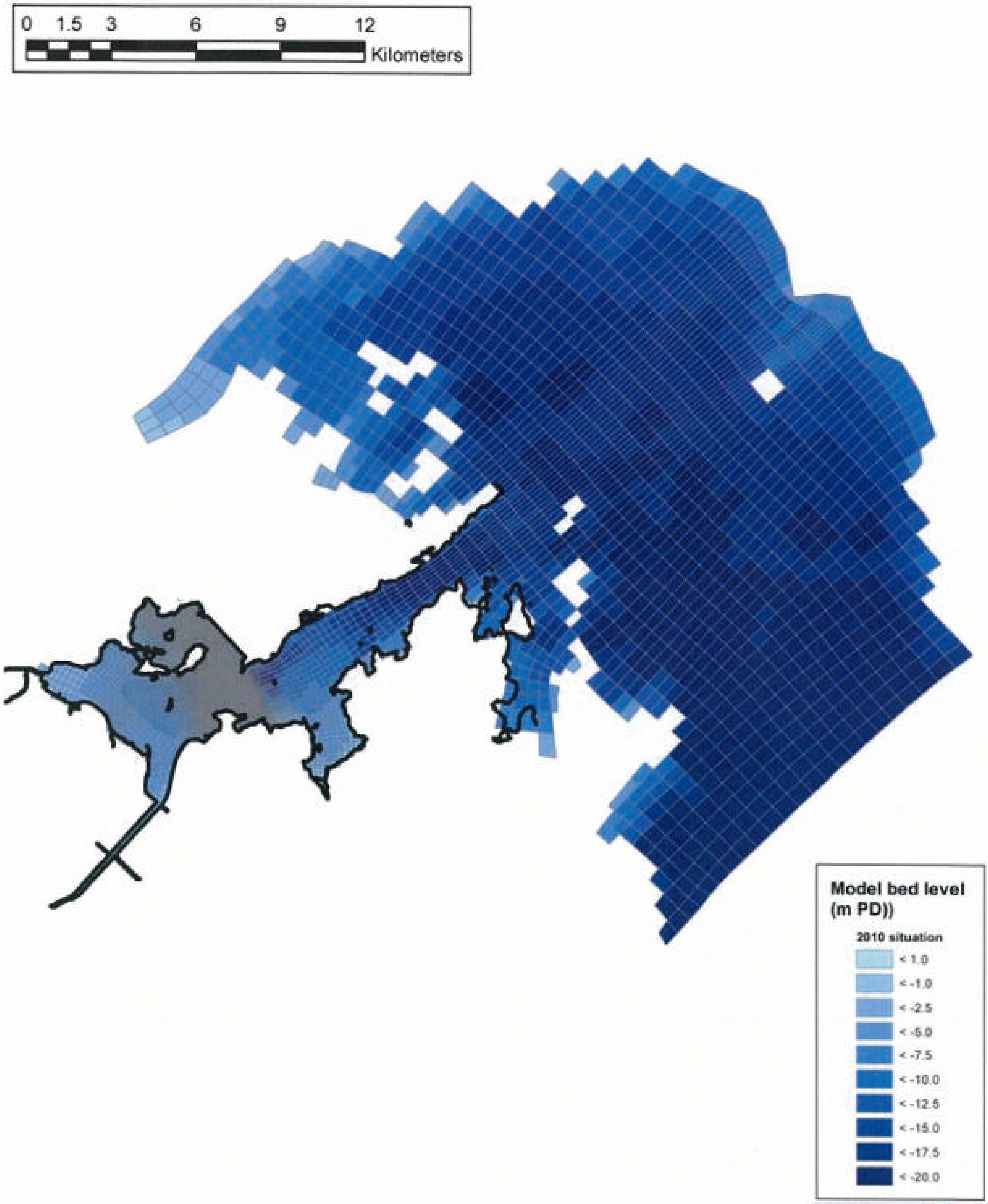


Figure E1.1b: THM Model Grid and Bathymetry (with refined PCM) for Tolo Harbour Area for Operational Phase in 2010

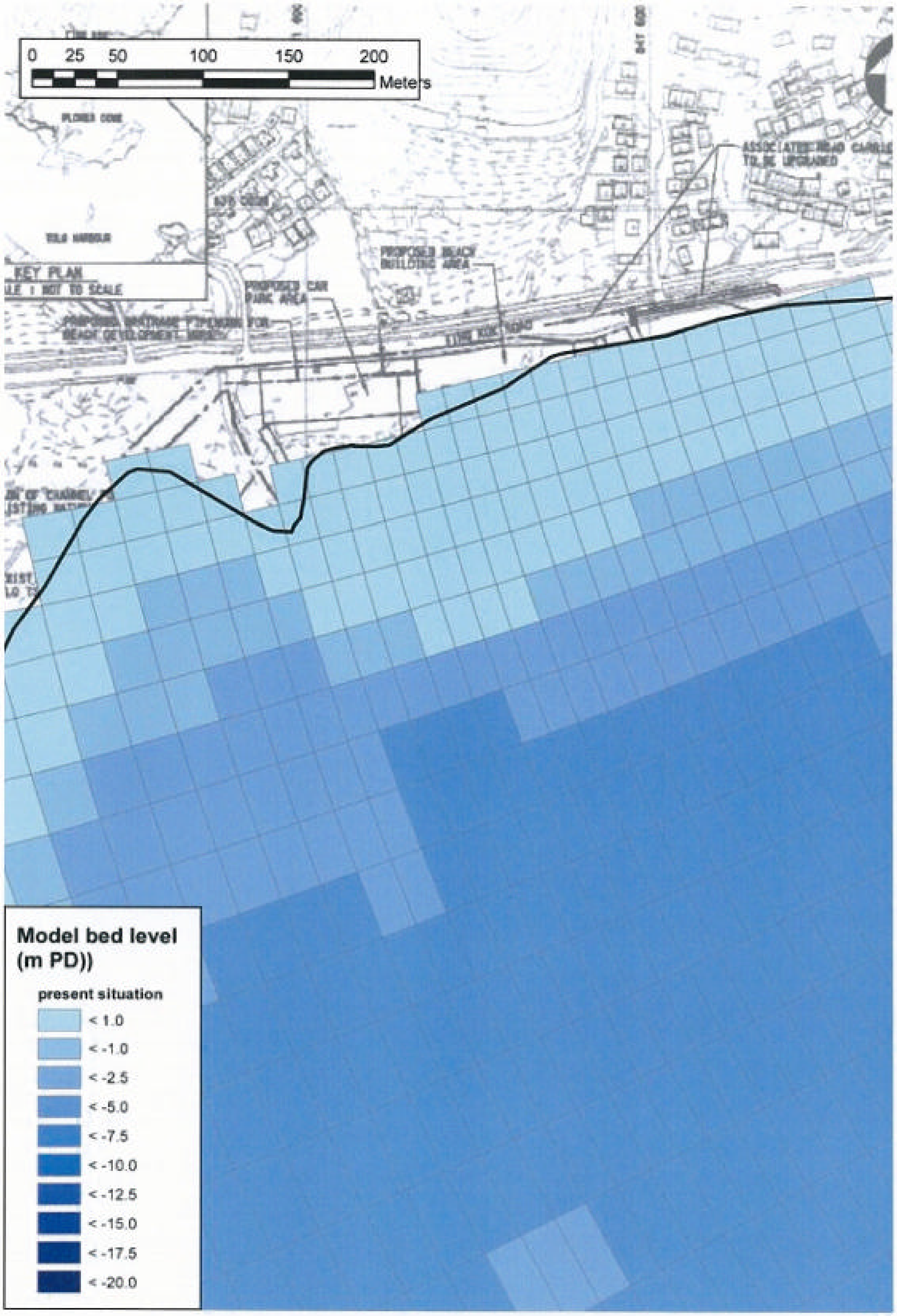


Figure E1.2a: Refined Model Grid and Bathymetry for PCM for the Study Area for Construction Phase in 2008

Agreement No.: CE 59/2005(EP)

DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

FIGURE E1.2a

Client: CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer: Halcrow
Halcrow China Ltd.

ERM Environmental Resources Management as sub-consultant

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

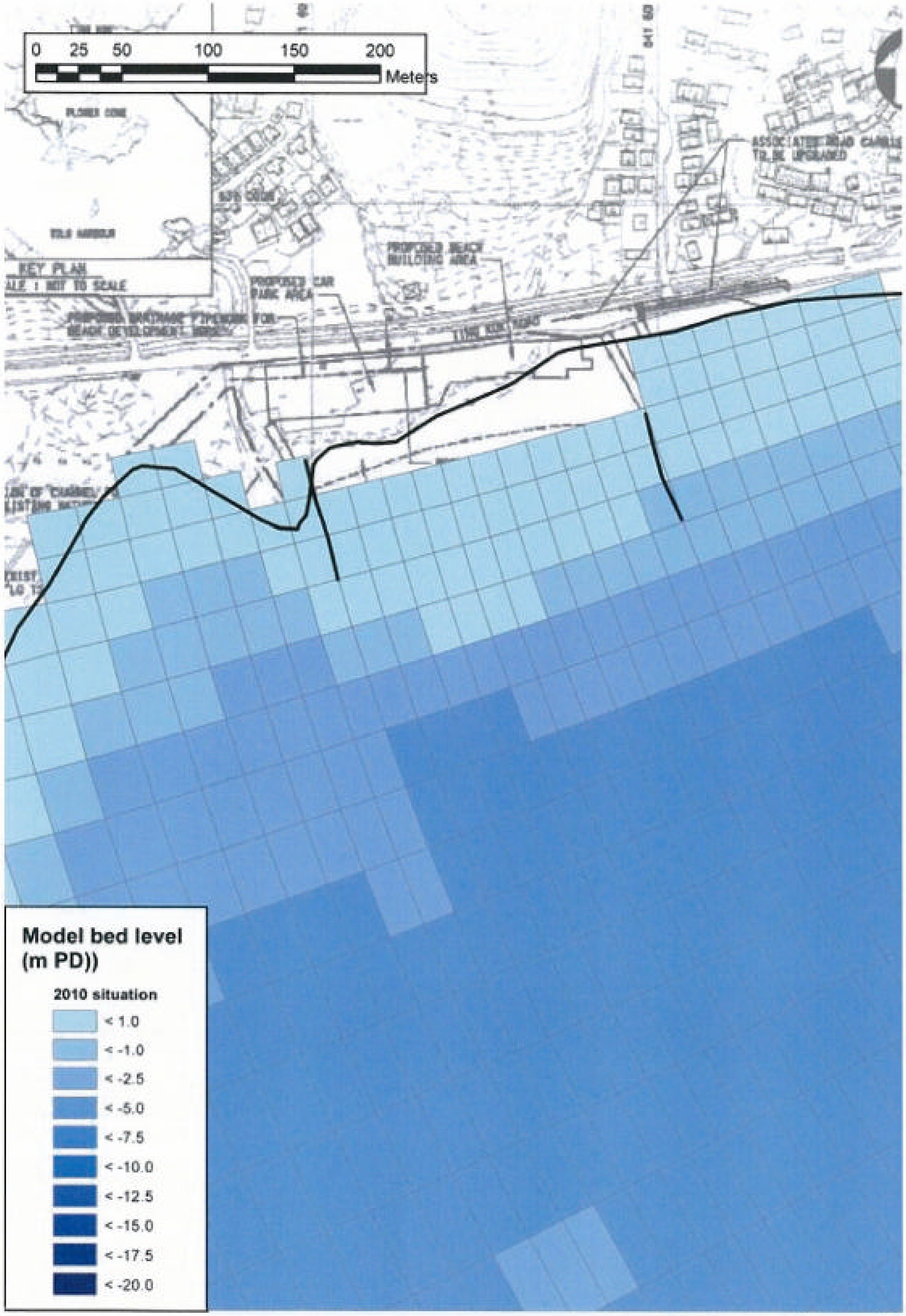
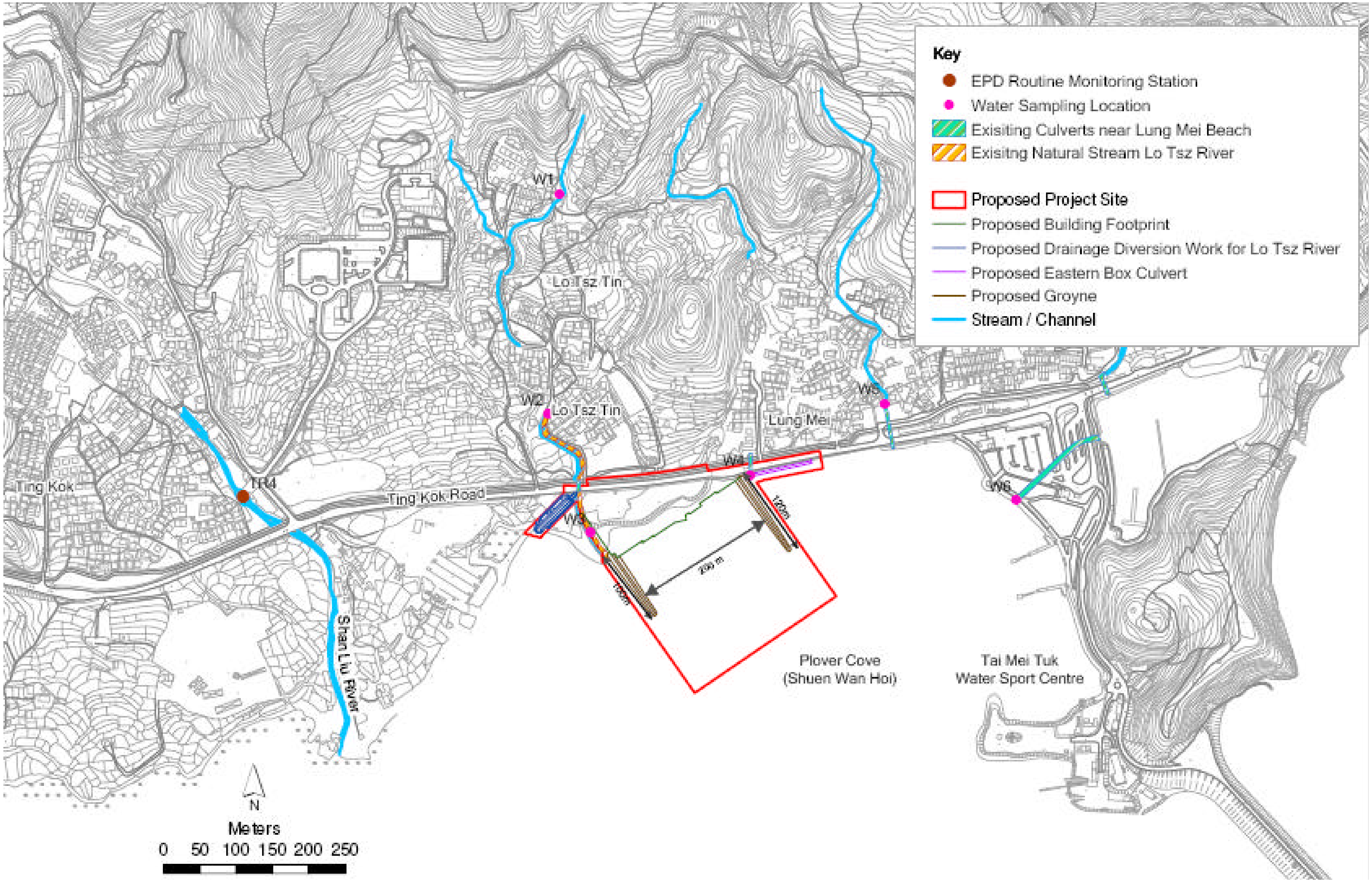


Figure E1.2b: Refined Model Grid and Bathymetry for PCM for the Study Area for Operational Phase in 2010

Agreement No.: CE 59/2005(EP)	DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	**FIGURE E1.2b**
Client CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Consulting Engineer Halcrow Halcrow China Ltd. ERM Environmental Resources Management as sub-consultant	ENVIRONMENTAL IMPACT ASSESSMENT REPORT



CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer

Halcrow
Halcrow China Ltd.

ERM Environmental Resources Management as sub-consultant

Agreement No.: CE 59/2005(EP)

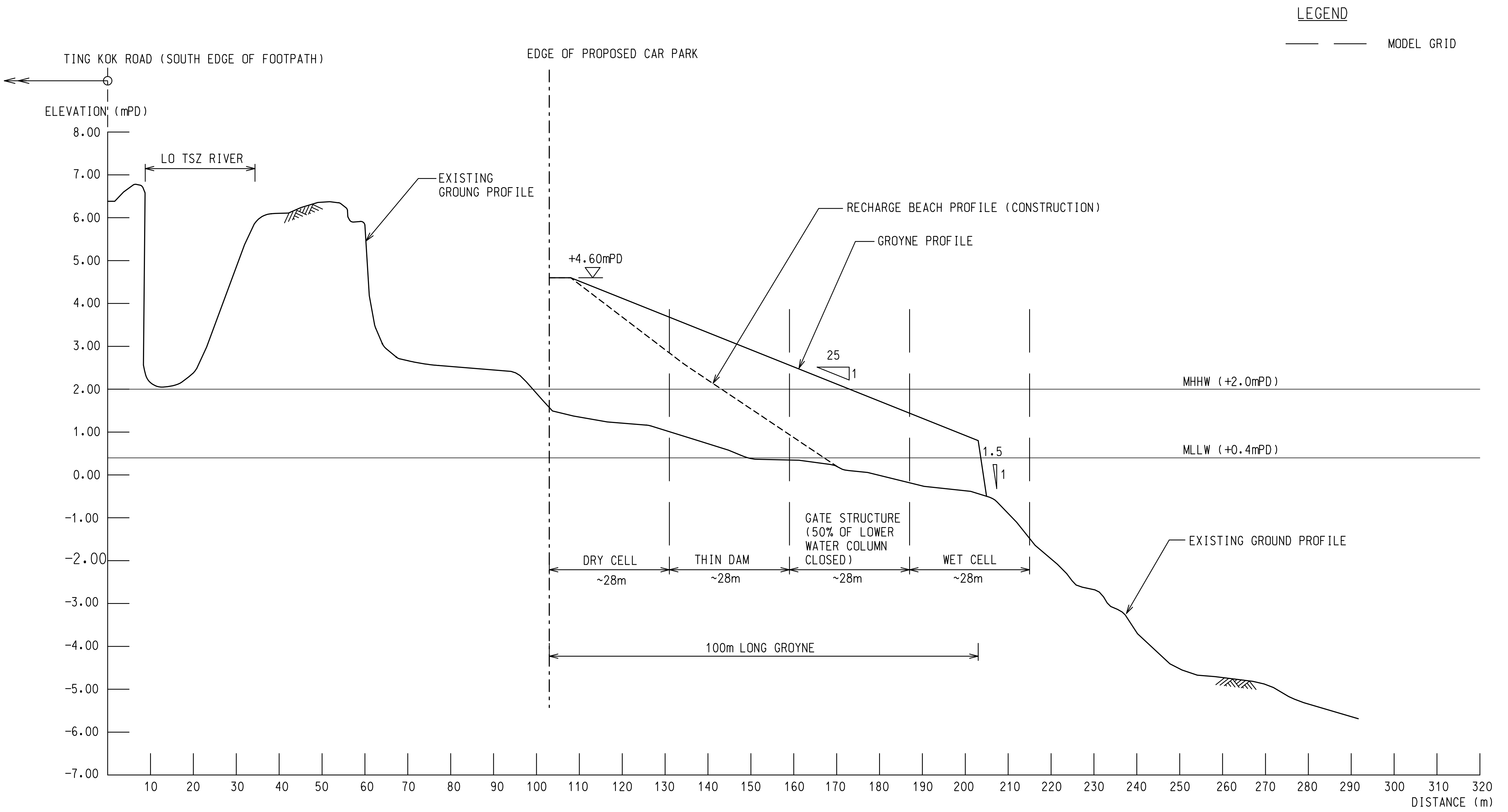
Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title: LOCATION OF EPD ROUTINE RIVER MONITORING STATION, SHAN LIU STREAM (SAMPLING POINT TR4)

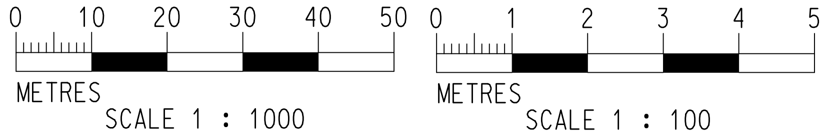
APPENDIX E – FIGURE E1.5a

Checked	Scale	Rev.
-	AS SHOWN	-
Designed	Drawn	Date
-	-	19/09/2007



PROFILE X1

(PLANTER NOT SHOWN FOR CLARITY)
VERTICAL SCALE 1:100 HORIZONTAL SCALE 1:1000



CIVIL ENGINEERING AND
DEVELOPMENT DEPARTMENT

Consulting Engineer
Halcrow
Halcrow China Ltd.

Environmental Resources
Management
as sub-consultant

Agreement No. : CE 59/2005 (EP)

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
PROFILE OF WESTERN GROYNE
(PROFILE X1) - PREFERRED OPTION

APPENDIX E - FIGURE E2.1a

Checked PS	Scale AS SHOWN	Rev. 0
Designed YC	Drawn MJY	Date 28/09/2007

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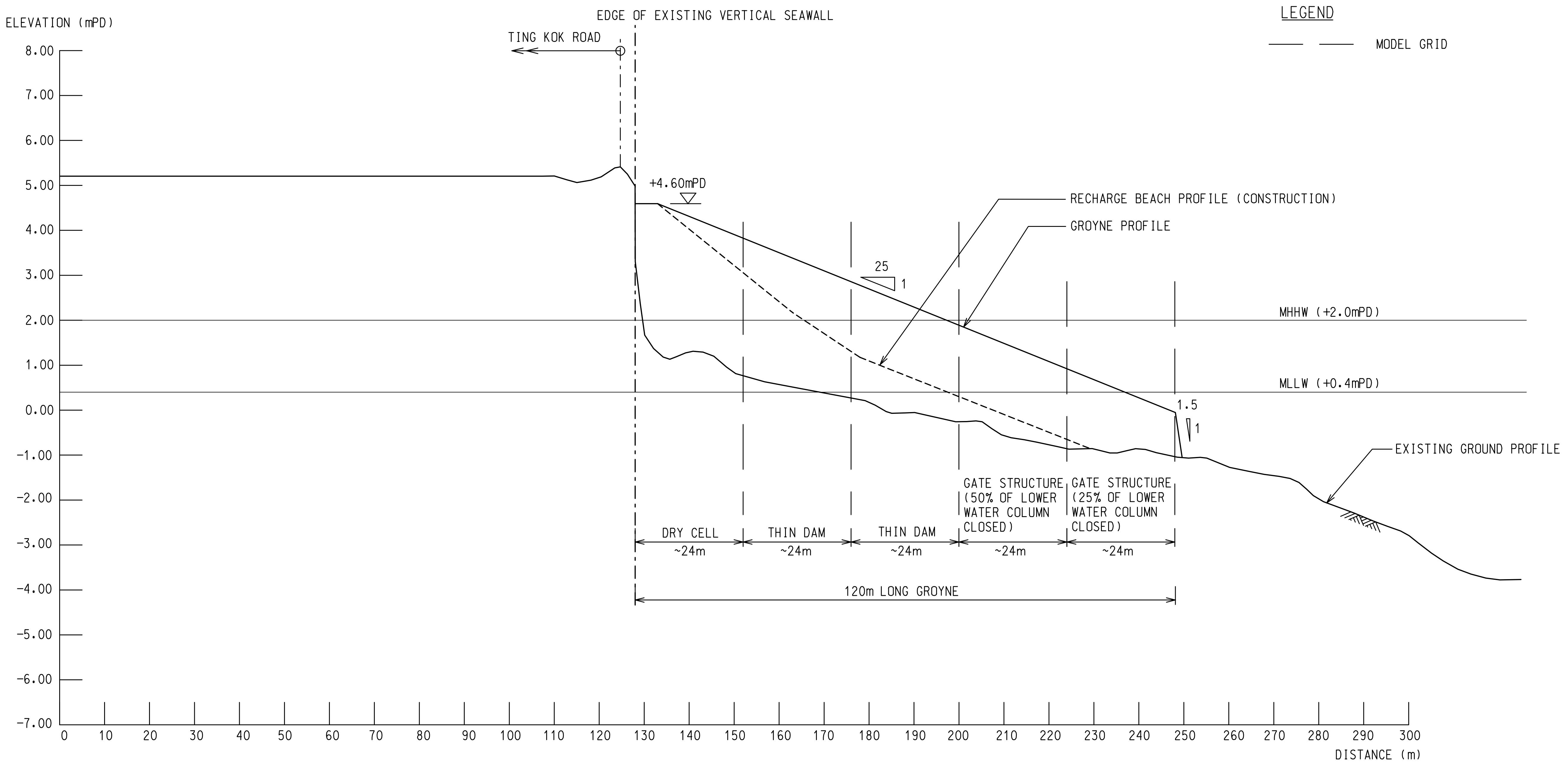
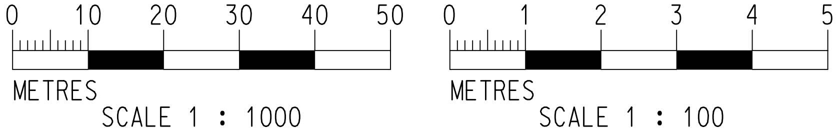
e:*proj*CALBDS*Figure*E_IA_Rpt*Fig2_1a_0_EIA_RPT.dgn
13/11/2007



PROFILE X2

(PLANTER NOT SHOWN FOR CLARITY)
VERTICAL SCALE 1:100 HORIZONTAL SCALE 1:1000



CEDD
CIVIL ENGINEERING AND
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Agreement No. : CE 59/2005 (EP)

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
PROFILE OF EASTERN GROYNE
(PROFILE X2) - PREFERRED OPTION

APPENDIX E - FIGURE E2.1b

Checked PS	Scale AS SHOWN	Rev. 0
Designed YC	Drawn MJY	Date 28/09/2007

philipF 13/11/2007
e:*proj*CALBDS*Figure*E_IA_Rpt*Fig2_1b_0_EIA_RPT.dgn

Appendix F

Sediment Quality Report
(June 2007)

Halcrow China Limited

Sub-consultant - Environmental Resources Management

AGREEMENT NO. CE 59/2005 (EP)
Development of a Bathing Beach at Lung Mei, Tai Po
Environmental, Drainage and Traffic Impact Assessments - Investigation
Sediment Quality Report

June 2007

The Government of Hong Kong Special Administrative Region
Civil Engineering and Development Department
Port Works Division

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Halcrow China Limited

AGREEMENT NO. CE 59/2005 (EP)
Development of a Bathing Beach at Lung Mei, Tai Po
Environmental, Drainage and Traffic Impact
Assessments - Investigation
Sediment Quality Report

June 2007

Doc No: CA/LBDS/7118834

Serial No:

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1	0	Draft	January 2007	P Shek
1	1	Final	February 2007	P Shek
1	2	Final	April 2007	P Shek
1	3	Final	May 2007	P Shek
1	4	Final	June 2007	

CONTENTS

1.0 INTRODUCTION

1.1 This Project is a designated project and an Environmental Impact Assessment is required under the Environmental Impact Assessment Ordinance. Port Works Division (PWD) of Civil Engineering and Development Department (CEDD) is the project vote controller and the scope of the project comprises:

a. a 200m long beach with a groyne at each end of the beach;

b. a beach building with associated beach facilities;

c. retaining structures;

d. refuse collection point;

e. a fee-paying public car park;

f. landscaped areas;

g. drainage diversion of an existing box culvert and Lo Tsz River into the proposed eastern box culvert and western drainage channel respectively; and

h. sewerage construction works.

CEDD is responsible for the overall planning, design and civil engineering construction of the Project, whereas Architectural Services Department is responsible for the design and construction of the beach building, car park and landscaping works. On 26 May 2006, CEDD appointed Halcrow China Limited (HCL), under Agreement No. CE 59/2005 (EP), to provide professional services in respect of "Development of a Bathing Beach at Lung Mei, Tai Po – Environmental, Drainage and Traffic Impact Assessments – Investigation" (hereafter called "the Assignment"). HCL has appointed their sub-consultant, Environmental Resources Management (ERM) to provide the environmental services in respect of the Assignment.

1.2 A proposal of sediment sampling and chemical testing was submitted to EPD for agreement in accordance with ETWB TC(W) No. 34/2002. EPD's agreement was given vide their memo (ref. (38) in EP2/N5/C/46) dated 25 September 2006. Sampling locations at the site are shown on Figure 1.

1.3 Sediment sampling and chemical testing were undertaken using GEO's term contracts under Contract No. GE/2005/28 for marine drilling (Works Order No. GE/2005/28.10), and Contract No. GE/2005/47 for chemical and biological testing (Works Order No. GE/2005/47.22). The sampling works and testing works for sediments had been completed and a summary of chemical testing results of the collected samples are summarised in Table 1. The laboratory report on heavy metals, PAHs (Low and High Molecular Weight), PCB and TBT analyses of the collected samples are attached in Appendix A.

2.0 TESTING LABORATORY

2.1 Lam Laboratories Ltd. was responsible for the chemical and biological testing of the collected sediment samples that were carried out under GEO's term contract GE/2005/47. They are accredited by HOKLAS for all the heavy metal, metalloid, PAH and PCB tests.

2.2 The chemical analysis was carried out using Lam Laboratories Ltd. in-house analytical methods which are based on the standard methods specified in ETWB TC(W) No. 34/2002. The results of the chemical analysis together with all QA/QC data, considered to be acceptable, are attached in Appendix A.

3.0 RESULTS OF THE CHEMICAL ANALYSIS OF SEDIMENT SAMPLES

3.1 The sampling locations are shown on Figure 1. The collected samples are to represent the quality of the dredging materials for construction of the proposed bathing beach, groynes and seawall. The proposed dredging extent within the Project site is also shown on Figures 2 and 3.

Vertical profile of sediments to be dredged was collected using a vibrocore device, and the vibrocore samples were collected to the required dredging depth of 3 m or until when further drilling was not possible, whichever was the shallowest. The vibrocore samples were cut on site at the proposed sampling depths in the existing seabed surface at -0.9 m, -1.9 m and -2.9 m. The sediment samples for further biological testing were also concurrently collected. In addition, a reference sediment sample was also collected at the Port Shelter of the EPD routine sediment monitoring station PS6 (Hong Kong Metric coordinates; 850234E, 820057N). It was found that all vibrocores collected were of depth less than 3m due to thin layer of marine deposit in the area. In addition, it should be noted that for virbocores SS1 and SS2, depths of 0.0m-0.2m and 0.0m-0.5m respectively, could not be recovered for testing due to its sandy material content. The relevant vibrocore records of sediment sampling are shown in Appendix B.

3.2 A total of twenty-one test sediment samples (including the reference sample) were delivered to the laboratory during the period from 12 to 18 October 2006, and the chemical tests were carried out from 14 October to 9 November 2006. Record of Sediment Sampling & Collection prepared according to ETWB TC(W) No. 34/2002 is attached in Appendix C.

The Lower Chemical Exceedance Levels (LCEL) and Upper Chemical Exceedance Levels (UCEL) specified in ETWB TC(W) No. 34/2002 are presented in Table 2 and the criteria for the classification of marine sediment are presented in Table 3. The results of the heavy metal analysis together with PAH and PCB and sediment classification are shown in Table 1. According to Table 1, **thirteen (13)** samples are Category L (including the reference sample), no sample of Category H and **eight (8)** samples are Category M among the **twenty-one (21)** sub-samples.

3.3 The quality control data presented in the "Final Report on Chemical analysis", attached in Appendix A, submitted by Lam Laboratories Ltd., consist of duplicate sample analysis, method spikes, sample reference material and method blanks. All the quality control data lay within acceptable ranges and the data were considered to be acceptable.

4.0 BIOLOGICAL TESTING PROPOSAL

4.1 According to ETWB TC(W) No. 34/2002, Category L material can be disposed of in a manner which minimizes the loss of contaminants either into solution or by resuspension. Category H materials that have any one or more contaminants at concentrations in excess of the UCEL will be dredged and transported with great care and must be effectively isolated from the environment upon final disposal. Category M material, however, must be dredged and transported with care, and must be effectively isolated from the environment upon final disposal unless appropriate biological tests demonstrate that the material will not adversely affect the marine environment. According to the sediment classification results shown in Table 1, eight (8) Category M samples require biological testing in order to allow an appropriate decision to be made on the ultimate disposal options.

The biological testing proposal was accepted by EPD vide their memo ref (7) in EP 60/G1/12-460 dated 29 November 2006, and the biological tests were carried out as described below.

4.2 The sediment samples requiring biological testing included three composite samples from the vertical profile of SS1 (composite sample CS1), vertical profile of SS2 (composite sample CS2) and the horizontal profile of SS4, SS7 and SS8 (composite sample CS3), and their mixing details are as follows:

Composite Sample No	Vibrocores	Depth
CS1	SS1	0.2m – 0.9m 0.9m – 1.2m
CS2	SS2	0.5m – 0.9m 0.9m – 1.9m 1.9m – 2.5m
CS3	SS4 SS7 SS8	0.9m – 1.3m (SS4) 0.9m – 1.3m (SS7) 0.9m – 1.7m (SS8)

Moreover, reference sediments (Control) collected were used to act as the 'Control' of the tests. The tests were conducted by Lam Laboratories Ltd., who is accredited by HOKLAS for all three of the required biological tests. In addition to the composite test sediments and the reference sediment, both positive and negative controls will be tested as part of the quality assurance and quality control programme.

5.0 RESULTS OF THE BIOLOGICAL TESTING OF SEDIMENTS SAMPLES

The biological tests were carried out in accordance with the requirements specified in the ETWB TC(W) No. 34/2002. The species used in the tests are listed in the table below. Details regarding the test and test species are presented in Appendix D (Laboratory Report for Biological Testing and Ancillary Analysis).

Test Species and Methods to be used in Biological Screening

Test Type	Species	Reference Test Conditions
10-day burrowing amphipod toxicity test	*Leptocheirus plumulosus*	U.S. EPA (1994)[1]
20-day burrowing polychaete toxicity test	*Neanthes arenaceodentata*	PSEP (1995)[2]
48-96 hour larvae (bivalve or echinoderm) toxicity test	*Crassostrea gigas*	PSEP (1995)[2]

Notes:

1 *U.S. EPA (U.S. Environmental Protection Agency) 1994. Methods for assessing the toxicity of sediment associated contaminants with estuarine and marine amphipods. Office of Research and Development. U.S. Environmental Protection Agency, Cincinnati, OH. EPA/600/R94/025.*

2 *PSEP (Puget Sound Estuary Program) 1995. Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments.*

Before commencing the biological tests, the samples were tested for the ancillary parameters consisting of salinity and ammonia concentrations in the porewater, Total Organic Carbon, moisture content and grain size. The test results are presented in Appendix D.

The test endpoints for the Project followed the requirements defined in the ETWB TC(W) No. 34/2002 and are reproduced in the Table below.

Test Endpoints and Decision Criteria for Tier III Biological Screening

Toxicity Test	**Endpoints Measured**	**Failure Criteria**
10-day amphipod	Survival	Mean survival in test sediment is significantly different ($p \leq 0.05$)[1] from mean survival in reference sediment **and** mean survival in test sediment < 80% of mean survival in reference sediment
20-day polychaete	Dry Weight[2]	Mean dry weight in test sediment is significantly different ($p \leq 0.05$) from mean dry weight in reference sediment **and** mean dry weight in test sediment < 90% of mean dry weight in reference sediment
48-96-hour larvae (bivalve or echinoderm)	Normality Survival[3]	Mean normality survival in test sediment is significantly different ($p \leq 0.05$) from mean normality survival in reference sediment **and** mean normality survival in test sediment < 80% of mean normality survival in reference sediment

Notes:

1 Statistically significant differences should be determined using appropriate two-sample comparisons (e.g. t-tests) at a probability of $p \leq 0.05$.
2 Dry weight means total dry weight after deducing dead and missing worms.
3 Normality survival integrates the normality and survival endpoints and measures survival of only larvae relative to the starting number.

The biological tests of amphipod, polychaete and bivalve larvae were carried out from 6 – 16 December, 7 – 27 December 2006 and 27 – 29 November 2006 respectively. The results of the biological tests are presented in Appendix D. The laboratory test report also included the water quality data collected as part of the test protocols. It can be seen that all parameters laid within acceptable ranges for all tests carried out. The biological tests were carried out within the eight-week holding time allowed under the ETWB TC(W) No. 34/2002, and the tests were all considered to be valid. The results of the tests are summarized below:

10-Day Amphipod Test	Sediment samples[#1] complied with the test
20-Day Polychaete Test	Sediment samples[#2] failed the test
48-96-Hour Bivalve Larvae Test	Sediment samples[#3] complied with the test

Notes:

#1 All samples complied with the requirements stipulated in the ETWB TC(W) No. 34/2002;

#2 CS1 sample could not comply with the requirements stipulated in the ETWB TC(W) No. 34/2002;

#3 All samples complied with the requirements stipulated in the ETWB TC(W) No. 34/2002

According to the ETWB TC(W) No. 34/2002, the sediment is deemed to have failed the biological test if it fails in any one of the three toxicity tests. Due to the failure on the 20-Day Polychaete Test, the sediment to be dredged represented by sample collected at location SS1 (shown on Figures 2 and 3) must be dredged and transported with great care for Type 2 – Confined Marine Disposal to the mud pits at East Sha Chau.

From the latest study review, the required dredging depth will generally vary from 0.5m to 1m, and will not be greater than previously estimated depth of 3m. The total estimated dredging volume is around 10,500m^3 to cover the proposed bathing beach and groynes areas.

6.0 SUMMARY OF TEST RESULTS AND DISPOSAL REQUIREMENT

The disposal criteria for the sediment that will be dredged within the project site are determined in accordance with the ETWB TC(W) No. 34/2002. Therefore, based on the chemical and biological test results, the sediment category, their estimated dredging depths and volumes, and the relevant supporting GI stations are summarised below. In addition, the GI location plan, the proposed dredging extent and the disposal proposal are presented on Figures 2 and 3.

Sediment Characteristics	**Disposal Requirement**	**Supporting GI Stations and Sample Depth**		**Estimated Dredging Depth**	**Estimated Dredging Volume (m^3)**
		Station No.	**Depth**		
Category L	Type 1 – Open Sea Disposal	SS3	0m – 0.9m	Approximate 0.5m	6,380
		SS3	0.9m – 1.9m		
		SS3	1.9m – 2.8m		
		SS4	0m – 0.9m		
		SS5	0m – 0.9m		
		SS6	0m – 0.9m		
		SS6	0.9m – 1.6m		
		SS7	0m – 0.9m	Generally vary from 0.5 to 1m and not greater than 3m	
		SS8	0m – 0.9m		
		SS9	0m – 0.9m	Approximate 0.5m	
		SS9	0.9m – 1.9m		
		SS9	1.9m – 2.1m		
Category M and passed biological tests	Type 1 – Open Sea Disposal (Dedicated Sites)	SS2	0.5m – 0.9m	Generally vary from 0.5 to 1m and not greater than 3 m	2,620
		SS2	0.9m – 1.9m		
		SS2	1.9m – 2.5m		
		SS4	0.9m – 1.3m	Approximate 0.5m	
		SS7	0.9m – 1.3m	Generally vary from 0.5 to 1m and not greater than 3m	
		SS8	0.9m – 1.7m		
Category M and failed biological test	Type 2 - Confined Marine Disposal (i.e East Sha Chau mud pits at present)	SS1	0.2m – 0.9m	Generally vary from 0.5 to 1m and not greater than 3m	1,500
		SS1	0.9m – 1.2m		
				Total	**10,500**

Tables

lam Laboratories

SUMMARY REPORT

Project Name : **CEDD Contract No. GE/2005/47Chemical and Biological Testing of Sediment (Service Contract)**
Agreement No. CE 59/2005(EP): Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation

Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Service Order No. : **GE/2005/47.22**
Customer : **Geotechnical Projects Division, Geotechnical Engineering, Civil Engineering and Development**

Lab. Job No. : J469

Matrix : Sediment

Table 1 : Summary of Chemical Testing Results

Laboratory Sample ID	Sample Reference			Heavy Metals									PAHs (Low Molecular Weight)							PAHs (High Molecular Weight)										
	Drillhole No.	Depth (m) From To	Sediment Category	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Mercury (Hg)	Arsenic (As)	Silver (Ag)	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Total LMW PAH	Benzo(a)anthracene	Benzo(a)pyrene	Chrysene	Dibenz(ah)anthracene	Fluoranthene	Pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Indeno(1,2,3-cd)pyrene	Benzo(ghi)perylene	Total HMW PAH
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
			Report Limit	0.20	8.0	7.0	4.0	8.0	20	0.05	1.0	0.10	55	55	55	55	55	55	55	170	170	170	170	170	170	170	170	170	170	170
18223/2	SS3	grab sample																												
18232/2	SS6	grab sample																												
18232/3	SS6	0.0-0.9m	Category L	<0.20	<8.0	<7.0	<4.0	8.5	<20	0.10	3.3	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18232/4	SS6	0.9-1.6m	Category L	<0.20	<8.0	<7.0	<4.0	<8.0	<20	0.06	4.2	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18232/6	SS9	grab sample																												
18232/7	SS3	0.0-0.9m	Category L	<0.20	<8.0	<7.0	<4.0	13	<20	0.07	5.8	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18232/8	SS3	0.9-1.9m	Category L	<0.20	<8.0	<7.0	<4.0	11	<20	0.05	5.0	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18232/9	SS3^{+}	1.9-2.8m	Category L	<0.20	<8.0	<7.0	<4.0	20	<20	0.06	12	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18236/2	SS8	grab sample																												
18236/3	SS8	0.0-0.9m	Category L	<0.20	<8.0	<7.0	<4.0	12	<20	0.08	10	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18236/4	SS8	0.9-1.7m	Category M and passed Biological Tests*	<0.20	<8.0	<7.0	<4.0	8.8	<20	0.07	16	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18236/5	SS9	0.0-0.9m	Category L	<0.20	<8.0	<7.0	<4.0	10	<20	0.07	4.0	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18236/6	SS9	0.9-1.9m	Category L	<0.20	<8.0	<7.0	<4.0	<8.0	<20	<0.05	2.5	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	250
18236/7	SS9	1.9-2.1m	Category L	<0.20	<8.0	<7.0	<4.0	<8.0	<20	<0.05	8.5	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18249/2	SS5	grab sample																												
18249/3	SS5^{+}	0.0-0.9m	Category L	<0.20	<8.0	<7.0	7.8	19	<20	<0.05	2.5	0.12	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18249/5	SS7	grab sample																												
18249/6	SS7	0.0-0.9m	Category L	<0.20	<8.0	<7.0	<4.0	<8.0	<20	<0.05	6.1	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18249/7	SS7	0.9-1.3m	Category M and passed Biological Tests*	<0.20	<8.0	<7.0	<4.0	16	<20	<0.05	14	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18255/2	SS2	grab sample																												
18255/3	SS2	0.5-0.9m	Category M and passed Biological Tests*	<0.20	<8.0	<7.0	<4.0	17	20	<0.05	17	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18255/4	SS2	0.9-1.9m	Category M and passed Biological Tests*	<0.20	<8.0	<7.0	<4.0	18	23	<0.05	28	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18255/5	SS2	1.9-2.5m	Category M and passed Biological Tests*	<0.20	<8.0	<7.0	<4.0	25	<20	<0.05	42	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18255/7	SS4	grab sample																												
18255/8	SS4	0.0-0.9m	Category L	<0.20	<8.0	<7.0	<4.0	12	20	<0.05	6.9	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18255/9	SS4^{+}	0.9-1.3m	Category M and passed Biological Tests*	<0.20	<8.0	<7.0	<4.0	12	<20	<0.05	27	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18273/2	SS1	grab sample																												
18273/3	SS1	0.2-0.9m	Category M and failed Biological Tests*	<0.20	<8.0	<7.0	<4.0	13	<20	<0.05	17	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18273/4	SS1	0.9-1.2m	Category M and failed Biological Tests*	<0.20	<8.0	<7.0	<4.0	31	26	<0.05	24	<0.10	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
18286/1	Reference Sample	grab sample	Category L	<0.20	28	14	19	36	72	0.1	5.5	0.22	<55	<55	<55	<55	<55	<55	<55	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170

Remark: 🟨 Exceedance of Sediment Criteria LCEL under ETWB TC(W) 34/2002

* For results of biological tests, refer to Appendix D of the report.

$^{+}$ SS3 terminated at the depth of 2.9m; SS5 terminated at the depth of 1.0m; SS4 terminated at the depth of 1.4m. Please refer Appendix B for details of Vibrocore records.

Laboratories

SUMMARY REPORT

Project Name : **CEDD Contract No. GE/2005/47Chemical and Biological Testing of Sediment (Service Contract)**

Agreement No. CE 59/2005(EP): Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation

Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Service Order No. : **GE/2005/47.22**

Customer : **Geotechnical Projects Division, Geotechnical Engineering, Civil Engineering and Development**

Lab. Job No. : J469

Matrix : Sediment

Table 1 : Summary of Chemical Testing Results

Laboratory Sample ID	Sample Reference			PCB																		
	Drillhole No.	Depth (m) From To	Sediment Category	PCB 8	PCB 18	PCB 28	PCB 44	PCB 52	PCB 66	PCB 77	PCB 101	PCB 105	PCB 118	PCB 126	PCB 128	PCB 138	PCB 153	PCB 169	PCB 170	PCB 180	PCB 187	Total PCB
				ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
			Report Limit	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
18223/2	SS3	grab sample																				
18232/2	SS6	grab sample																				
18232/3	SS6	0.0-0.9m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18232/4	SS6	0.9-1.6m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18232/6	SS9	grab sample																				
18232/7	SS3	0.0-0.9m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18232/8	SS3	0.9-1.9m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18232/9	SS3^{+}	1.9-2.8m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18236/2	SS8	grab sample																				
18236/3	SS8	0.0-0.9m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18236/4	SS8	0.9-1.7m	Category M and passed Biological Tests*	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18236/5	SS9	0.0-0.9m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18236/6	SS9	0.9-1.9m	Category L	<3	<3	<3	<3	<3	<3	<3	3.4	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	19
18236/7	SS9	1.9-2.1m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18249/2	SS5	grab sample																				
18249/3	SS5^{+}	0.0-0.9m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18249/5	SS7	grab sample																				
18249/6	SS7	0.0-0.9m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18249/7	SS7	0.9-1.3m	Category M and passed Biological Tests*	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18255/2	SS2	grab sample																				
18255/3	SS2	0.5-0.9m	Category M and passed Biological Tests*	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18255/4	SS2	0.9-1.9m	Category M and passed Biological Tests*	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18255/5	SS2	1.9-2.5m	Category M and passed Biological Tests*	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18255/7	SS4	grab sample																				
18255/8	SS4	0.0-0.9m	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18255/9	SS4^{+}	0.9-1.3m	Category M and passed Biological Tests*	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18273/2	SS1	grab sample																				
18273/3	SS1	0.2-0.9m	Category M and failed Biological Tests*	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18273/4	SS1	0.9-1.2m	Category M and failed Biological Tests*	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
18286/1	Reference Sample	grab sample	Category L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3

lam Laboratories

SUMMARY REPORT

Project Name : **CEDD Contract No. GE/2005/47Chemical and Biological Testing of Sediment (Service Contract)**
Agreement No. CE 59/2005(EP): Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation

Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Service Order No. : **GE/2005/47.22**
Customer : **Geotechnical Projects Division, Geotechnical Engineering, Civil Engineering and Development**

Lab. Job No. : J469

Matrix : Sediment

Table 1 : Summary of Chemical Testing Results

Laboratory Sample ID	Sample Reference			Chlorinated Pesticides												PSD														
	Drillhole No.	Depth (m) From To	Sediment Category	Alpha-BHC	Beta-BHC	Gamma-BHC	Delta-BHC	Heptachlor	Aldrin	Heptachlor epoxide	Endosulfan	p,p'-DDT	p,p'-DDD	p,p'-DDE	Endosulfan sulfate	Gravel	Sand	Silt & Clay	TOC	TBT	Ammonia Nitrogen	SOD_5	Redox Potential (soil)	TKN (soil)	Nitrite (soil)	Nitrate (soil)	OP (soil)	TP (soil)	COD (soil)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	%	%	ug/L	mg/kg	mg/kg	mV	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
			Report Limit	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA	NA	NA	0.015	1	100	NA	50	1	1	0.1	10	5000
18223/2	SS3	grab sample																											
18232/2	SS6	grab sample																											
18232/3	SS6	0.0-0.9m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	7	79	14	1.42	<0.015	<1	160	103.1	<50	<1.0	<1.0	<0.1	<10	<5000
18232/4	SS6	0.9-1.6m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	20	69	11	2.55	<0.015	<1	200	86.3	71	<1.0	<1.0	<0.1	<10	<5000
18232/6	SS9	grab sample																											
18232/7	SS3	0.0-0.9m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	8	81	11	1.79	<0.015	<1	200	63.4	110	<1.0	<1.0	<0.1	<10	6100
18232/8	SS3	0.9-1.9m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	15	64	21	1.33	<0.015	<1	<100	49.4	52	<1.0	<1.0	0.35	<10	<5000
18232/9	SS3$^+$	1.9-2.8m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				0.87	<0.015	<1	180	78.3	<50	<1.0	<1.0	0.21	<10	<5000
18236/2	SS8	grab sample																											
18236/3	SS8	0.0-0.9m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	18	75	7	1.69	<0.015	<1	240	88.6	84	<1.0	<1.0	<0.1	98	<5000
18236/4	SS8	0.9-1.7m	Category M and passed Biological Tests*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				0.51	<0.015	<1	<100	124.3	57	<1.0	<1.0	<0.1	180	<5000
18236/5	SS9	0.0-0.9m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1	92	7	1.76	<0.015	<1	170	69.6	210	<1.0	<1.0	<0.1	83	<5000
18236/6	SS9	0.9-1.9m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				0.90	<0.015	<1	160	127.4	65	<1.0	<1.0	0.15	61	<5000
18236/7	SS9	1.9-2.1m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				1.64	<0.015	<1	<100	64.4	68	<1.0	<1.0	<0.1	71	<5000
18249/2	SS5	grab sample																											
18249/3	SS5$^+$	0.0-0.9m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	6	90	4	0.28	<0.015	<1	260	94.4	88	<1.0	<1.0	<0.1	28	<5000
18249/5	SS7	grab sample																											
18249/6	SS7	0.0-0.9m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	50	46	4	0.31	<0.015	<1	260	91.6	59	<1.0	<1.0	<0.1	85	<5000
18249/7	SS7	0.9-1.3m	Category M and passed Biological Tests*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	55	38	7	0.56	<0.015	1.8	<100	103.5	<50	<1.0	<1.0	<0.1	11	<5000
18255/2	SS2	grab sample																											
18255/3	SS2	0.5-0.9m	Category M and passed Biological Tests*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	29	64	7	0.74	<0.015	<1	170	124.3	130	<1.0	<1.0	<0.1	130	<5000
18255/4	SS2	0.9-1.9m	Category M and passed Biological Tests*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	42	52	6	1.12	<0.015	<1	110	120.2	68	<1.0	<1.0	0.15	110	<5000
18255/5	SS2	1.9-2.5m	Category M and passed Biological Tests*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				0.71	<0.015	<1	600	105.9	84	<1.0	<1.0	<0.1	94	<5000
18255/7	SS4	grab sample																											
18255/8	SS4	0.0-0.9m	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	20	75	5	0.73	<0.015	<1	<100	79.3	110	<1.0	<1.0	0.11	22	<5000
18255/9	SS4 $^+$	0.9-1.3m	Category M and passed Biological Tests*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.05	<0.015	<1	150	94.5	<50	<1.0	<1.0	<0.1	110	<5000
18273/2	SS1	grab sample																											
18273/3	SS1	0.2-0.9m	Category M and failed Biological Tests*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	42	53	5	0.59	<0.015	<1	<100	89.8	104	<1.0	<1.0	<0.1	84	<5000
18273/4	SS1	0.9-1.2m	Category M and failed Biological Tests*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				0.21	<0.015	<1	120	122.2	<50	<1.0	<1.0	<0.1	110	<5000
18286/1	Reference Sample	grab sample	Category L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0	10	90	1.46	<0.015	2.9	292	48.8	180	<1.0	<1.0	1.1	1100	13000

Sediment Quality Criteria for the Classification of Sediment

Table 2 Upper and Lower Chemical Exceedance Levels (ETWB TC(W) No. 34/2002)

Contaminants	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	3160
High Molecular Weight PAHs	1700	9600
Organic-non-PAHs *(μg/kg dry wt.)*		
Total PCBs	23	180
Organometallics *(μg TBT/L in Interstitial water)*		
Tributyltin*+	0.15	0.15

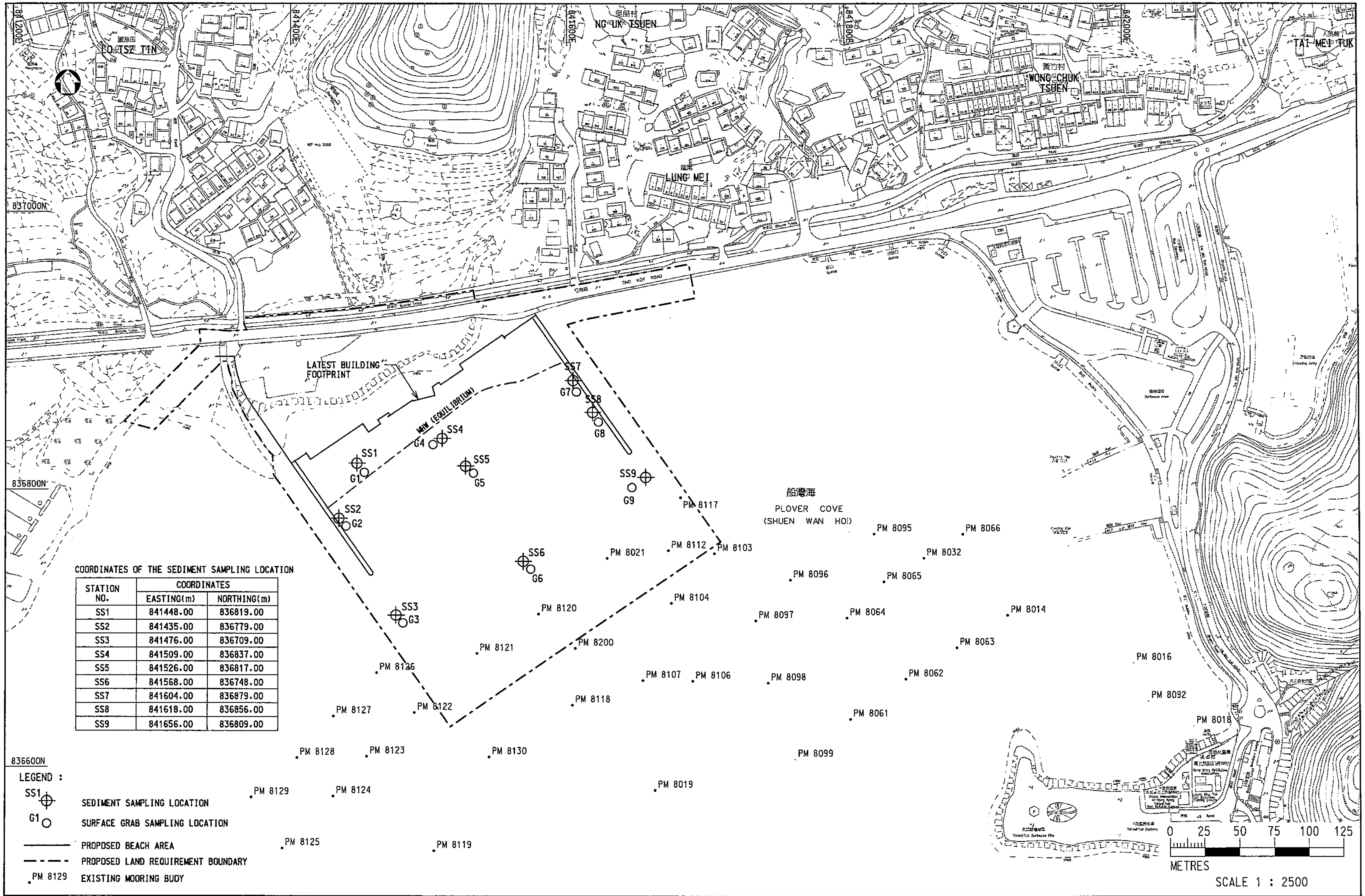
* *The contaminant level is considered to have exceeded the UCEL if it is greater than the value shown.*

\+ *Testing for TBT is only required if instructed by EPD for sediments suspected to be contaminated by TBT*

Table 3 **Classification of Marine Sediment According to ETWB TC(W) No. 34/2002**

Category	Criteria
L	All contaminant concentrations less than or equal to the LCEL
M	Any one contaminant concentration greater than the LCEL but all contaminant concentrations less than or equal to the UCEL
H	Any one contaminant concentration greater than the UCEL

Figures



COORDINATES OF THE SEDIMENT SAMPLING LOCATION

STATION NO.	COORDINATES	
	EASTING(m)	NORTHING(m)
SS1	841448.00	836819.00
SS2	841435.00	836779.00
SS3	841476.00	836709.00
SS4	841509.00	836837.00
SS5	841526.00	836817.00
SS6	841568.00	836748.00
SS7	841604.00	836879.00
SS8	841618.00	836856.00
SS9	841656.00	836809.00

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer
Halcrow
Halcrow China Ltd.

ERM Enviromental Resources Management as sub-consultant

Agreement No. : CE 59/2005 (EP)

Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

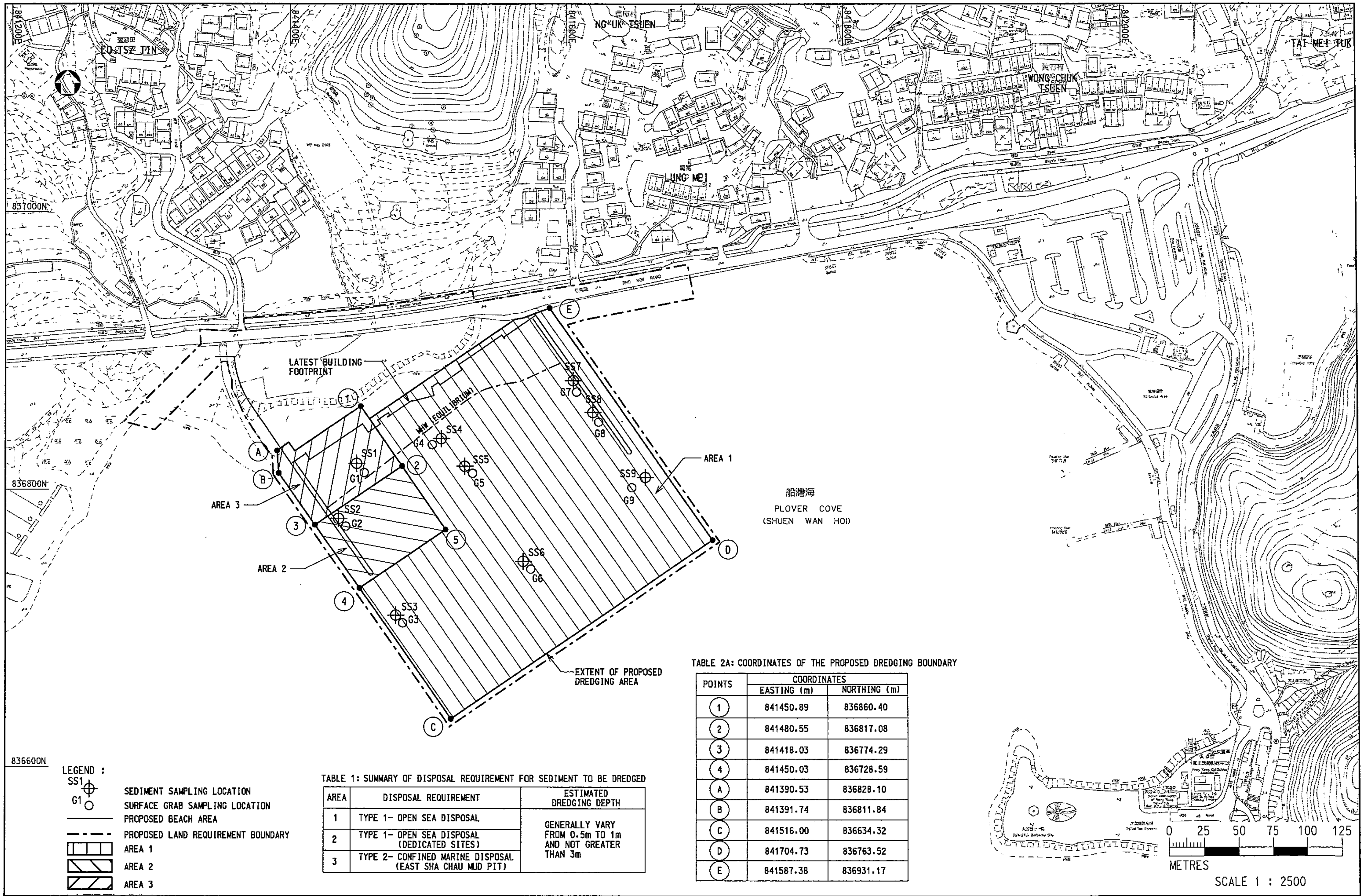
SEDIMENT QUALITY REPORT

Figure Title: AS-BUILT GROUND INVESTIGATION PLAN

FIGURE 1

Checked	Scale	Rev.
PS	1:2500 @ A3	3
Designed	Drawn	Date
YC	PF	26/01/2007

phillipF 25/5/2007
e:¤proj¤CALBDS¤Figure¤Figure1_GI_3_SQR.dgn



LEGEND :

SS1 ⌖	SEDIMENT SAMPLING LOCATION
G1 ○	SURFACE GRAB SAMPLING LOCATION
———	PROPOSED BEACH AREA
— - — -	PROPOSED LAND REQUIREMENT BOUNDARY
▥	AREA 1
▧	AREA 2
▨	AREA 3

TABLE 1: SUMMARY OF DISPOSAL REQUIREMENT FOR SEDIMENT TO BE DREDGED

AREA	DISPOSAL REQUIREMENT	ESTIMATED DREDGING DEPTH
1	TYPE 1- OPEN SEA DISPOSAL	GENERALLY VARY FROM 0.5m TO 1m AND NOT GREATER THAN 3m
2	TYPE 1- OPEN SEA DISPOSAL (DEDICATED SITES)	
3	TYPE 2- CONFINED MARINE DISPOSAL (EAST SHA CHAU MUD PIT)	

TABLE 2A: COORDINATES OF THE PROPOSED DREDGING BOUNDARY

POINTS	COORDINATES	
	EASTING (m)	NORTHING (m)
①	841450.89	836860.40
②	841480.55	836817.08
③	841418.03	836774.29
④	841450.03	836728.59
Ⓐ	841390.53	836828.10
Ⓑ	841391.74	836811.84
Ⓒ	841516.00	836634.32
Ⓓ	841704.73	836763.52
Ⓔ	841587.38	836931.17

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer
Halcrow
Halcrow China Ltd.

ERM Enviromental Resources Management as sub-consultant

Agreement No. : CE 59/2005 (EP)

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

SEDIMENT QUALITY REPORT

Figure Title:
DREDGING AND SEDIMENT DISPOSAL REQUIREMENT PLANS (DEPTH FROM 0m TO 0.9m)

FIGURE 2

Checked: PS
Scale: 1:2500 @ A3
Rev.: 4
Designed: YC
Drawn: PF
Date: 26/01/2007

philipF
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25/5/2007

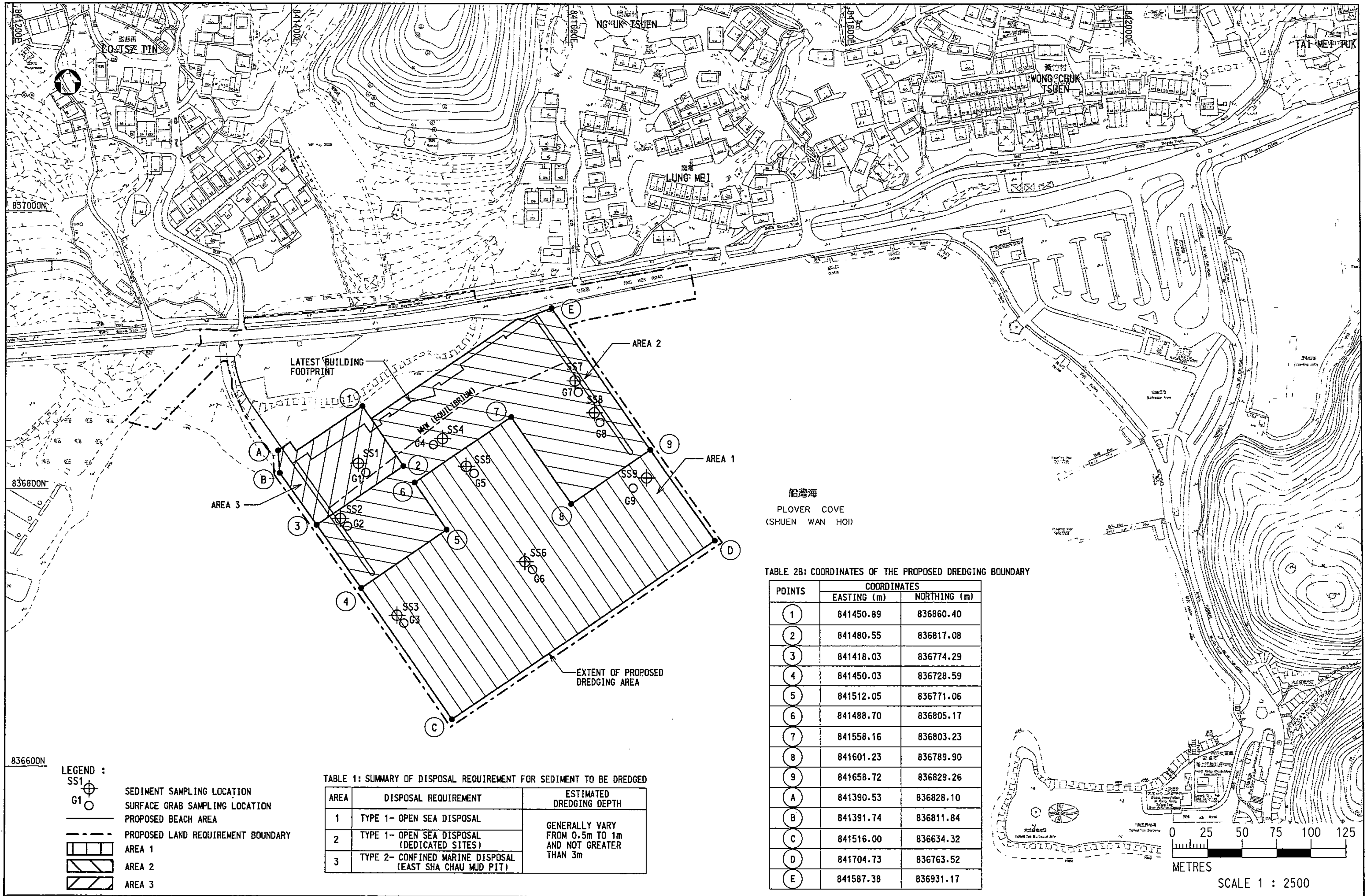

TABLE 1: SUMMARY OF DISPOSAL REQUIREMENT FOR SEDIMENT TO BE DREDGED

AREA	DISPOSAL REQUIREMENT	ESTIMATED DREDGING DEPTH
1	TYPE 1- OPEN SEA DISPOSAL	GENERALLY VARY FROM 0.5m TO 1m AND NOT GREATER THAN 3m
2	TYPE 1- OPEN SEA DISPOSAL (DEDICATED SITES)	
3	TYPE 2- CONFINED MARINE DISPOSAL (EAST SHA CHAU MUD PIT)	

TABLE 2B: COORDINATES OF THE PROPOSED DREDGING BOUNDARY

POINTS	COORDINATES	
	EASTING (m)	NORTHING (m)
1	841450.89	836860.40
2	841480.55	836817.08
3	841418.03	836774.29
4	841450.03	836728.59
5	841512.05	836771.06
6	841488.70	836805.17
7	841558.16	836803.23
8	841601.23	836789.90
9	841658.72	836829.26
A	841390.53	836828.10
B	841391.74	836811.84
C	841516.00	836634.32
D	841704.73	836763.52
E	841587.38	836931.17

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer
Halcrow
Halcrow China Ltd.

ERM Environmental Resources Management as sub-consultant

Agreement No. : CE 59/2005 (EP)

Project Title:
DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

SEDIMENT QUALITY REPORT

Figure Title:
DREDGING AND SEDIMENT DISPOSAL REQUIREMENT PLANS (DEPTH FROM 0.9m TO 2.9m)

FIGURE 3

Checked	Scale	Rev.
PS	1: 2500 @ A3	1
Designed	Drawn	Date
YC	PF	02/04/2007

Appendix A

Final Report on Chemical Analysis of the Collected Sediments

CEDD Contract No. GE/2005/47
Chemical and Biological Testing of Sediment (Service Contract)

Service Order No. GE/2005/47.22

Agreement No. CE 59/2005 (EP)
Development of a Bathing Beach at Lung Mei, Tai Po
Environmental, Drainage and Traffic Impact Assessments - Investigation

Final Report

Checked in accordance with
Contract No. GE/2005/47
requirements and accepted.
Signed Date 5/2/07

CLIENT:

Geotechnical Projects Division
Geotechnical Engineering Office
Civil Engineering and Development Department
Civil Engineering and Development Building
101 Princess Margaret Road,
Kowloon, Hong Kong
Telephone: (852) 2762 5463
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CERTIFIED BY:

Maureen Chia Chi Chang
PAAC

DATE:

31 January 2007

Chemical Analysis

Metals

HOKLAS 013

TEST REPORT

Report No. : 101718A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei,
Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department
Address : 8/F Civil Engineering and Development Building, 101 Princess Margaret Road,
Kowloon, Hong Kong

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286
Sample Description : 21 samples said to be sediment
Sample Receipt Date : 13 October 2006 - 24 October 2006
Test Period : 14 October 2006 - 06 November 2006

Test Information

Code	Test Parameter	Reporting Limits	Test Procedure
		Sediment/Soil	
		mg/kg	
Cd	Cadmium	0.20	S/M/DIG-RAR & M/ICP-MS
Cr	Chromium	8.0	S/M/DIG-RAR & M/ICP-MS
Cu	Copper	7.0	S/M/DIG-RAR & M/ICP-MS
Ni	Nickel	4.0	S/M/DIG-RAR & M/ICP-MS
Pb	Lead	8.0	S/M/DIG-RAR & M/ICP-MS
Zn	Zinc	20	S/M/DIG-RAR & M/ICP-MS
Hg	Mercury	0.05	S/M/DIG-RAR & M/ICP-MS
As	Arsenic	1.0	S/M/DIG-RAR & M/ICP-MS
Ag	Silver	0.10	S/M/DIG-RAR & M/ICP-MS

Notes :
1. This report shall not be reproduced, except in full, without prior approval from Lam Laboratories Ltd.
2. Results related to samples as received.
3. Results are based on dry sample weight.
4. < = less than
5. N/A = Not applicable
6. Test results satisfy all in-house QA/QC protocols as attached.
7. Test description (for in-house methods) as follows:
   S/M/DIG-RAR: Acid digestion.
   M/ICP-MS: ICP-MS Quantification.

Authorized Signatory :

Wong Yau Tim
(Operations Manager)

Issue Date: 30 Dec. 2006

Hong Kong Accreditation Service (HKAS) has accredited this laboratory under Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific laboratory activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this report were determined by this laboratory in accordance with its terms of accreditation.

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Tel: (852) 2897 3282 Fax: (852) 2897 5509 e-mail: info@lamlab.com

TEST REPORT

Report No.	:	101718A
Project Name	:	Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer	:	Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
Lab Job No.	:	J469
Lab Sample No.	:	18232,18236,18249,18255,18273,18286

Test Result

Customer Ref.	Sample					Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag
Drillhole No.	Depth, m			Type	Specimen									
	No.	From	To		Depth, m	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
SS6	NA	0.00	0.90		NA	<0.20	<8.0	<7.0	<4.0	8.5	<20	0.10	3.3	<0.10
SS6	NA	0.90	1.60		NA	<0.20	<8.0	<7.0	<4.0	<8.0	<20	0.06	4.2	<0.10
SS3	NA	0.00	0.90		NA	<0.20	<8.0	<7.0	<4.0	13	<20	0.07	5.8	<0.10
SS3	NA	0.90	1.90		NA	<0.20	<8.0	<7.0	<4.0	11	<20	0.05	5.0	<0.10
SS3	NA	1.90	2.80		NA	<0.20	<8.0	<7.0	<4.0	20	<20	0.06	12	<0.10
SS8	NA	0.00	0.90		NA	<0.20	<8.0	<7.0	<4.0	12	<20	0.08	10	<0.10
SS8	NA	0.90	1.70		NA	<0.20	<8.0	<7.0	<4.0	8.8	<20	0.07	16	<0.10
SS9	NA	0.00	0.90		NA	<0.20	<8.0	<7.0	<4.0	10	<20	0.07	4.0	<0.10
SS9	NA	0.90	1.90		NA	<0.20	<8.0	<7.0	<4.0	<8.0	<20	<0.05	2.5	<0.10
SS9	NA	1.90	2.10		NA	<0.20	<8.0	<7.0	<4.0	<8.0	<20	<0.05	8.5	<0.10
SS5	NA	0.00	0.90		NA	<0.20	<8.0	<7.0	7.8	19	<20	<0.05	2.5	0.12
SS7	NA	0.00	0.90		NA	<0.20	<8.0	<7.0	<4.0	<8.0	<20	<0.05	6.1	<0.10
SS7	NA	0.90	1.30		NA	<0.20	<8.0	<7.0	<4.0	16	<20	<0.05	14	<0.10
SS2	NA	0.50	0.90		NA	<0.20	<8.0	<7.0	<4.0	17	20	<0.05	17	<0.10
SS2	NA	0.90	1.90		NA	<0.20	<8.0	<7.0	<4.0	18	23	<0.05	28	<0.10
SS2	NA	1.90	2.50		NA	<0.20	<8.0	<7.0	<4.0	25	<20	<0.05	42	<0.10
SS4	NA	0.00	0.90		NA	<0.20	<8.0	<7.0	<4.0	12	20	<0.05	6.9	<0.10
SS4	NA	0.90	1.30		NA	<0.20	<8.0	<7.0	<4.0	12	<20	<0.05	27	<0.10
SS1	NA	0.90	0.90		NA	<0.20	<8.0	<7.0	<4.0	13	<20	<0.05	17	<0.10
SS1	NA	0.90	1.20		NA	<0.20	<8.0	<7.0	<4.0	31	26	<0.05	24	<0.10

TEST REPORT

Report No.	:	101718A
Project Name	:	Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer	:	Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
Lab Job No.	:	J469
Lab Sample No.	:	18232,18236,18249,18255,18273,18286

Test Result

Customer Ref.	Sample					Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag
Drillhole No.	Depth, m			Type	Specimen									
	No.	From	To		Depth, m	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Ref. Sediment	NA	NA	NA		NA	<0.20	28	14	19	36	72	0.10	5.5	0.22

-----------------------End of Report-----------------------

QUALITY CONTROL REPORT

Report No. : 101718A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei,
Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

1.1 Sample Duplicate (Relative deviation)

Customer Ref.	Sample					Batch	Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag
Drillhole No.	Depth, m			Type	Specimen										
	No.	From	To		Depth m		%	%	%	%	%	%	%	%	%
SS6	NA	0.00	0.90		NA	1	*na	*na	*na	*na	14	*na	1.4	6.2	*na
SS1	NA	0.90	0.90		NA	2	*na	*na	*na	*na	20	*na	*na	1.0	*na
Control Limits							+/- 30 % of the mean								

1.2 Method Spike (Standard Addition)

Customer Ref.	Sample					Batch	Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag
Drillhole No.	Depth, m			Type	Specimen										
	No.	From	To		Depth m		%	%	%	%	%	%	%	%	%
SS6	NA	0.00	0.90		NA	1	90	84	79	83	107	91	84	90	88
SS1	NA	0.90	0.90		NA	2	92	80	82	84	116	94	89	118	90
Control Limits							75 - 125 %								

Note: 1. *na = Relative deviation(RD) for duplicates cannot be evaluated as the value determined is lower than reporting limits.
2. Results are based on dry sample weight
3. < = less than

Authorized Signatory :

Wong Yau Tim
(Operations Manager)

Issue Date: 30 Dec. 2006

QUALITY CONTROL REPORT

Report No. : 101718A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
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Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

1.3 Sample Reference Material (ISE 2005.3.1)

Reference	Sample					Batch	Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag
	Depth, m			Type	Specimen										
	No.	From	To		Depth m		%	%	%	%	%	%	%	%	%
ISE 2005.3.1	N/A	N/A	N/A		N/A	1	97	83	78	82	92	79	103	86	97
ISE 2005.3.1	N/A	N/A	N/A		N/A	2	93	84	79	78	90	81	100	86	90
Control Limits							75 - 125% of nominal value								

1.4 Method Blank

Reference	Sample					Batch	Cd	Cr	Cu	Ni	Pb	Zn	Hg	As	Ag
	Depth, m			Type	Specimen										
	No.	From	To		Depth m		mg/kg								
N/A	N/A	N/A	N/A		N/A	1	<0.20	<8.0	<7.0	<4.0	<8.0	<20	<0.05	<1.0	<0.10
N/A	N/A	N/A	N/A		N/A	2	<0.20	<8.0	<7.0	<4.0	<8.0	<20	<0.05	<1.0	<0.10
Control Limits							Less than reporting limit								

Note: 1. Results are based on dry sample weight
2. < = less than

PAHs

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TEST REPORT

Report No. : 101719A
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Address : 8/F Civil Engineering and Development Building, 101 Princess Margaret Road,
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Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286
Sample Description : 21 samples said to be sediment
Sample Receipt Date : 13 October 2006 - 24 October 2006
Test Period : 14 October 2006 - 06 November 2006

Test Information

1. Low Molecular Weight Polyaromatic Hydrocarbons, LMW PAHs

CODE	Test Parameter	Reporting Limit	Test Procedure
		ug/kg	
NAP	Naphthalene	55	S/O/PAH
ANY	Acenaphthylene	55	S/O/PAH
ANA	Acenaphthene	55	S/O/PAH
FLU	Fluorene	55	S/O/PAH
PHE	Phenanthrene	55	S/O/PAH
ANT	Anthracene	55	S/O/PAH
LMW PAH	Total LMW PAH	55	S/O/PAH

2. High Molecular Weight Polyaromatic Hydrocarbons, HMW PAHs

CODE	Test Parameter	Reporting Limit	Test Procedure
		ug/kg	
CHR	Chrysene	170	S/O/PAH
BaA	Benzo(a)anthracene	170	S/O/PAH
BbF	Benzo(b)fluoranthene	170	S/O/PAH
BkF	Benzo(k)fluoranthene	170	S/O/PAH
BaP	Benzo(a)pyrene	170	S/O/PAH
DBA	Dibenz(ah)anthracene	170	S/O/PAH
FLT	Fluoranthene	170	S/O/PAH
IPY	Indeno(1,2,3-cd)pyrene	170	S/O/PAH
PYR	Pyrene	170	S/O/PAH
BPE	Benzo(ghi)perylene	170	S/O/PAH
HMW PAH	Total HMW PAH	170	S/O/PAH

Notes :
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2. Results relate to samples as received.
3. Results are based on dry sample weight.
4. < = less than
5. N/A = Not applicable
6. Test results satisfy all in-house QA/QC protocols as attached.
7. Test description (for in-house methods only) as follows:
S/O/PAH:Ultra-Sonic extraction and GC-MS Quantification.
8. Total LMW PAH Equals to the summary of NAP,ANY,ANA,FLU,PHE,ANT.
9. Total HMW PAH Equals to the summary of CHR,BaA,BbF,BkF,BaP,DBA,FLT,IPY,PYR,BPE.
10. Total LMW PAH & Total HMW PAH are not HOKLAS accredited parameters.

Authorized Signatory :

Wong Yau Tim
(Operations Manager)

Issue Date: 30 Dec. 2006

TEST REPORT

Report No. : 101719A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

1. Low Molecular Weight Polyaromatic Hydrocarbons, LMW PAHs

Customer Ref.	Sample					NAP	ANY	ANA	FLU	PHE	ANT	LMW PAH
Drillhole No.	Depth, m			Type	Specimen							
	No.	From	To		Depth m	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
SS6	NA	0.00	0.90		NA	<55	<55	<55	<55	<55	<55	<55
SS6	NA	0.90	1.60		NA	<55	<55	<55	<55	<55	<55	<55
SS3	NA	0.00	0.90		NA	<55	<55	<55	<55	<55	<55	<55
SS3	NA	0.90	1.90		NA	<55	<55	<55	<55	<55	<55	<55
SS3	NA	1.90	2.80		NA	<55	<55	<55	<55	<55	<55	<55
SS8	NA	0.00	0.90		NA	<55	<55	<55	<55	<55	<55	<55
SS8	NA	0.90	1.70		NA	<55	<55	<55	<55	<55	<55	<55
SS9	NA	0.00	0.90		NA	<55	<55	<55	<55	<55	<55	<55
SS9	NA	0.90	1.90		NA	<55	<55	<55	<55	<55	<55	<55
SS9	NA	1.90	2.10		NA	<55	<55	<55	<55	<55	<55	<55
SS5	NA	0.00	0.90		NA	<55	<55	<55	<55	<55	<55	<55
SS7	NA	0.00	0.90		NA	<55	<55	<55	<55	<55	<55	<55
SS7	NA	0.90	1.30		NA	<55	<55	<55	<55	<55	<55	<55
SS2	NA	0.50	0.90		NA	<55	<55	<55	<55	<55	<55	<55
SS2	NA	0.90	1.90		NA	<55	<55	<55	<55	<55	<55	<55
SS2	NA	1.90	2.50		NA	<55	<55	<55	<55	<55	<55	<55
SS4	NA	0.00	0.90		NA	<55	<55	<55	<55	<55	<55	<55
SS4	NA	0.90	1.30		NA	<55	<55	<55	<55	<55	<55	<55
SS1	NA	0.20	0.90		NA	<55	<55	<55	<55	<55	<55	<55
SS1	NA	0.90	1.20		NA	<55	<55	<55	<55	<55	<55	<55

TEST REPORT

Report No. : 101719A

Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei,
Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469

Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

2. High Molecular Weight Polyaromatic Hydrocarbons, HMW PAHs

Customer Ref.	Sample					CHR	BaA	BbF	BkF	BaP	DBA	FLT	IPY	PYR	BPE	HMW PAH
Drillhole No.		Depth, m		Type	Specimen Depth m											
	No.	From	To			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
SS6	NA	0.00	0.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS6	NA	0.90	1.60		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS3	NA	0.00	0.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS3	NA	0.90	1.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS3	NA	1.90	2.80		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS8	NA	0.00	0.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS8	NA	0.90	1.70		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS9	NA	0.00	0.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS9	NA	0.90	1.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	250
SS9	NA	1.90	2.10		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS5	NA	0.00	0.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS7	NA	0.00	0.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS7	NA	0.90	1.30		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS2	NA	0.50	0.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS2	NA	0.90	1.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS2	NA	1.90	2.50		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS4	NA	0.00	0.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS4	NA	0.90	1.30		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS1	NA	0.20	0.90		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
SS1	NA	0.90	1.20		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170

TEST REPORT

Report No. : 101719A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

1. Low Molecular Weight Polyaromatic Hydrocarbons, LMW PAHs

Customer Ref.	Sample					NAP	ANY	ANA	FLU	PHE	ANT	LMW PAH
Drillhole No.	Depth, m			Type	Specimen							
	No.	From	To		Depth m	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
R.Sediment	NA	NA	NA		NA	<55	<55	<55	<55	<55	<55	<55

TEST REPORT

Report No.	:	101719A
Project Name	:	Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer	:	Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
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Lab Sample No.	:	18232,18236,18249,18255,18273,18286

Test Results

2. High Molecular Weight Polyaromatic Hydrocarbons, HMW PAHs

Customer Ref.	Sample					CHR	BaA	BbF	BkF	BaP	DBA	FLT	IPY	PYR	BPE	HMW PAH
Drillhole No.		Depth, m		Type	Specimen											
	No.	From	To		Depth m	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
R.Sediment	NA	NA	NA		NA	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170

-----------End of Report-----------

QUALITY CONTROL REPORT

Report No.	:	101719A
Project Name	:	Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer	:	Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
Lab Job No.	:	J469
Lab Sample No.	:	18232,18236,18249,18255,18273,18286

Test Results

1. Low Molecular Weight Polyaromatic Hydrocarbons, LMW PAHs

1.1 Sample Duplicate

Customer Ref.	Sample					Batch	NAP	ANY	ANA	FLU	PHE	ANT
Drillhole No.	Depth, m			Type	Specimen Depth m							
	No.	From	To				%	%	%	%	%	%
SS6	N/A	0.00	0.90		N/A	1	na*	na*	na*	na*	na*	na*
SS1	NA	0.20	0.90		N/A	2	na*	na*	na*	na*	na*	na*
Control Limits							+/- 30 % of the mean					

1.2 Sample Spike (Spike Level = 5 ug)

Customer Ref.	Sample					Batch	NAP	ANY	ANA	FLU	PHE	ANT
Drillhole No.	Depth, m			Type	Specimen Depth m							
	No.	From	To				%	%	%	%	%	%
SS6	N/A	0.00	0.90		N/A	1	111	93	98	94	95	110
SS1	N/A	0.20	0.90		N/A	2	100	96	93	95	85	93
Control Limits							70 - 130 %					

Notes :

1. na* = Relative deviation (RD) for duplicates cannot be evaluated as the value determined is lower than reporting limit.

Authorized Signatory :

Wong Yau Tim
(Operations Manager)

Issue Date: : 30 Dec. 2006

QUALITY CONTROL REPORT

Report No. : 101719A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

2. High Molecular Weight Polyaromatic Hydrocarbons, HMW PAHs

2.1 Sample Duplicate

Customer Ref.	Sample					Batch	CHR	BaA	BbF	BkF	BaP	DBA	FLT	IPY	PYR	BPE
Drillhole No.	Depth, m			Type	Specimen Depth m											
	No.	From	To				%	%	%	%	%	%	%	%	%	%
SS6	N/A	0.00	0.90		N/A	1	na*	na*	na*	na*	na*	na*	na*	na*	na*	na*
SS1	NA	0.20	0.90		N/A	2	na*	na*	na*	na*	na*	na*	na*	na*	na*	na*
Control Limits							+/- 30 % of the mean									

2.2 Sample Spike (Spike Level = 5 ug)

Customer Ref.	Sample					Batch	CHR	BaA	BbF	BkF	BaP	DBA	FLT	IPY	PYR	BPE
Drillhole No.	Depth, m			Type	Specimen Depth m											
	No.	From	To				%	%	%	%	%	%	%	%	%	%
SS6	N/A	0.00	0.90		N/A	1	101	85	97	82	111	113	82	99	92	104
SS1	N/A	0.20	0.90		N/A	2	86	100	105	94	105	100	83	95	94	89
Control Limits							70 - 130 %									

Notes :

1. na* = Relative deviation (RD) for duplicates cannot be evaluated as the value determined is lower than reporting limit.

QUALITY CONTROL REPORT

Report No. : 101719A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

1. Low Molecular Weight Polyaromatic Hydrocarbons, LMW PAHs

1.3 QC Sample (SETOC 2002.3.3)

Customer Ref.	Sample						NAP	ANY	ANA	FLU	PHE	ANT
Drillhole No.	Depth, m			Type	Specimen	Batch						
	No.	From	To		Depth m		%	%	%	%	%	%
SETOC 2002.3.3	N/A	N/A	N/A		N/A	1	92	109	120	101	92	109
SETOC 2002.3.3	N/A	N/A	N/A		N/A	2	103	90	108	92	102	101
Control Limits							70 - 130 % of nominal value					

1.4 Method Blank

Customer Ref.	Sample						NAP	ANY	ANA	FLU	PHE	ANT
Drillhole No.	Depth, m			Type	Specimen	Batch						
	No.	From	To		Depth m		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
N/A	N/A	N/A	N/A		N/A	1	<55	<55	<55	<55	<55	<55
N/A	N/A	N/A	N/A		N/A	2	<55	<55	<55	<55	<55	<55
Control Limits							Less than reporting limit					

QUALITY CONTROL REPORT

Report No. : 101719A
Project Name : Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286
Test Results

2. High Molecular Weight Polyaromatic Hydrocarbons, HMW PAHs

2.3 QC Sample (SETOC 2002.3.3)

Customer Ref.	Sample					Batch	CHR	BaA	BbF	BkF	BaP	DBA	FLT	IPY	PYR	BPE
Drillhole No.	Depth, m			Type	Specimen											
	No.	From	To		Depth m		%	%	%	%	%	%	%	%	%	%
SETOC 2002.3.3	N/A	N/A	N/A		N/A	1	89	105	90	91	108	112	82	100	92	86
SETOC 2002.3.3	N/A	N/A	N/A		N/A	2	91	112	83	97	115	97	85	102	93	87
Control Limits							70 - 130% of nominal value									

2.4 Method Blank

Customer Ref.	Sample					Batch	CHR	BaA	BbF	BkF	BaP	DBA	FLT	IPY	PYR	BPE
Drillhole No.	Depth, m			Type	Specimen											
	No.	From	To		Depth m		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
N/A	N/A	N/A	N/A		N/A	1	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
N/A	N/A	N/A	N/A		N/A	2	<170	<170	<170	<170	<170	<170	<170	<170	<170	<170
Control Limits							Less than reporting limit									

PCBs

HOKLAS 013

TEST REPORT

Report No. : 101720A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei,
Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department
Address : 8/F Civil Engineering and Development Building, 101 Princess Margaret Road,
Kowloon, Hong Kong

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286
Sample Description : 21 samples said to be sediment
Sample Receipt Date : 13 October 2006 - 24 October 2006
Test Period : 14 October 2006 - 06 November 2006

Test Information

CODE	Test Parameter	Reporting Limit ug/kg	Test Procedure
8	2,4' dichlorobiphenyl	3.0	S/O/PCB
18	2,2',5 trichlorobiphenyl	3.0	S/O/PCB
28	2,4,4' trichlorobiphenyl	3.0	S/O/PCB
44	2,2',3,5' tetrachlorobiphenyl	3.0	S/O/PCB
52	2,2',5,5' tetrachlorobiphenyl	3.0	S/O/PCB
66	2,3',4,4' tetrachlorobiphenyl	3.0	S/O/PCB
77	3,3',4,4' tetrachlorobiphenyl	3.0	S/O/PCB
101	2,2',4,5,5' pentachlorobiphenyl	3.0	S/O/PCB
105	2,3,3',4,4' pentachlorobiphenyl	3.0	S/O/PCB
118	2,3',4,4',5 pentachlorobiphenyl	3.0	S/O/PCB
126	3,3',4,4',5 pentachlorobiphenyl	3.0	S/O/PCB
128	2,2',3,3',4,4' hexachlorobiphenyl	3.0	S/O/PCB
138	2,2',3,4,4',5' hexachlorobiphenyl	3.0	S/O/PCB
153	2,2',4,4',5,5' hexachlorobiphenyl	3.0	S/O/PCB
169	3,3',4,4',5,5' hexachlorobiphenyl	3.0	S/O/PCB
170	2,2',3,3',4,4',5 heptachlorobiphenyl	3.0	S/O/PCB
180	2,2',3,4,4',5,5' heptachlorobiphenyl	3.0	S/O/PCB
187	2,2',3,4',5,5',6 heptachlorobiphenyl	3.0	S/O/PCB
Total PCB	Total PCB	3.0	S/O/PCB

Notes :
1. This report shall not be reproduced, except in full, without prior approval from Lam Laboratories Ltd.
2. Results relate to samples as received.
3. Results are based on dry sample weight.
4. < = less than
5. N/A = Not applicable
6. Test results satisfy all in-house QA/QC protocols as attached.
7. Test description (for in-house methods only) as follows:
S/O/PCB:Ultra-Sonic extraction and GC-MS Quantification.
8. Total PCB Equals to the summary of individual reported PCBs.
9. Total PCB is not HOKLAS accredited parameter.

Authorized Signatory :

Wong Yau Tim
(Operations Manager)

Issue Date: 30 Dec. 2006

TEST REPORT

Report No. : 101720A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei,
Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

Customer Ref.	Sample					8	18	28	44	52	66	77	101	105
Drillhole No.	Depth, m			Type	Specimen									
	No.	From	To		Depth m	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
SS6	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS6	NA	0.90	1.60		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS3	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS3	NA	0.90	1.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS3	NA	1.90	2.80		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS8	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS8	NA	0.90	1.70		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS9	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS9	NA	0.90	1.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	3.4	<3.0
SS9	NA	1.90	2.10		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS5	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS7	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS7	NA	0.90	1.30		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS2	NA	0.50	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS2	NA	0.90	1.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS2	NA	1.90	2.50		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS4	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS4	NA	0.90	1.30		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS1	NA	0.20	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS1	NA	0.90	1.20		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

TEST REPORT

Report No. : 101720A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

Customer Ref.	Sample					118	126	128	138	153	169	170	180	187	Total PCB
Drillhole No.	Depth, m			Type	Specimen										
	No.	From	To		Depth m	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
SS6	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS6	NA	0.90	1.60		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS3	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS3	NA	0.90	1.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS3	NA	1.90	2.80		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS8	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS8	NA	0.90	1.70		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS9	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS9	NA	0.90	1.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	19
SS9	NA	1.90	2.10		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS5	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS7	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS7	NA	0.90	1.30		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS2	NA	0.50	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS2	NA	0.90	1.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS2	NA	1.90	2.50		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS4	NA	0.00	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS4	NA	0.90	1.30		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS1	NA	0.20	0.90		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SS1	NA	0.90	1.20		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

TEST REPORT

Report No. : 101720A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei,
Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

Customer Ref.	Sample					8	18	28	44	52	66	77	101	105
Drillhole No.	Depth, m			Type	Specimen Depth m									
	No.	From	To			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
R.Sediment	NA	NA	NA		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

TEST REPORT

Report No. : 101720A
Project Name : Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

Customer Ref.	Sample					118	126	128	138	153	169	170	180	187	Total
Drillhole No.	Depth, m			Type	Specimen										PCB
	No.	From	To		Depth m	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
R.Sediment	NA	NA	NA		NA	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

-----------End of Report------------

QUALITY CONTROL REPORT

Report No. : 101720A
Project Name : Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

1.1 Sample Duplicate

Customer Ref.	Sample					Batch	8	18	28	44	52	66	77	101	105
Drillhole No.	Depth, m			Type	Specimen Depth m										
	No.	From	To				%	%	%	%	%	%	%	%	%
SS6	N/A	0.00	0.90		N/A	1	na*	na*	na*	na*	na*	na*	na*	na*	na*
SS1	NA	0.20	0.90		N/A	2	na*	na*	na*	na*	na*	na*	na*	na*	na*
Control Limit							+/- 30% of the mean								

1.2 Sample Spike (Spike Level = 1 ug)

Customer Ref.	Sample					Batch	8	18	28	44	52	66	77	101	105
Drillhole No.	Depth, m			Type	Specimen Depth m										
	No.	From	To				%	%	%	%	%	%	%	%	%
SS6	N/A	0.00	0.90		N/A	1	83	91	78	97	93	90	100	107	113
SS1	NA	0.20	0.90		N/A	2	83	79	82	86	86	80	84	87	103
Control Limit							70-130 %								

Notes :

1. na* = Relative deviation (RD) for duplicates cannot be evaluated as the value determined is lower than reporting limit.

Authorized Signatory :

Wong Yau Tim
(Operations Manager)

Issue Date: : 30 Dec. 2006

QUALITY CONTROL REPORT

Report No. : 101720A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei,
Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

1.3 Sample Duplicate

Customer Ref.	Sample					Batch	118	126	128	138	153	169	170	180	187
Drillhole No.	Depth, m			Type	Specimen Depth m										
	No.	From	To				%	%	%	%	%	%	%	%	%
SS6	N/A	0.00	0.90		N/A	1	na*	na*	na*	na*	na*	na*	na*	na*	na*
SS1	NA	0.20	0.90		N/A	2	na*	na*	na*	na*	na*	na*	na*	na*	na*
Control Limit							+/- 30% of the mean								

1.4 Sample Spike (Spike Level = 1 ug)

Customer Ref.	Sample					Batch	118	126	128	138	153	169	170	180	187
Drillhole No.	Depth, m			Type	Specimen Depth m										
	No.	From	To				%	%	%	%	%	%	%	%	%
SS6	N/A	0.00	0.90		N/A	1	110	97	119	114	103	92	100	104	111
SS1	NA	0.20	0.90		N/A	2	86	97	104	101	95	117	119	108	90
Control Limit							70-130 %								

Notes :

1. na* = Relative deviation (RD) for duplicates cannot be evaluated as the value determined is lower than reporting limit.

QUALITY CONTROL REPORT

Report No. : 101720A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

2.1 QC Sample (SETOC 2002.4.4)

Customer Ref. Drillhole No.	Batch	28 %	52 %	101 %	105 %	118 %	128 %	138 %	153 %	180 %
SETOC 2002.4.4	1	88	90	86	95	103	97	95	90	115
SETOC 2002.4.4	2	97	79	100	88	107	90	109	101	122
Control Limit		70 - 130% of nominal value								

2.2 Method Blank

Customer Ref.	Sample					Batch	8	18	28	44	52	66	77	101	105
Drillhole No.	Depth, m			Type	Specimen										
	No.	From	To		Depth m		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
N/A	N/A	N/A	N/A		N/A	1	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
N/A	N/A	N/A	N/A		N/A	2	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Control Limit							less than reporting limit								

Customer Ref.	Sample					Batch	118	126	128	138	153	169	170	180	187
Drillhole No.	Depth, m			Type	Specimen										
	No.	From	To		Depth m		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
N/A	N/A	N/A	N/A		N/A	1	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
N/A	N/A	N/A	N/A		N/A	2	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Control Limit							less than reporting limit								

TBT

HOKLAS 013

TEST REPORT

Report No.	: 101721A
Project Name	: Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer	: Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
Address	: 8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong
Lab Job No.	: J469
Lab Sample No.	: 18232,18236,18249,18255,18273,18286
Sample Description	: 21 samples said to be water
Sample Receipt Date	: 13 October 2006 - 24 October 2006
Test Period	: 14 October 2006 - 06 November 2006

Test Information

CODE	Test Parameter	Reporting Limit	Test Procedure
		ug/L	
TBT	Tri-Butyl Tin	0.015	W/O/TBT

Notes :
1. This report shall not be reproduced, except in full, without prior approval from Lam Laboratories Ltd.
2. < = less than
3. N/A = Not applicable
4. Test results satisfy all in-house QA/QC protocols as attached.
5. Test description (for in-house methods) as follows:
   W/O/TBT: Solvent extraction and GC-MS Quantification.
6. Reporting limit of one sample is 0.075ug/L as no enough sample.

Authorized Signatory :

Wong Yau Tim
(Operations Manager)

Issue Date: 30 Dec. 2006

TEST REPORT

Report No. : 101721A

Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469

Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

Customer Ref.	Sample					TBT
Drillhole No.	Depth, m			Type	Specimen	
	No.	From	To		Depth m	ug TBT / L
SS6	NA	0.00	0.90		NA	<0.015
SS6	NA	0.90	1.60		NA	<0.015
SS3	NA	0.00	0.90		NA	<0.015
SS3	NA	0.90	1.90		NA	<0.015
SS3	NA	1.90	2.80		NA	<0.015
SS8	NA	0.00	0.90		NA	<0.015
SS8	NA	0.90	1.70		NA	<0.015
SS9	NA	0.00	0.90		NA	<0.015
SS9	NA	0.90	1.90		NA	<0.015
SS9	NA	1.90	2.10		NA	<0.075
SS5	NA	0.00	0.90		NA	<0.015
SS7	NA	0.00	0.90		NA	<0.015
SS7	NA	0.90	1.30		NA	<0.015
SS2	NA	0.50	0.90		NA	<0.015
SS2	NA	0.90	1.90		NA	<0.015
SS2	NA	1.90	2.50		NA	<0.015
SS4	NA	0.00	0.90		NA	<0.015
SS4	NA	0.90	1.30		NA	<0.015
SS1	NA	0.20	0.90		NA	<0.015
SS1	NA	0.90	1.20		NA	<0.015

TEST REPORT

Report No. : 101721A
Project Name : Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department

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Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

Customer Ref.	Sample					TBT
Drillhole No.	Depth, m			Type	Specimen Depth m	
	No.	From	To			ug TBT / L
R.Sediment	NA	NA	NA		NA	<0.015

---------------End of report---------------

QUALITY CONTROL REPORT

Report No. : 101721A
Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei,
Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department
Lab Job No. : J469
Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

1.1 Sample Duplicate (Relative deviation)

Customer Ref.	Sample					Batch	TBT
Drillhole No.	Depth, m			Type	Specimen Depth m		
	No.	From	To				%
18223/1	N/A	N/A	N/A		N/A	1	na*
18236/1	N/A	N/A	N/A		N/A	2	na*
Control Limit							+/- 30% of the mean

1.2 Sample Spike (Spike Level = 50 ng)

Customer Ref.	Sample					Batch	TBT
Drillhole No.	Depth, m			Type	Specimen Depth m		
	No.	From	To				%
18223/1	N/A	N/A	N/A		N/A	1	83
18236/1	N/A	N/A	N/A		N/A	2	104
Control Limit							70-130 %

Notes :

1. na* = Relative deviation (RD) for duplicates cannot be evaluated as the value determined is lower than reporting limit.

Authorized Signatory :

Wong Yau Tim
(Operations Manager)

Issue Date: 30 Dec. 2006

QUALITY CONTROL REPORT

Report No. : 101721A

Project Name : Chemical and Biological Testing of Sediment (Service Contract)
Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation
Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469

Lab Sample No. : 18232,18236,18249,18255,18273,18286

Test Results

1.3 QC Sample (Spike level = 50 ng)

Customer Ref.	Sample					Batch	TBT
Drillhole No.	Depth, m			Type	Specimen Depth m		
	No.	From	To				%
MB Spike	N/A	N/A	N/A		N/A	1	92
MB Spike	N/A	N/A	N/A		N/A	2	104
Control Limit							70 - 130 %

1.4 Method Blank

Customer Ref.	Sample					Batch	TBT
Drillhole No.	Depth, m			Type	Specimen Depth m		
	No.	From	To				ug TBT / L
N/A	N/A	N/A	N/A		N/A	1	<0.015
N/A	N/A	N/A	N/A		N/A	2	<0.015
Control Limit							Less than reporting limit

Inorganic

TEST REPORT

Report No. : 101822N
Project Name : CEDD Contract No. GE/2005/47Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005(EP) Development of a Bathing Beach a Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water Service Order No. : GE/2005/47.22
Customer : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
Address : 8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No. : J469 **Lab Sample No.** : 18232,18236,18249,18255 18273,18286

Sample Description : 21 solid samples said to be soil
Sample Receipt Date : 12/10/2006-26/10/2006 **Test Period** : 12/10/2006-9/11/2006

Test Information

Code	Test Parameter	Reporting Limit (unit)	Test Procedure
SOD	Sediment Oxygen Demand (5days)	100 (mg O_2/kg)	In-house Method
COD	Chemical Oxygen Demand	5000 (mg O_2/kg)	APHA 19e 5220D (Closed Reflux)
TOC	Total Organic Carbon	0.05 (%)	In-house Method EP-005(NDIR)
RP	Redox potential	N/A (mV)	In-house Method S/N/ORP
TKN	Nitrogen (Total Kjeldahl)	50 (mg-N/kg)	In-house Method W/N/TKN
NH3-N	Nitrogen (Ammonia)	1.0 (mg NH_3-N/kg)	In-house Method W/N/NH3-FIA
TP	Phosphorus (Total)	10 (mg-P/kg)	APHA 19e 4500-P B & E
PO4-P	Orthophosphate	0.1 (mg-P/kg)	In-house Method W/N/TRP-FIA
NO3-N	Nitrogen (Nitrate)	1.0 (mg NO_3-N/kg)	In-house Method W/N/NOx-FIA
NO2-N	Nitrogen (Nitrite)	1.0 (mg NO_2-N/kg)	In-house Method W/N/NOx-FIA

Notes :
1. This report shall not be reproduced, except in full, without prior written approval from Lam Laboratories Limited.
2. Results related to sample(s) as received.
3. Results satisfy all in-house QA/QC protocols as attached.
4. W/N/NOx-FIA: Determination of Nitrate and/or Nitrite by Flow Injection Analysis.
5. W/N/NH3-FIA: Determination of Ammonia by Flow Injection Analysis.
6. W/N/TRP/FIA: Determination of Total Reactive Phosphorus by Flow Injection Analysis.
7. W/N/TKN: In-house method based on APHA 19e 4500-NorgB and 4500-NH3 C
8. S/N/ORP: Determination of Redox Potential
9. Samples for Total Organic Carbon Analysis were subcontracted to ALS Technichem (HK) Pty. Limited.

Authorized Signatory :

MA Hiu Tung
(Chemist)

Issue Date : 29/1/2007

TEST REPORT

Report No. : 101822N
Project Name : CEDD Contract No. GE/2005/47Chemical and Biological Testing of Sediment
(Service Contract) Agreement No. CE 59/2005(EP) Development of a Bathing Beach a
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Service Order No. : GE/2005/47.22
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469 **Lab Sample No.** : 18232,18236,18249,18255
18273,18286

Test Results

Customer Ref.	Lab Sample No.	RP (mV)	SOD (mg O_2/kg)	COD (mg O_2/kg)	TOC (%)
SS6 0.0-0.9m	18232/3	103.1	160	<5000	1.4
SS6 0.9-1.6m	18232/4	86.3	200	<5000	2.6
SS3 0.0-0.9m	18232/7	63.4	200	6100	1.8
SS3 0.9-1.9m	18232/8	49.4	<100	<5000	1.3
SS3 1.9-2.8m	18232/9	78.3	180	<5000	0.9
SS8 0.0-0.9m	18236/3	88.6	240	<5000	1.7
SS8 0.9-1.7m	18236/4	124.3	<100	<5000	0.5
SS9 0.0-0.9m	18236/5	69.6	170	<5000	1.8
SS9 0.9-1.9m	18236/6	127.4	160	<5000	0.9
SS9 1.9-2.1m	18236/7	64.4	<100	<5000	1.6
SS5 0.0-0.9m	18249/3	94.4	260	<5000	0.3
SS7 0.0-0.9m	18249/6	91.6	260	<5000	0.3
SS7 0.9-1.3m	18249/7	103.5	<100	<5000	0.6
SS2 0.5-0.9m	18255/3	124.3	170	<5000	0.7
SS2 0.9-1.9m	18255/4	120.2	110	<5000	1.1
SS2 1.9-2.5m	18255/5	105.9	600	<5000	0.7
SS4 0.0-0.9m	18255/8	79.3	<100	<5000	0.7
SS4 0.9-1.3m	18255/9	94.5	150	<5000	<0.05
SS1 0.2-0.9m	18273/3	89.8	<100	<5000	0.6
SS1 0.9-1.2m	18273/4	122.2	120	<5000	0.2
Reference Sample	18286/1	48.8	292	13000	1.5

Notes : 1. < = less than

TEST REPORT

Report No. : 101822N
Project Name : CEDD Contract No. GE/2005/47Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005(EP) Development of a Bathing Beach a Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water Service Order No. : GE/2005/47.22
Customer : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
Lab Job No. : J469 **Lab Sample No.** : 18232,18236,18249,18255 18273,18286

Test Results

Customer Ref.	Lab Sample No.	TKN (mg-N/kg)	NH3-N (mg NH_3-N/kg)	TP (mg-P/kg)	PO4-P (mg-P/kg)
SS6 0.0-0.9m	18232/3	<50	<1.0	<10	<0.1
SS6 0.9-1.6m	18232/4	71	<1.0	<10	<0.1
SS3 0.0-0.9m	18232/7	110	<1.0	<10	<0.1
SS3 0.9-1.9m	18232/8	52	<1.0	<10	<0.1
SS3 1.9-2.8m	18232/9	<50	<1.0	<10	0.35
SS8 0.0-0.9m	18236/3	84	<1.0	<10	0.21
SS8 0.9-1.7m	18236/4	57	<1.0	98	<0.1
SS9 0.0-0.9m	18236/5	210	<1.0	180	<0.1
SS9 0.9-1.9m	18236/6	65	<1.0	83	<0.1
SS9 1.9-2.1m	18236/7	68	<1.0	61	0.15
SS5 0.0-0.9m	18249/3	88	<1.0	71	<0.1
SS7 0.0-0.9m	18249/6	59	<1.0	28	<0.1
SS7 0.9-1.3m	18249/7	<50	1.8	85	<0.1
SS2 0.5-0.9m	18255/3	130	<1.0	11	<0.1
SS2 0.9-1.9m	18255/4	68	<1.0	130	<0.1
SS2 1.9-2.5m	18255/5	84	<1.0	110	0.15
SS4 0.0-0.9m	18255/8	110	<1.0	94	<0.1
SS4 0.9-1.3m	18255/9	<50	<1.0	22	0.11
SS1 0.2-0.9m	18273/3	104	<1.0	110	<0.1
SS1 0.9-1.2m	18273/4	<50	<1.0	84	<0.1
				110	<0.1
Reference Sample	18286/1	180	2.9	1100	1.1

Notes : 1. < = less than

TEST REPORT

Report No. : 101822N

Project Name : CEDD Contract No. GE/2005/47Chemical and Biological Testing of Sediment (Service Contract) Agreement No. CE 59/2005(EP) Development of a Bathing Beach a Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Service Order No. : GE/2005/47.22

Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469 **Lab Sample No.** : 18232,18236,18249,18255
18273,18286

Test Results

Customer Ref.	Lab Sample No.	NO3-N (mg NO3-N/kg)	NO2-N (mg NO_2-N/kg)
SS6 0.0-0.9m	18232/3	<1.0	<1.0
SS6 0.9-1.6m	18232/4	<1.0	<1.0
SS3 0.0-0.9m	18232/7	<1.0	<1.0
SS3 0.9-1.9m	18232/8	<1.0	<1.0
SS3 1.9-2.8m	18232/9	<1.0	<1.0
SS8 0.0-0.9m	18236/3	<1.0	<1.0
SS8 0.9-1.7m	18236/4	<1.0	<1.0
SS9 0.0-0.9m	18236/5	<1.0	<1.0
SS9 0.9-1.9m	18236/6	<1.0	<1.0
SS9 1.9-2.1m	18236/7	<1.0	<1.0
SS5 0.0-0.9m	18249/3	<1.0	<1.0
SS7 0.0-0.9m	18249/6	<1.0	<1.0
SS7 0.9-1.3m	18249/7	<1.0	<1.0
SS2 0.5-0.9m	18255/3	<1.0	<1.0
SS2 0.9-1.9m	18255/4	<1.0	<1.0
SS2 1.9-2.5m	18255/5	<1.0	<1.0
SS4 0.0-0.9m	18255/8	<1.0	<1.0
SS4 0.9-1.3m	18255/9	<1.0	<1.0
SS1 0.2-0.9m	18273/3	<1.0	<1.0
SS1 0.9-1.2m	18273/4	<1.0	<1.0
Reference Sample	18286/1	<1.0	<1.0

Notes : 1. < = less than

- End of Report -

QUALITY CONTROL REPORT

Report No. : 101822N

Project Name : CEDD Contract No. GE/2005/47Chemical and Biological Testing of Sediment
(Service Contract) Agreement No. CE 59/2005(EP) Development of a Bathing Beach a
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water
Service Order No. : GE/2005/47.22

Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469 **Lab Sample No.** : 18232,18236,18249,18255
18273,18286

Test Results

1.1 Method Blank

Lab Sample No.	NOx-N (mg NO_x-N/kg)	NH3-N (mg NH_3-N/kg)	PO4-P (mg P/kg)	TKN (mg N/kg)	TP (mg P/kg)	NO2-N (mg NO2-N/kg)
N/A	<0.01	<0.02	<0.001	<0.02	<0.004	<0.01
Control Limit	0.01	0.02	0.001	0.02	0.004	0.01

Lab Sample No.	SOD (mg O_2/kg)	COD (mg O_2/kg)	TOC (%)
N/A	0.6	<10	<1
Control Limit	0.60-1.0	10	1

1.2 Quality Control Standard (Recovery)

Lab Sample No.	NOx-N (%)	NH3-N (%)	PO4-P (%)	TKN (%)	TP (%)	NO2-N (%)
LCS	100	106	114	103	92	99
Control Limit	80-120	80-120	80-120	80-120	80-120	80-120

Lab Sample No.	BOD (mg/L)	COD (%)	TOC (%)	RP (mV)
LCS	202	99	111	230
Control Limit	198+/-30.5	80-120	85-115	228+/-10

1.3 Sample Duplicate (Relative Deviation)

Lab Sample No.	NOx-N (%)	NH3-N (%)	PO4-P (%)	TKN (%)	TP (%)	NO2-N (%)
18289/1	13	N/A	N/A	N/A	N/A	0.36
18352/3	N/A	1.7	N/A	N/A	N/A	N/A
18289/1	N/A	N/A	5.7	N/A	N/A	N/A
18249/1	N/A	N/A	N/A	0.0	0.0	N/A
Control Limit	20	20	20	20	20	20

Lab Sample No.	BOD (%)	COD (%)	TOC (%)	RP (%)
18279/5	9.8	N/A	N/A	N/A
18268/1	N/A	17	N/A	N/A
18232/3	N/A	N/A	0.0	6.9
HK0605308-001	N/A	N/A	0.0	N/A
Control Limit	20	20	N/A	20

Notes: 1. < = less than
2. +/- = plus or minus
3. N/A = Not applicable

Authorized Signatory :

MA Hiu Tung
(Chemist)

Issue Date : 29/1/2007

QUALITY CONTROL REPORT

Report No. : 101822N
Project Name : CEDD Contract No. GE/2005/47Chemical and Biological Testing of Sediment
(Service Contract) Agreement No. CE 59/2005(EP) Development of a Bathing Beach
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Wate
Service Order No. : GE/2005/47.22
Customer : Geotechnical Projects Division, Geotechnical Engineering office,
Civil Engineering and Development Department

Lab Job No. : J469 **Lab Sample No.** : 18232,18236,18249,18255
18273,18286

Test Results

1.4 Sample Spike (Recovery)

Lab Sample No.	NOx-N (%)	NH3-N (%)	PO4-P (%)	TKN (%)	TP (%)	NO2-N (%)
18289/1	96	N/A	N/A	N/A	N/A	92
18352/3	N/A	114	N/A	N/A	N/A	N/A
18289/1	N/A	N/A	97	N/A	N/A	N/A
18249/1	N/A	N/A	N/A	99	100	N/A
Control Limit	80-120	80-120	80-120	80-120	80-120	80-120

Lab Sample No.	COD (%)
18268/1	86
Control Limit	80-120

Notes: 1. < = less than
2. N/A = Not applicable

Chlorinated Pesticides

REPORT OF ANALYSIS

Page: 1 of 6

Report No. RN580927

Client	: LAM LABORATORIES LTD 1412 - 1416 HONOUR IND CENTRE 6 SUN YIP STREET CHAI WAN HONG KONG	**Job No.** **Quote No.** **Order No.** **Date Sampled** **Date Received**	: LAML01/061020/2 : QT-00441 : : : 20-OCT-2006
Attention	: WONG YAU TIM	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Brian Woodward	**Phone**	: (02) 94490151

Lab Reg No.	Sample Ref	Sample Description
NQ06/06618	SS3	SOIL GE/2005/047 JOB J469 SO22 (0.0-0.9M)
NQ06/06619	SS3	SOIL GE/2005/047 JOB J469 SO22 (0.9-1.9M)
NQ06/06620	SS3	SOIL GE/2005/047 JOB J469 SO22 (1.9-2.8M)

Lab Reg No.			NQ06/06618	NQ06/06619	NQ06/06620	
Sample Reference	Units	LOR	SS3	SS3	SS3	Method
Organochlorine (OC) Pesticides						
HCB	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor epoxide	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Aldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
gamma-BHC (Lindane)	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
delta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
trans-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
cis-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Oxychlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Dieldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDE	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDD	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDT	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Aldehyde	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Ketone	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endosulfan Sulfate	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Methoxychlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Surrogate						
Surrogate OC Rec.	%		67	96	109	NR_19
Dates						
Date extracted			24-OCT-2006	24-OCT-2006	24-OCT-2006	
Date analysed			26-OCT-2006	26-OCT-2006	26-OCT-2006	

REPORT OF ANALYSIS

Lab Reg No.			**NQ06/06618**	**NQ06/06619**	**NQ06/06620**	
Sample Reference	**Units**	**LOR**	**SS3**	**SS3**	**SS3**	**Method**

Danny Slee, Section Manager
Organics - NSW (Accreditation No. 198)

3-NOV-2006

Lab Reg No.			**NQ06/06618**	**NQ06/06619**	**NQ06/06620**	
Sample Reference	**Units**	**LOR**	**SS3**	**SS3**	**SS3**	**Method**
Trace Elements						
Total Solids	%		79.5	82.4	85.0	NT2_49

Dr. Honway Louie, Section Manager
Inorganics - NSW (Accreditation No. 198)

3-NOV-2006

REPORT OF ANALYSIS

Client	: LAM LABORATORIES LTD 1412 - 1416 HONOUR IND CENTRE 6 SUN YIP STREET CHAI WAN HONG KONG	**Job No.** **Quote No.** **Order No.** **Date Sampled** **Date Received**	: LAML01/061020/2 : QT-00441 : : : 20-OCT-2006
Attention	: WONG YAU TIM	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Brian Woodward	**Phone**	: (02) 94490151

Lab Reg No.	Sample Ref	Sample Description
NQ06/06621	SS6	SOIL GE/2005/047 JOB J469 SO22 (0.0-0.9M)
NQ06/06622	SS6	SOIL GE/2005/047 JOB J469 SO22 (0.9-1.6M)
NQ06/06623	SS8	SOIL GE/2005/047 JOB J469 SO22 (0.0-0.9M)

Lab Reg No.			**NQ06/06621**	**NQ06/06622**	**NQ06/06623**	
Sample Reference	**Units**	**LOR**	**SS6**	**SS6**	**SS8**	**Method**
Organochlorine (OC) Pesticides						
HCB	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor epoxide	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Aldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
gamma-BHC (Lindane)	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
delta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
trans-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
cis-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Oxychlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Dieldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDE	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDD	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDT	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Aldehyde	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Ketone	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endosulfan Sulfate	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Methoxychlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Surrogate						
Surrogate OC Rec.	%		62	63	70	NR_19
Dates						
Date extracted			24-OCT-2006	24-OCT-2006	24-OCT-2006	
Date analysed			26-OCT-2006	26-OCT-2006	26-OCT-2006	

REPORT OF ANALYSIS

Lab Reg No.			**NQ06/06621**	**NQ06/06622**	**NQ06/06623**	
Sample Reference	**Units**	**LOR**	**SS6**	**SS6**	**SS8**	**Method**

Danny Slee, Section Manager
Organics - NSW (Accreditation No. 198)

3-NOV-2006

Lab Reg No.			**NQ06/06621**	**NQ06/06622**	**NQ06/06623**	
Sample Reference	**Units**	**LOR**	**SS6**	**SS6**	**SS8**	**Method**
Trace Elements						
Total Solids	%		76.3	82.8	81.3	NT2_49

Dr. Honway Louie, Section Manager
Inorganics - NSW (Accreditation No. 198)

3-NOV-2006

REPORT OF ANALYSIS

Client	: LAM LABORATORIES LTD 1412 - 1416 HONOUR IND CENTRE 6 SUN YIP STREET CHAI WAN HONG KONG	**Job No.** **Quote No.** **Order No.** **Date Sampled** **Date Received**	: LAML01/061020/2 : QT-00441 : : : 20-OCT-2006
Attention	: WONG YAU TIM	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Brian Woodward	**Phone**	: (02) 94490151

Lab Reg No.	**Sample Ref**	**Sample Description**
NQ06/06624	SS8	SOIL GE/2005/047 JOB J469 SO22 (0.9-1.7M)
NQ06/06625	SS9	SOIL GE/2005/047 JOB J469 SO22 (0.0-0.9M)
NQ06/06626	SS9	SOIL GE/2005/047 JOB J469 SO22 (0.9-1.9M)

Lab Reg No.			**NQ06/06624**	**NQ06/06625**	**NQ06/06626**	
Sample Reference	**Units**	**LOR**	**SS8**	**SS9**	**SS9**	**Method**
Organochlorine (OC) Pesticides						
HCB	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor epoxide	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Aldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
gamma-BHC (Lindane)	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
delta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
trans-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
cis-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Oxychlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Dieldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDE	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDD	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDT	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Aldehyde	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Ketone	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endosulfan Sulfate	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Methoxychlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Surrogate						
Surrogate OC Rec.	%		100	65	62	NR_19
Dates						
Date extracted			24-OCT-2006	24-OCT-2006	24-OCT-2006	
Date analysed			26-OCT-2006	26-OCT-2006	26-OCT-2006	

REPORT OF ANALYSIS

Lab Reg No.	Units	LOR	NQ06/06624	NQ06/06625	NQ06/06626	Method
Sample Reference			SS8	SS9	SS9	

Danny Slee, Section Manager
Organics - NSW (Accreditation No. 198)

3-NOV-2006

Lab Reg No.	Units	LOR	NQ06/06624	NQ06/06625	NQ06/06626	Method
Sample Reference			SS8	SS9	SS9	
Trace Elements						
Total Solids	%		85.1	78.1	86.3	NT2_49

Dr. Honway Louie, Section Manager
Inorganics - NSW (Accreditation No. 198)

3-NOV-2006

All results are expressed on a dry weight basis.

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This report is issued in accordance with NATA's accreditation requirements.
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Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: LAM LABORATORIES LTD

NMI QA Report No: LAML01/061020/2 **Sample Matrix:** Soil

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		mg/kg	mg/kg	mg/kg	mg/kg	%	%	%
Organics Section								
OC Pesticides								
HCB	NR19	0.01	<0.01	NA	NA	NA	-	NA
Heptachlor	NR19	0.01	<0.01	NA	NA	NA	82	NA
Heptachlor epoxide	NR19	0.01	<0.01	NA	NA	NA	-	NA
Aldrin	NR19	0.01	<0.01	NA	NA	NA	108	NA
gamma-BHC (Lindane)	NR19	0.01	<0.01	NA	NA	NA	84	NA
alpha-BHC	NR19	0.01	<0.01	NA	NA	NA	-	NA
beta-BHC	NR19	0.01	<0.01	NA	NA	NA	-	NA
delta-BHC	NR19	0.01	<0.01	NA	NA	NA	-	NA
trans-Chlordane	NR19	0.01	<0.01	NA	NA	NA	-	NA
cis-Chlordane	NR19	0.01	<0.01	NA	NA	NA	-	NA
Oxychlordane	NR19	0.01	<0.01	NA	NA	NA	-	NA
Dieldrin	NR19	0.01	<0.01	NA	NA	NA	76	NA
pp-DDE	NR19	0.01	<0.01	NA	NA	NA	-	NA
pp-DDD	NR19	0.01	<0.01	NA	NA	NA	-	NA
pp-DDT	NR19	0.01	<0.01	NA	NA	NA	108	NA
Endrin	NR19	0.01	<0.01	NA	NA	NA	78	NA
Endrin Aldehyde	NR19	0.01	<0.01	NA	NA	NA	-	NA
Endrin Ketone	NR19	0.01	<0.01	NA	NA	NA	-	NA
alpha-Endosulfan	NR19	0.01	<0.01	NA	NA	NA	-	NA
beta-Endosulfan	NR19	0.01	<0.01	NA	NA	NA	-	NA
Endosulfan Sulfate	NR19	0.01	<0.01	NA	NA	NA	-	NA
Methoxychlor	NR19	0.01	<0.01	NA	NA	NA	-	NA
Surrogate OC Rec.	NR19	-	-	NA	NA	NA	96	NA

Results expressed in percentage (%) or mg/kg wherever appropriate.
Acceptable Spike recovery is 50-150%
Acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.
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Signed: For **Danny Slee**
Organics Manager, NMI-Pymble

Date: **3/11/2006**

REPORT OF ANALYSIS

Page: 1 of 8

Report No. RN583051

Client	: LAM LABORATORIES LTD 1412 - 1416 HONOUR IND CENTRE 6 SUN YIP STREET CHAI WAN HONG KONG	**Job No.** **Quote No.** **Order No.** **Date Sampled** **Date Received**	: LAML01/061031 : QT-00441 : : : 31-OCT-2006
Attention	: WONG YAU TIM	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Brian Woodward	**Phone**	: (02) 94490151

Lab Reg No.	**Sample Ref**	**Sample Description**
NQ06/06882	SS1	SOIL GE/2005/047 JOB J469 SO22 0.2-0.9M
NQ06/06883	SS1	SOIL GE/2005/047 JOB J469 SO22 0.9-1.2M
NQ06/06884	SS2	SOIL GE/2005/047 JOB J469 SO22 0.5-0.9M

Lab Reg No.			**NQ06/06882**	**NQ06/06883**	**NQ06/06884**	
Sample Reference	**Units**	**LOR**	**SS1**	**SS1**	**SS2**	**Method**
Organochlorine (OC) Pesticides						
HCB	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor epoxide	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Aldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
gamma-BHC (Lindane)	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
delta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
trans-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
cis-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Oxychlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Dieldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDE	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDD	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDT	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Aldehyde	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Ketone	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endosulfan Sulfate	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Methoxychlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Surrogate						
Surrogate OC Rec.	%		90	82	83	NR_19
Dates						
Date extracted			31-OCT-2006	31-OCT-2006	31-OCT-2006	
Date analysed			1-NOV-2006	1-NOV-2006	1-NOV-2006	

REPORT OF ANALYSIS

Lab Reg No.	Units	LOR	NQ06/06882	NQ06/06883	NQ06/06884	Method
Sample Reference			SS1	SS1	SS2	

Danny Slee, Section Manager
Organics - NSW (Accreditation No. 198)

16-NOV-2006

Lab Reg No.	Units	LOR	NQ06/06882	NQ06/06883	NQ06/06884	Method
Sample Reference			SS1	SS1	SS2	
Trace Elements						
Total Solids	%		83.4	84.0	82.6	NT2_49

Dr. Honway Louie, Section Manager
Inorganics - NSW (Accreditation No. 198)

16-NOV-2006

REPORT OF ANALYSIS

Report No. RN583051

Client	: LAM LABORATORIES LTD 1412 - 1416 HONOUR IND CENTRE 6 SUN YIP STREET CHAI WAN HONG KONG	**Job No.**	: LAML01/061031
		Quote No.	: QT-00441
		Order No.	:
		Date Sampled	:
		Date Received	: 31-OCT-2006
Attention	: WONG YAU TIM	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Brian Woodward	**Phone**	: (02) 94490151

Lab Reg No.	Sample Ref	Sample Description
NQ06/06885	SS2	SOIL GE/2005/047 JOB J469 SO22 0.9-1.9M
NQ06/06886	SS2	SOIL GE/2005/047 JOB J469 SO22 1.9-2.5M
NQ06/06887	SS4	SOIL GE/2005/047 JOB J469 SO22 0.0-0.9M

Lab Reg No.			NQ06/06885	NQ06/06886	NQ06/06887	
Sample Reference	Units	LOR	SS2	SS2	SS4	Method
Organochlorine (OC) Pesticides						
HCB	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor epoxide	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Aldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
gamma-BHC (Lindane)	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
delta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
trans-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
cis-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Oxychlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Dieldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDE	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDD	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDT	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Aldehyde	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Ketone	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endosulfan Sulfate	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Methoxychlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Surrogate						
Surrogate OC Rec.	%		91	87	86	NR_19
Dates						
Date extracted			31-OCT-2006	31-OCT-2006	31-OCT-2006	
Date analysed			1-NOV-2006	1-NOV-2006	1-NOV-2006	

REPORT OF ANALYSIS

Lab Reg No.			NQ06/06885	NQ06/06886	NQ06/06887	
Sample Reference	Units	LOR	SS2	SS2	SS4	Method

Danny Slee, Section Manager
Organics - NSW (Accreditation No. 198)

16-NOV-2006

Lab Reg No.			NQ06/06885	NQ06/06886	NQ06/06887	
Sample Reference	Units	LOR	SS2	SS2	SS4	Method
Trace Elements						
Total Solids	%		83.3	84.8	80.0	NT2_49

Dr. Honway Louie, Section Manager
Inorganics - NSW (Accreditation No. 198)

16-NOV-2006

REPORT OF ANALYSIS

Client : LAM LABORATORIES LTD
1412 - 1416 HONOUR IND CENTRE
6 SUN YIP STREET
CHAI WAN
HONG KONG
Attention : WONG YAU TIM
Project Name :
Your Client Services Manager : Brian Woodward

Job No. : LAML01/061031
Quote No. : QT-00441
Order No. :
Date Sampled :
Date Received : 31-OCT-2006
Sampled By : CLIENT
Phone : (02) 94490151

Lab Reg No.	Sample Ref	Sample Description
NQ06/06888	SS4	SOIL GE/2005/047 JOB J469 SO22 0.9-1.3M
NQ06/06889	SS5	SOIL GE/2005/047 JOB J469 SO22 0.0-0.9M
NQ06/06890	SS7	SOIL GE/2005/047 JOB J469 SO22 0.0-0.9M

Lab Reg No.			NQ06/06888	NQ06/06889	NQ06/06890	
Sample Reference	**Units**	**LOR**	**SS4**	**SS5**	**SS7**	**Method**
Organochlorine (OC) Pesticides						
HCB	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor epoxide	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Aldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
gamma-BHC (Lindane)	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
delta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
trans-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
cis-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Oxychlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Dieldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDE	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDD	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDT	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Aldehyde	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Ketone	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endosulfan Sulfate	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Methoxychlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Surrogate						
Surrogate OC Rec.	%		89	91	88	NR_19
Dates						
Date extracted			31-OCT-2006	31-OCT-2006	31-OCT-2006	
Date analysed			1-NOV-2006	1-NOV-2006	1-NOV-2006	

REPORT OF ANALYSIS

Lab Reg No.			NQ06/06888	NQ06/06889	NQ06/06890	
Sample Reference	Units	LOR	SS4	SS5	SS7	Method

Danny Slee, Section Manager
Organics - NSW (Accreditation No. 198)

16-NOV-2006

Lab Reg No.			NQ06/06888	NQ06/06889	NQ06/06890	
Sample Reference	Units	LOR	SS4	SS5	SS7	Method
Trace Elements						
Total Solids	%		82.7	82.2	82.2	NT2_49

Dr. Honway Louie, Section Manager
Inorganics - NSW (Accreditation No. 198)

16-NOV-2006

REPORT OF ANALYSIS

Client	: LAM LABORATORIES LTD 1412 - 1416 HONOUR IND CENTRE 6 SUN YIP STREET CHAI WAN HONG KONG	**Job No.** **Quote No.** **Order No.** **Date Sampled** **Date Received**	: LAML01/061031 : QT-00441 : : : 31-OCT-2006
Attention	: WONG YAU TIM	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Brian Woodward	**Phone**	: (02) 94490151

Lab Reg No.	**Sample Ref**	**Sample Description**
NQ06/06891	SS7	SOIL GE/2005/047 JOB J469 SO22 0.9-1.3M
NQ06/06892	SS9	SOIL GE/2005/047 JOB J469 SO22 1.9-2.1M
NQ06/06893	.	SOIL REFERENCE GRAB SAMPLE GE/2005/047 JOB J469 SO22

Lab Reg No.			**NQ06/06891**	**NQ06/06892**	**NQ06/06893**	
Sample Reference	**Units**	**LOR**	**SS7**	**SS9**	**.**	**Method**
Organochlorine (OC) Pesticides						
HCB	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Heptachlor epoxide	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Aldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
gamma-BHC (Lindane)	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
delta-BHC	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
trans-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
cis-Chlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Oxychlordane	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Dieldrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDE	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDD	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
pp-DDT	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Aldehyde	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endrin Ketone	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
alpha-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
beta-Endosulfan	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Endosulfan Sulfate	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Methoxychlor	mg/kg	0.01	<0.01	<0.01	<0.01	NR_19
Surrogate						
Surrogate OC Rec.	%		90	95	95	NR_19
Dates						
Date extracted			31-OCT-2006	31-OCT-2006	31-OCT-2006	
Date analysed			1-NOV-2006	1-NOV-2006	1-NOV-2006	

REPORT OF ANALYSIS

Lab Reg No.			NQ06/06891	NQ06/06892	NQ06/06893	
Sample Reference	Units	LOR	SS7	SS9	.	Method

Danny Slee, Section Manager
Organics - NSW (Accreditation No. 198)

16-NOV-2006

Lab Reg No.			NQ06/06891	NQ06/06892	NQ06/06893	
Sample Reference	Units	LOR	SS7	SS9	.	Method
Trace Elements						
Total Solids	%		82.2	84.7	44.1	NT2_49

Dr. Honway Louie, Section Manager
Inorganics - NSW (Accreditation No. 198)

16-NOV-2006

All results are expressed on a dry weight basis.

This Report supersedes reports: *RN581353* *RN581379*

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: LAM LABORATORIES LTD

NMI QA Report No: LAML01/061031 **Sample Matrix:** Soil

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		mg/kg	mg/kg	mg/kg	mg/kg	%	%	%
Organics Section								
OC Pesticides				**NQ06/06884**				**Blank Soil**
HCB	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
Heptachlor	NR19	0.01	<0.01	<0.01	<0.01	-	96	115
Heptachlor epoxide	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
Aldrin	NR19	0.01	<0.01	<0.01	<0.01	-	114	127
gamma-BHC (Lindane)	NR19	0.01	<0.01	<0.01	<0.01	-	96	111
alpha-BHC	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
beta-BHC	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
delta-BHC	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
trans-Chlordane	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
cis-Chlordane	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
Oxychlordane	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
Dieldrin	NR19	0.01	<0.01	<0.01	<0.01	-	104	121
pp-DDE	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
pp-DDD	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
pp-DDT	NR19	0.01	<0.01	<0.01	<0.01	-	116	112
Endrin	NR19	0.01	<0.01	<0.01	<0.01	-	117	129
Endrin Aldehyde	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
Endrin Ketone	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
alpha-Endosulfan	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
beta-Endosulfan	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
Endosulfan Sulfate	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
Methoxychlor	NR19	0.01	<0.01	<0.01	<0.01	-	-	-
Surrogate OC Rec.	NR19	-	-	85	83	2.4	94	102

Results expressed in percentage (%) or mg/kg wherever appropriate.
Acceptable Spike recovery is 50-150%
Acceptable RPDs on spikes and duplicates is 40%.
RPD= Relative Percentage Difference.
This report shall not be reproduced except in full.

Signed:

For **Danny Slee**
Organics Manager, NMI-Pymble

Date: **7/11/2006**

Particle Size

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101698N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments–
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18232/3

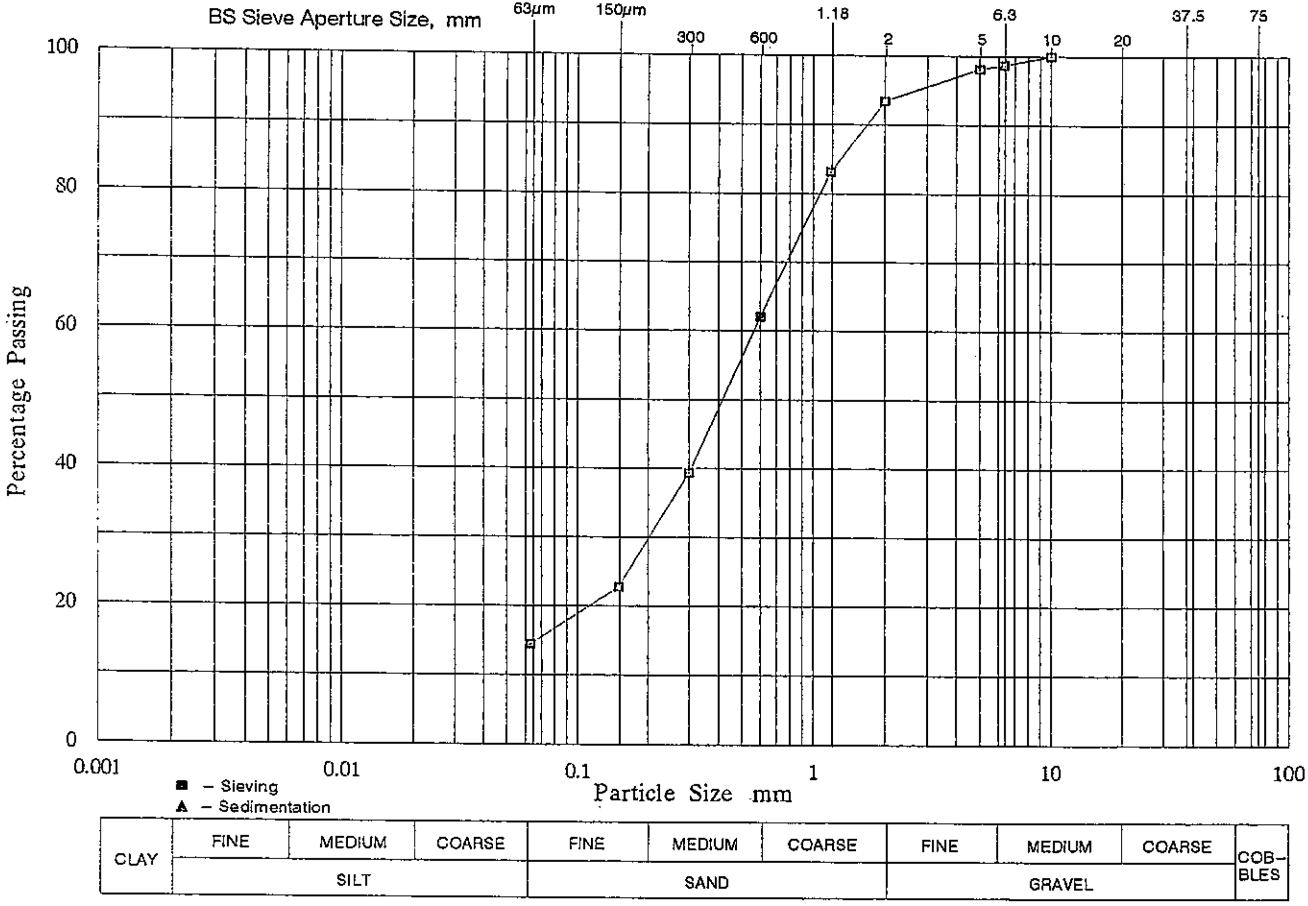
Client Ref. : SS6 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, gravelly, clayey, silty SAND with occasional shell fragments

Date Sample Received: 13/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	7 %
SAND	79 %
SILT & CLAY	14 %

Approved Signatory: Lo Kam chuen

Lo Kam–chuen

Date: 6-11-2006

Lam Laboratories Limited Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong Tel: 28973282

TEST\GEO36\PSDA (19970811)

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101698N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

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Client Ref. : SS6 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, gravelly, clayey, silty SAND with occasional shell fragments

Date Sample Received: 13/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 118.75

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	118.75	*cum. mass ret. + m2 =*		*118.75*
Riffled m3 20.0	118.75	*difference from m1 % =*		*0.00*
Washed m4	101.65	Note: m4 = mass >63um		
10.0		0.00	0.0	100.0
6.3	1.59	1.59	1.3	98.7
Passing m5 6.3	100.06	*cum. mass ret. + m5 =*		*101.65*
Riffled m6 6.3	100.06	*difference from m4 % =*		*0.00*
5.00	0.60	0.60	0.5	98.2
2.00	5.65	5.65	4.8	93.4
1.18	12.11	12.11	10.2	83.2
0.600	25.10	25.10	21.1	62.1
0.300	26.98	26.98	22.7	39.3
0.150	19.65	19.65	16.5	22.8
0.063	9.65	9.65	8.1	14.5
Pan mE	0.07			
		cum. mass ret. + mE =		*99.81*
		difference from m6 % =		*0.25*

Approved Signatory: Lo Kam chuen
Lo Kam – chuen

Date: 6-11-2006

TEST\GEO36\PSDA (19970811)

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101699N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments– Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18232/4

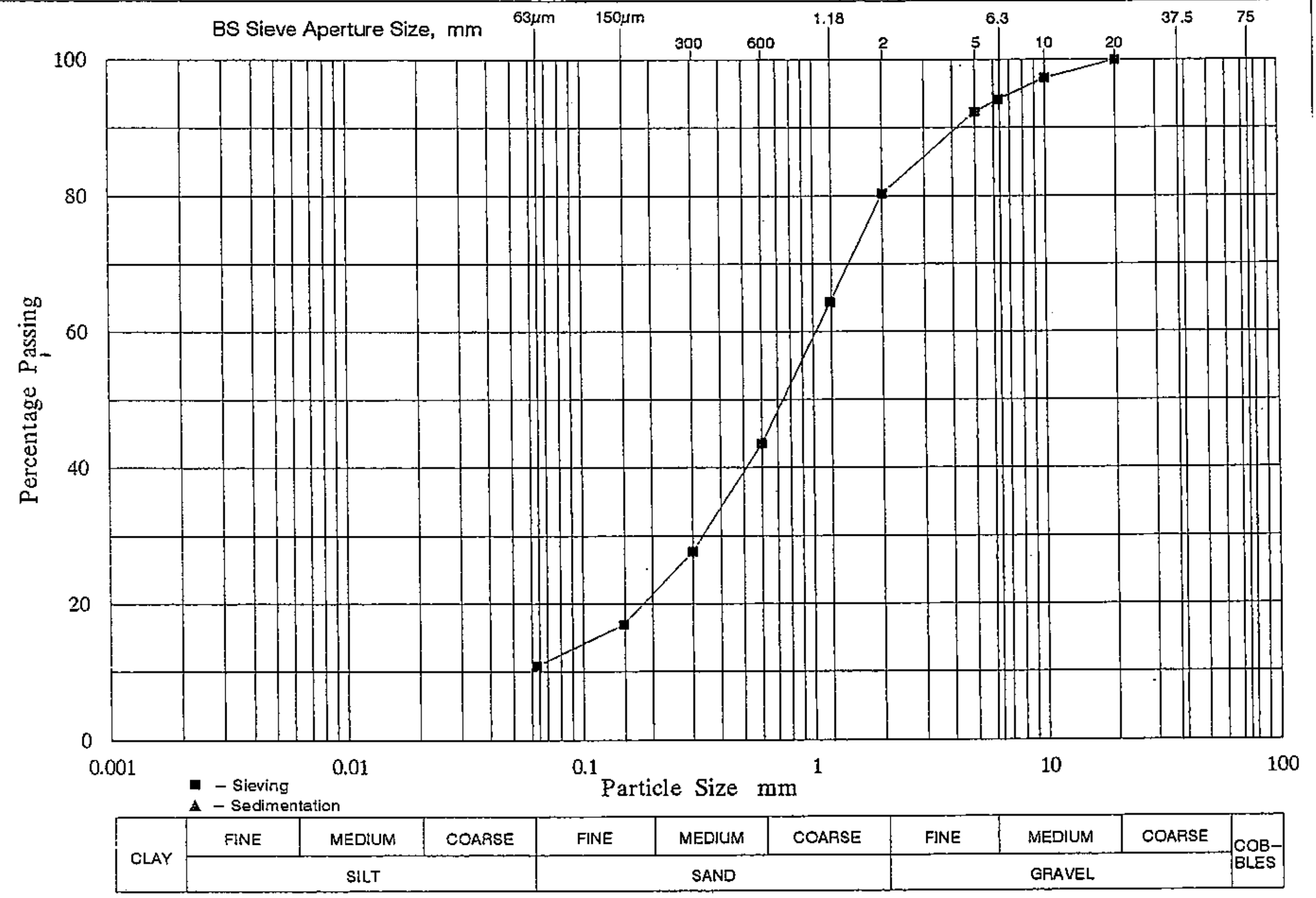
Client Ref. : SS6 **Sample No:** **Depth m:** 0.90 – 1.60 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, clayey, silty, gravelly SAND with occasional shell fragments

Date Sample Received: 13/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	20 %
SAND	69 %
SILT & CLAY	11 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6–11–2006

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101699N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18232/4

Client Ref. : SS6 **Sample No:** **Depth m:** 0.90 – 1.60 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, clayey, silty, gravelly SAND with occasional shell fragments

Date Sample Received: 13/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 153.54

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	153.54	*cum. mass ret. + m2 =*		*153.54*
Riffled m3 20.0	153.54	*difference from m1 % =*		*0.00*
Washed m4	137.02	Note: m4 = mass >63um		
10.0	4.12	4.12	2.7	97.3
6.3	4.77	4.77	3.1	94.2
Passing m5 6.3	128.13	*cum. mass ret. + m5 =*		*137.02*
Riffled m6 6.3	128.13	*difference from m4 % =*		*0.00*
5.00	2.90	2.90	1.9	92.3
2.00	18.48	18.48	12.0	80.3
1.18	24.50	24.50	16.0	64.3
0.600	31.97	31.97	20.8	43.5
0.300	24.32	24.32	15.8	27.7
0.150	16.43	16.43	10.7	17.0
0.063	9.23	9.23	6.0	10.8
Pan mE	0.09			
		cum. mass ret. + mE =		*127.92*
		difference from m6 % =		*0.16*

Approved Signatory: Lo Kam chuen
Lo Kam-chuen

Date: 6-11-2006

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101700N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18232/7

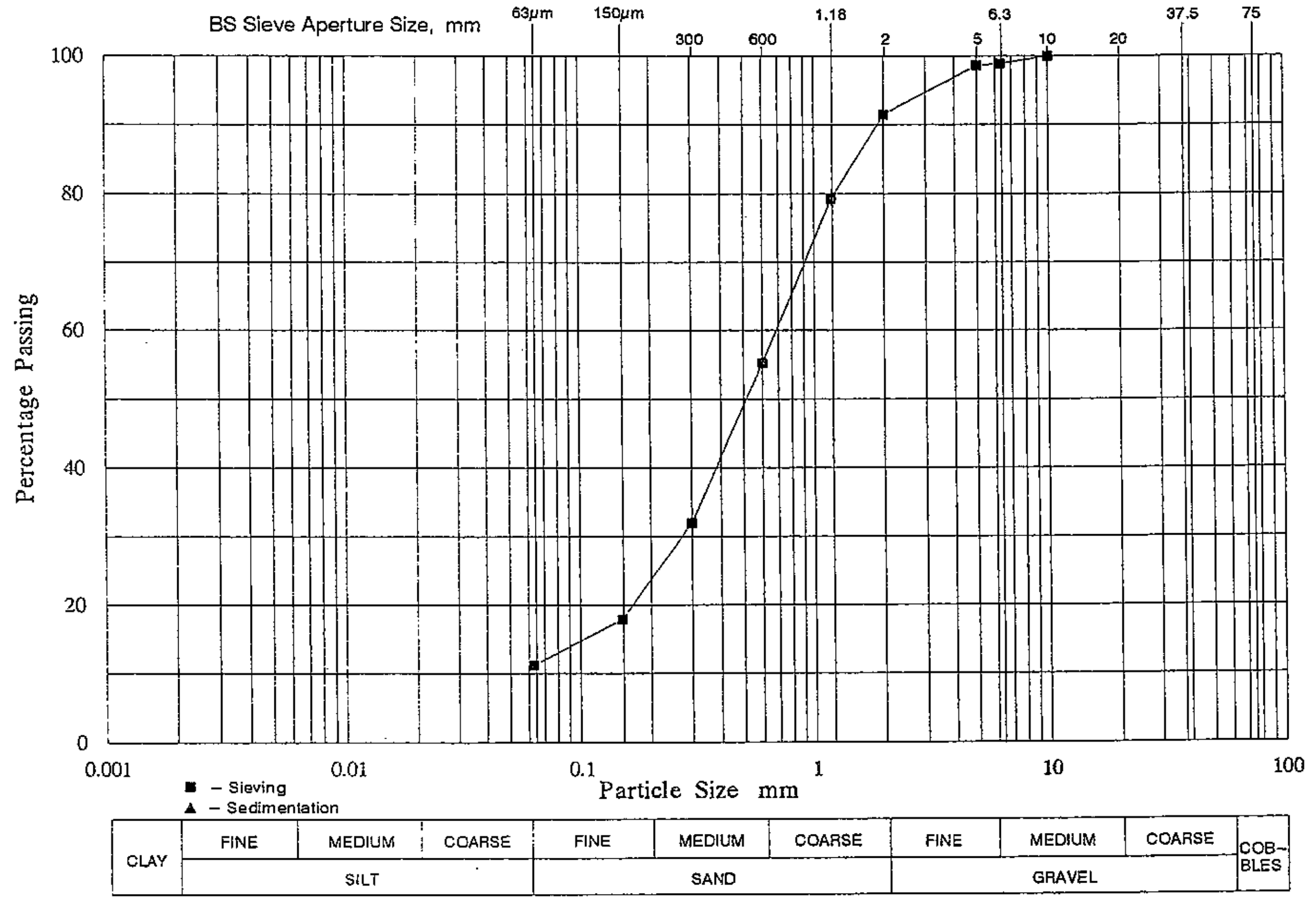
Client Ref. : SS3 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, gravelly, clayey, silty SAND with occasional shell fragments

Date Sample Received: 13/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	8 %
SAND	81 %
SILT & CLAY	11 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101700N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments–
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18232/7

Client Ref. : SS3 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, gravelly, clayey, silty SAND with occasional shell fragments

Date Sample Received: 13/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 155.40

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	155.40	*cum. mass ret. + m2 =*		*155.40*
Riffled m3 20.0	155.40	*difference from m1 % =*		*0.00*
Washed m4	138.07	Note: m4 = mass >63um		
10.0		0.00	0.0	100.0
6.3	1.69	1.69	1.1	98.9
Passing m5 6.3	136.38	*cum. mass ret. + m5 =*		*138.07*
Riffled m6 6.3	136.38	*difference from m4 % =*		*0.00*
5.00	0.45	0.45	0.3	98.6
2.00	11.01	11.01	7.1	91.5
1.18	19.13	19.13	12.3	79.2
0.600	37.29	37.29	24.0	55.2
0.300	36.16	36.16	23.3	32.0
0.150	21.85	21.85	14.1	17.9
0.063	10.23	10.23	6.6	11.2
Pan mE	0.13			
		cum. mass ret. + mE =		*136.25*
		difference from m6 % =		*0.10*

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

Quality Control - Laboratory Duplicate (DUP) Results

Matrix Type: SOIL

				Duplicate (DUP) Results				
Laboratory Sample ID	*Client Sample ID*	*Method: Analysis Description*	*CAS number*	*LOR*	*Units*	*Original Result*	*Duplicate Result*	*RPD (%)*
EP: Aggregate Organics (QC Lot: 321857)								
HK0607412-002	18507/2	EP009: Total Organic Carbon	----	0.05	%	<0.05	<0.05	0.0

Quality Control - Method Blank (MB), Single Control Spike (SCS) and Duplicate Control Spike (DCS) Results

Matrix Type: SOIL

		Method Blank (MB) Results			Single Control Spike (SCS) and Duplicate Control Spike (DCS) Results						
					Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Method: Analysis Description	*CAS number*	*LOR*	*Units*	*Result*	*Concentration*	*SCS*	*DCS*	*Low*	*High*	*Value*	*Control Limit*
EP: Aggregate Organics (QCLot: 321857)											
EP009: Total Organic Carbon	----	0.05	%	<0.05	40 %	98.0	----	85	115	----	----

Quality Control - Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Results

Matrix Type: SOIL

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Results						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory Sample ID	*Client Sample ID*	*Method: Analysis Description*	*CAS number*	*Concentration*	*MS*	*MSD*	*Low*	*High*	*Value*	*Control Li*
EP: Aggregate Organics (QCLot: 321857)										
HK0607412-001	18507/1	EP009: Total Organic Carbon	----	40 %	87.6	----	75	125	----	----

Analytical Results

Submatrix: SOIL

Client Sample ID :				18507/1	18507/2	18507/3	18507/4
Laboratory Sample ID :				HK0607412-001	HK0607412-002	HK0607412-003	HK0607412-004
Sample Date / Time :				[6 Dec 2006]	[6 Dec 2006]	[6 Dec 2006]	[6 Dec 2006]
Method: Analysis Description	*CAS number*	*LOR*	*Units*				
EP: Aggregate Organics							
EP009: Total Organic Carbon	----	0.05	%	<0.05	<0.05	<0.05	**0.37**

ALS Technichem (HK) Pty Ltd

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

CERTIFICATE OF ANALYSIS

Client	: LAM LABORATORIES LIMITED	*Laboratory*	: ALS Technichem (HK) Pty Ltd	*Page*	: 1 of 3
Contact	: MS MAUREEN CHANG	*Contact*	: Alice Wong / Ivan Leung	*Work Order*	: **HK0607412**
Address	: RM 1412-16, HONOUR INDUSTRIAL CENTRE, 6 SUN YIP STREET, CHAI WAN, HONG KONG	*Address*	: 11/F., Chung Shun Knitting Centre, 1 - 3 Wing Yip Street, Kwai Chung, N.T., Hong Kong		
E-mail	: maureenchang@lamlab.com	*E-mail*	: alice.wong@alsenviro.com		
Telephone	: +852 2975 3372	*Telephone*	: +852 2610 1044		
Facsimile	: +852 2897 5509	*Facsimile*	: +852 2610 2021		
Project	: J469 SO22	*Quote number*	: ----	*Date received*	: 6 Dec 2006
Order number	: ----			*Date of issue*	: 12 Dec 2006
C-O-C number	: ----			*No. of samples*	- *Received* : 4
Site	: ----				*Analysed* : 4

Report Comments

This report for ALS Technichem (HK) Py Ltd work order reference HK0607412 supersedes any previous reports with this reference. The completion date of analysis is 11 Dec 2006. Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number. LOR = Limit of reporting.

Specific comments for Work Order HK0607412 : **Sample(s) analysed and reported on an as received basis.**
Samples were received in an ambient condition.

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the 'Electronic Transactions Ordinance' o Hong Kong, Chapter 553, Section 6.

Signatory	*Position*	*Authorised results for:-*
Fung Lim Chee, Richard	**General Manager**	**Inorganics**

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 102239N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/4

Composite Sample No. : Reference Sediment **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Grey, slightly sandy CLAY with occasional shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 102.72

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	102.72	*cum. mass ret. + m2 =*		*102.72*
Riffled m3 20.0	102.72	*difference from m1 % =*		*0.00*
Washed m4	10.58	Note: m4 = mass >63um		
10.0		0.00	0.0	100.0
6.3		0.00	0.0	100.0
Passing m5 6.3	10.58	*cum. mass ret. + m5 =*		*10.58*
Riffled m6 6.3	10.58	*difference from m4 % =*		*0.00*
5.00		0.00	0.0	100.0
2.00	0.10	0.10	0.1	99.9
1.18	0.18	0.18	0.2	99.7
0.600	0.73	0.73	0.7	99.0
0.300	1.59	1.59	1.5	97.5
0.150	2.59	2.59	2.5	94.9
0.063	5.32	5.32	5.2	89.7
Pan mE	0.03			
		cum. mass ret. + mE =		*10.54*
		difference from m6 % =		*0.38*

Approved Signatory: Lo Kam-chuen
Lo Kam-chuen

Date: 11-1-2007

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 102239N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Client Name & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/4

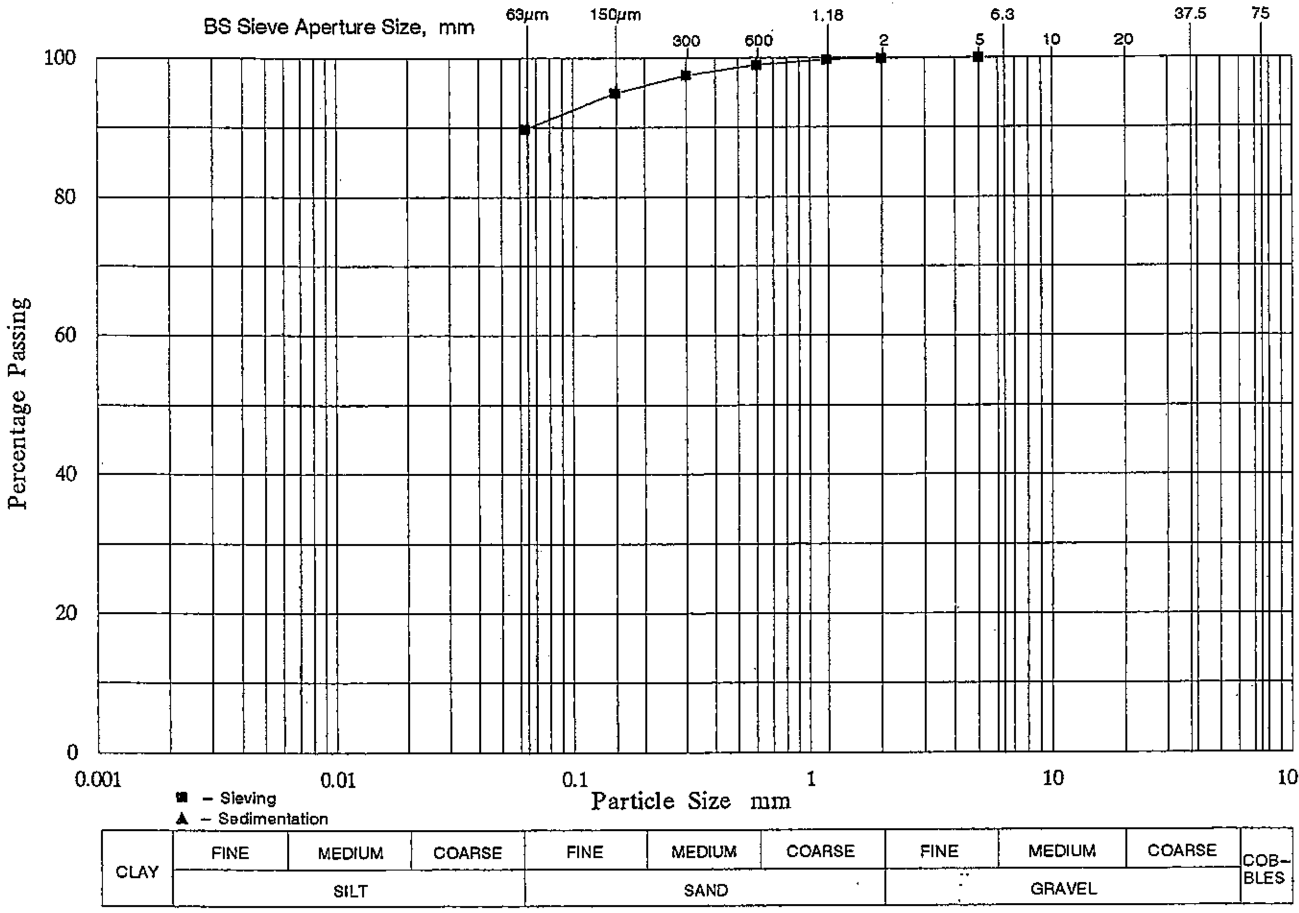
Composite Sample No. : Reference Sediment **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Grey, slightly sandy CLAY with occasional shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	0 %
SAND	10 %
SILT & CLAY	90 %

Approved Signatory: Lo Kam-chuen

Lo Kam-chuen

Date: 11-1-2007

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 102238N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/3

Composite Sample No. : CS3 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Yellowish brown, silty, clayey, very gravelly SAND

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 201.53

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	201.53	*cum. mass ret. + m2 =*		*201.53*
Riffled m3 20.0	201.53	*difference from m1 % =*		*0.00*
Washed m4	156.62	Note: m4 = mass >63um		
10.0	14.27	14.27	7.1	92.9
6.3	10.13	10.13	5.0	87.9
Passing m5 6.3	132.22	*cum. mass ret. + m5 =*		*156.62*
Riffled m6 6.3	132.22	*difference from m4 % =*		*0.00*
5.00	4.20	4.20	2.1	85.8
2.00	21.38	21.38	10.6	75.2
1.18	30.18	30.18	15.0	60.2
0.600	37.20	37.20	18.5	41.8
0.300	24.50	24.50	12.2	29.6
0.150	10.01	10.01	5.0	24.6
0.063	4.62	4.62	2.3	22.3
Pan mE	0.01			
		cum. mass ret. + mE =		*132.10*
		difference from m6 % =		*0.09*

Approved Signatory: Lo Kam chuen
Lo Kam-chuen

Date: 11-1-2007

TEST|GEO36|PSDA (19970811)

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 102238N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Client Name & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/3

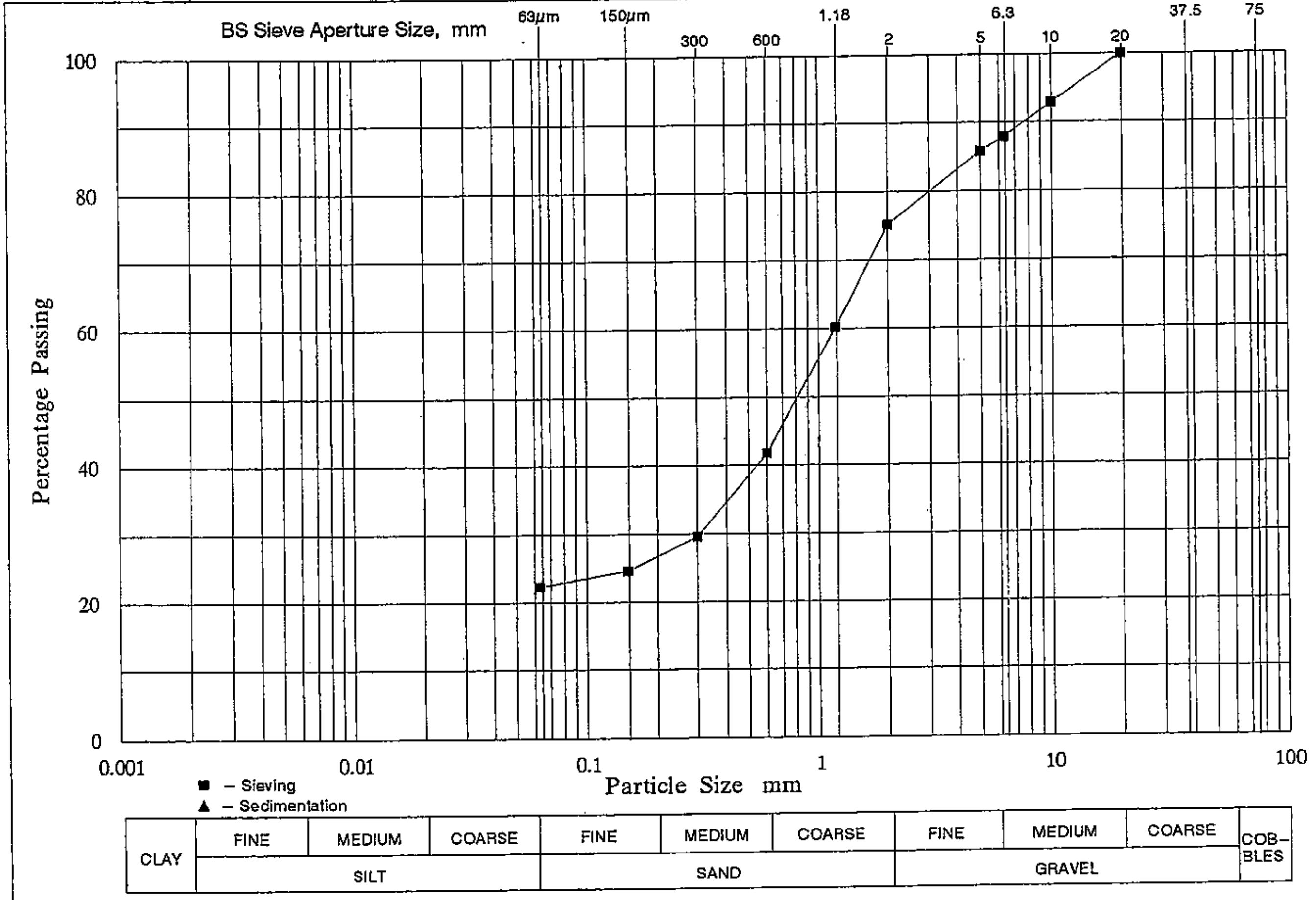
Composite Sample No. : CS3 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Yellowish brown, silty, clayey, very gravelly SAND

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	25 %
SAND	53 %
SILT & CLAY	22 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 112237N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/2

Composite Sample No. : CS2 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Brown, silty, very gravelly SAND with some shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 201.70

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	201.70	*cum. mass ret. + m2 =*		*201.70*
Riffled m3 20.0	201.70	*difference from m1 % =*		*0.00*
Washed m4	191.11	Note: m4 = mass >63um		
10.0	19.84	19.84	9.8	90.2
6.3	34.04	34.04	16.9	73.3
Passing m5 6.3	137.23	*cum. mass ret. + m5 =*		*191.11*
Riffled m6 6.3	137.23	*difference from m4 % =*		*0.00*
5.00	7.31	7.31	3.6	69.7
2.00	39.15	39.15	19.4	50.3
1.18	38.58	38.58	19.1	31.1
0.600	26.17	26.17	13.0	18.2
0.300	16.07	16.07	8.0	10.2
0.150	6.50	6.50	3.2	7.0
0.063	2.40	2.40	1.2	5.3
Pan mE	0.10			
		cum. mass ret. + mE =		*136.28*
		difference from m6 % =		*0.69*

Approved Signatory: Lo Kam Chuen
Lo Kam–chuen

Date: 11-1-2007

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 112237N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Client Name & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/2

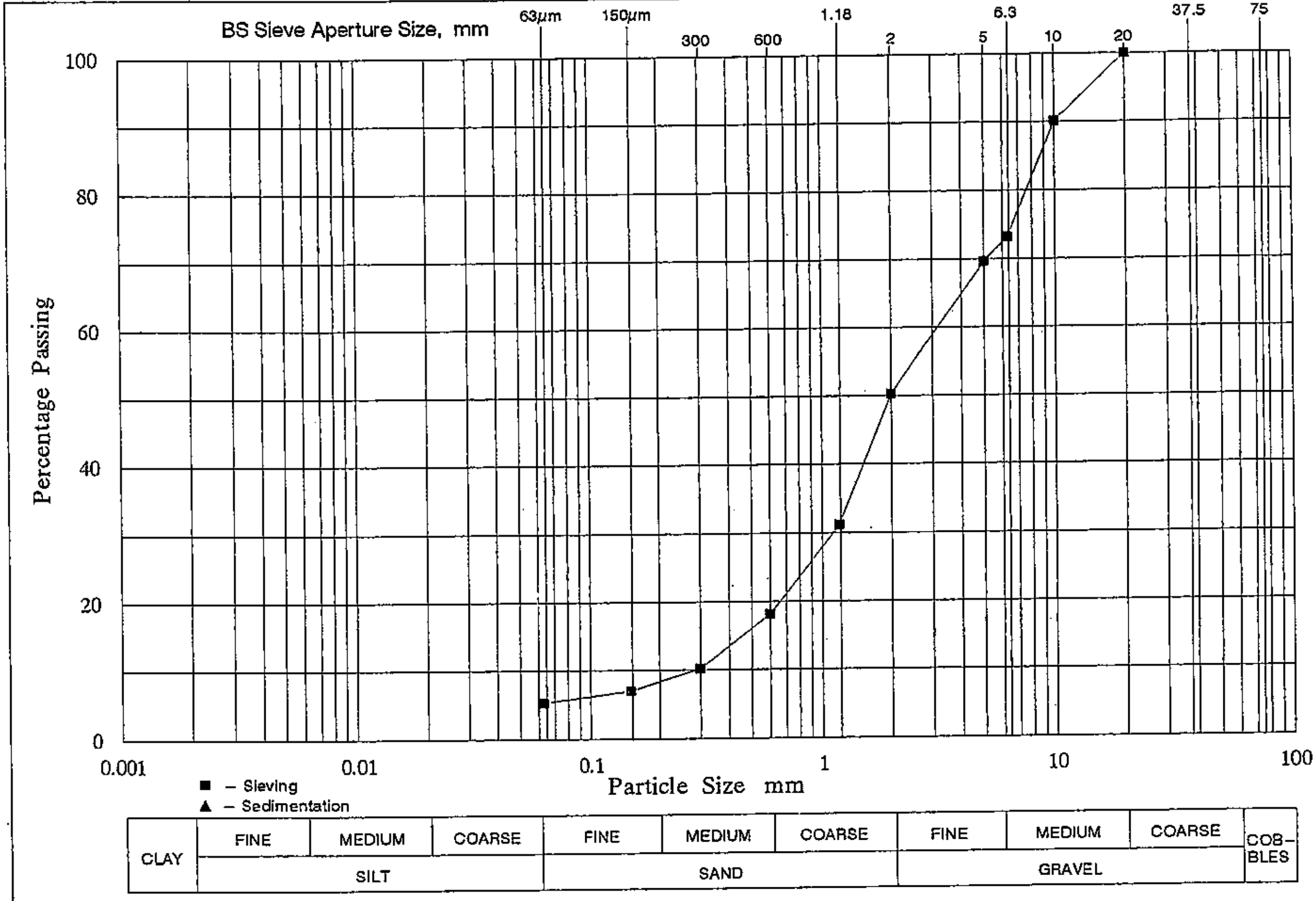
Composite Sample No. : CS2 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Brown, silty, very gravelly SAND with some shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :	GRAVEL	50 %
	SAND	45 %
	SILT & CLAY	5 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

Lam Laboratories Limited Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong Tel: 28973282

TEST\GEO36\PSDA (19970811)

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 102236N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/1

Composite Sample No. : CS1 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Brown, slightly silty, very gravelly SAND with some shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 202.90

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	202.90	*cum. mass ret. + m2 =*		*202.90*
Riffled m3 20.0	202.90	*difference from m1 % =*		*0.00*
Washed m4	194.57	Note: m4 = mass >63um		
10.0	20.07	20.07	9.9	90.1
6.3	37.21	37.21	18.3	71.8
Passing m5 6.3	137.29	*cum. mass ret. + m5 =*		*194.57*
Riffled m6 6.3	137.29	*difference from m4 % =*		*0.00*
5.00	10.73	10.73	5.3	66.5
2.00	39.00	39.00	19.2	47.3
1.18	30.79	30.79	15.2	32.1
0.600	27.19	27.19	13.4	18.7
0.300	18.53	18.53	9.1	9.6
0.150	8.30	8.30	4.1	5.5
0.063	2.58	2.58	1.3	4.1
Pan mE	0.03			
		cum. mass ret. + mE =		*137.15*
		difference from m6 % =		*0.10*

Approved Signatory: Lo Kam Chuen
Lo Kam–chuen

Date: 11-1-2007

TEST\GEO36\PSDA (19970811)

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 102236N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Client Name & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/1

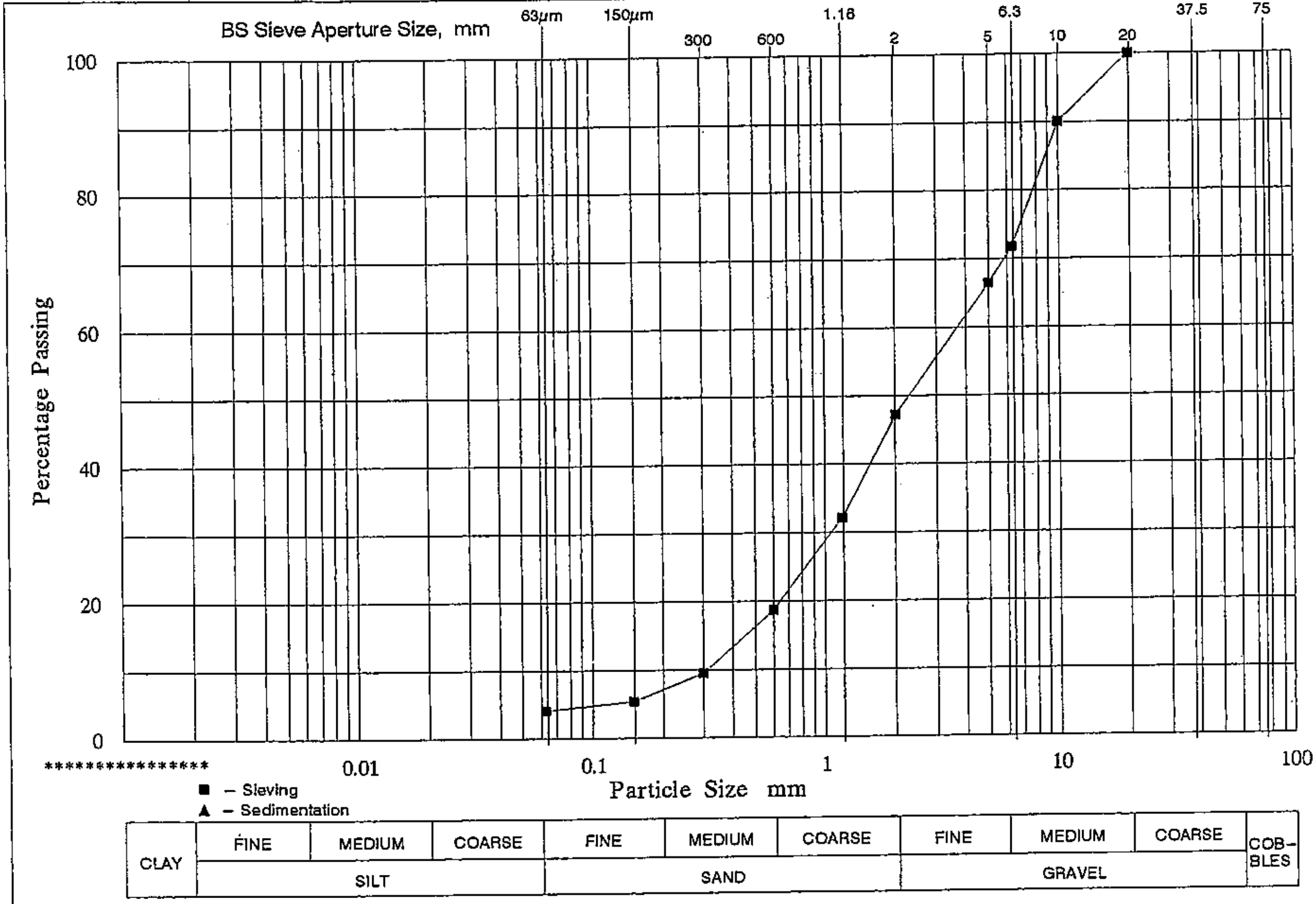
Composite Sample No. : CS1 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Brown, slightly silty, very gravelly SAND with some shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :	GRAVEL	53 %
	SAND	43 %
	SILT & CLAY	4 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

Lam Laboratories Limited Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong Tel: 28973282

TEST\GEO36\PSDA (19970811)

TEST REPORT ON
DETERMINATION OF MOISTURE CONTENT
(By oven drying at 105°C ± 5°C)

Report No: 102235N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No** : GE/2005/47.22

Date Samples Received : 29/11/2006

Tested in Accordance With : GEOSPEC 3: 2001 Test 5.2

Composite Sample No.	Sample				Lab. Sample Ref. No.	Date Tested	Tested By	Description	Geological Origin	Moistur Conter %
	No.	Depth m	Type	Specimen Depth m						
CS1			Bulk		18507/1	4/12/06	HWC	Brown, slightly silty, very gravelly SAND with some shell fragments	Sediment	1
CS2			Bulk		18507/2	4/12/06	HWC	Brown, silty, very gravelly SAND with some shell fragments	Sediment	1
CS3			Bulk		18507/3	4/12/06	HWC	Yellowish brown, silty, clayey, very gravelly SAND	Sediment	1
Reference Sediment			Bulk		18507/4	4/12/06	HWC	Grey, slightly sandy CLAY with occasional shell fragments	Sediment	11

Remarks:

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

Test report

Report No.	:	102245N
Project Name	:	Agreement No. EP 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation
Customer Name	:	Geotechnical Projects Division, Geotechnical Engineering Office, Civil Engineering and Development Department
Contract No.	:	GE/2005/47
Works Order No.	:	GE/2005/47.22
Lab. Sample Ref. No.	:	18507/1-4

Sample ID	Grain Size < 63 mm (%)	Moisture Content [1] (%)	TOC (% Wet Weight)	TOC (% Dry Weight) [2]
Composite Sample No. CS1	4	12	<0.05	<0.1
Composite Sample No. CS2	5	10	<0.05	<0.1
Composite Sample No. CS3	22	12	<0.05	<0.1
Reference sediment	90	116	0.37	0.80
Detection Limit	NA	NA	0.05	0.1

Note 1. Moisture content is calculated as: (Sample Wet Weight – Sample Dry Weight) / Sample Dry Weight x 100%

End of Report

Data entry checked by: ~~W. K. Cheuk~~ / Y.M.Choy

TEST REPORT

Report No. : 102245N
Project Name : Agreement No. EP 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation

Customer Name : Geotechnical Projects Division, Geotechnical Engineering Office, Civil Engineering and Development Department
Customer Address : 8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong
Contract No. : GE/2005/47
Works Order No. : GE/2005/47.22

Lab. Job No. : J469
Lab. Sample Ref. No. : 18507/1-4
No. of Sample(s) & Description : 9 no. of samples were received on chilled condition. The samples are said to be sediment, however contain large amount of sand and stone. 4 no. of samples were tested including Composite Sample No. CS1-CS3[4] and Reference Sediment prepared as per customer's instruction
Sample Receive Date : 14 - 24 Oct, 2006
Test Date : 6 Dec 2006 - 11 Jan 2007

Test Parameter

Parameter	Test Method
Grain size	Geospec 3: Test 8.1
Moisture content	Geospec 3: Test 5.2
Total Organic Carbon	ALS Method Code EP-009

Note(s):
1. Results related to sample(s) as received.
2. NA = Not applicable.
3. The TOC samples were subcontracted to ALS Technichem (HK) Pty Ltd.
4. The composite samples were mixed in unequal portion due to the stony nature of the samples.
5. This is the final report and supersedes the draft report with the same report number.

Authorized signatory: ______________________
Yi Zhang
(Ecotoxicologist)

Date: 30-Jan-2007

Remark(s): This report shall not be reproduced, except in full, without prior written approval from Lam Laboratories Ltd.

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101701N

Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)

Project : Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments– Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18232/8

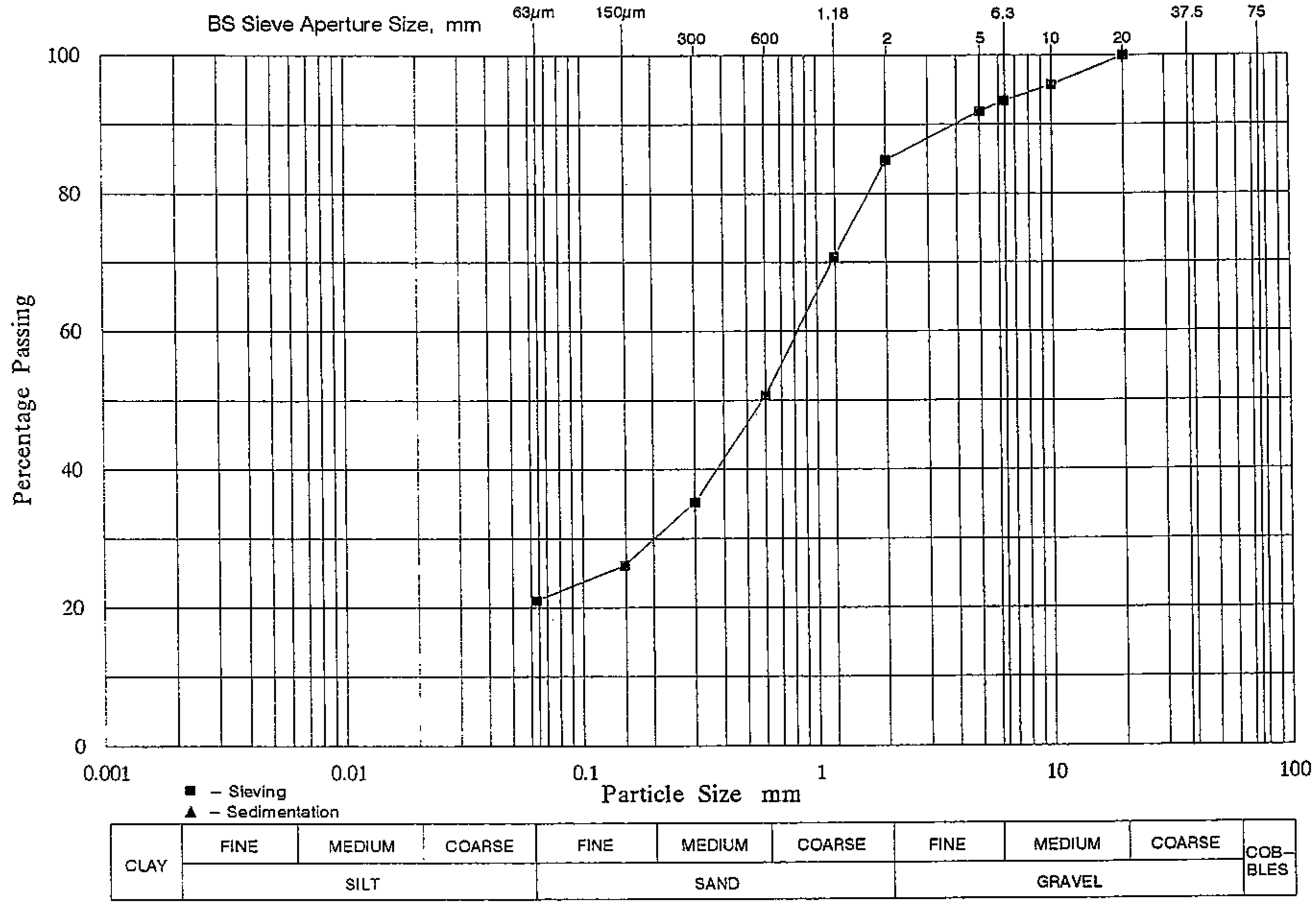
Client Ref. : SS3 **Sample No:** **Depth m:** 0.90 – 1.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Light grey, brown, clayey, gravelly, silty SAND with occasional shell fragments

Date Sample Received: 13/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	15 %
SAND	64 %
SILT & CLAY	21 %

Approved Signatory: Lo Kam Chuen
Lo Kam–chuen

Date: 6-11-2006

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101701N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments–
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18232/8

Client Ref. : SS3 **Sample No:** **Depth m:** 0.90 – 1.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Light grey, brown, clayey, gravelly, silty SAND with occasional shell fragments

Date Sample Received: 13/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 200.50

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	200.50	*cum. mass ret. + m2 =*		*200.50*
Riffled m3 20.0	200.50	*difference from m1 % =*		*0.00*
Washed m4	158.43	Note: m4 = mass >63um		
10.0	8.46	8.46	4.2	95.8
6.3	4.70	4.70	2.3	93.4
Passing m5 6.3	145.27	*cum. mass ret. + m5 =*		*158.43*
Riffled m6 6.3	145.27	*difference from m4 % =*		*0.00*
5.00	3.15	3.15	1.6	91.9
2.00	13.93	13.93	6.9	84.9
1.18	28.39	28.39	14.2	70.8
0.600	40.23	40.23	20.1	50.7
0.300	30.94	30.94	15.4	35.3
0.150	18.43	18.43	9.2	26.1
0.063	10.10	10.10	5.0	21.0
Pan mE	0.09			
		cum. mass ret. + mE =		*145.26*
		difference from m6 % =		*0.01*

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6–11–2006

TEST\GEO36\PSDA (19970811)

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101702N

Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)

Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments–

Project : Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18236/3

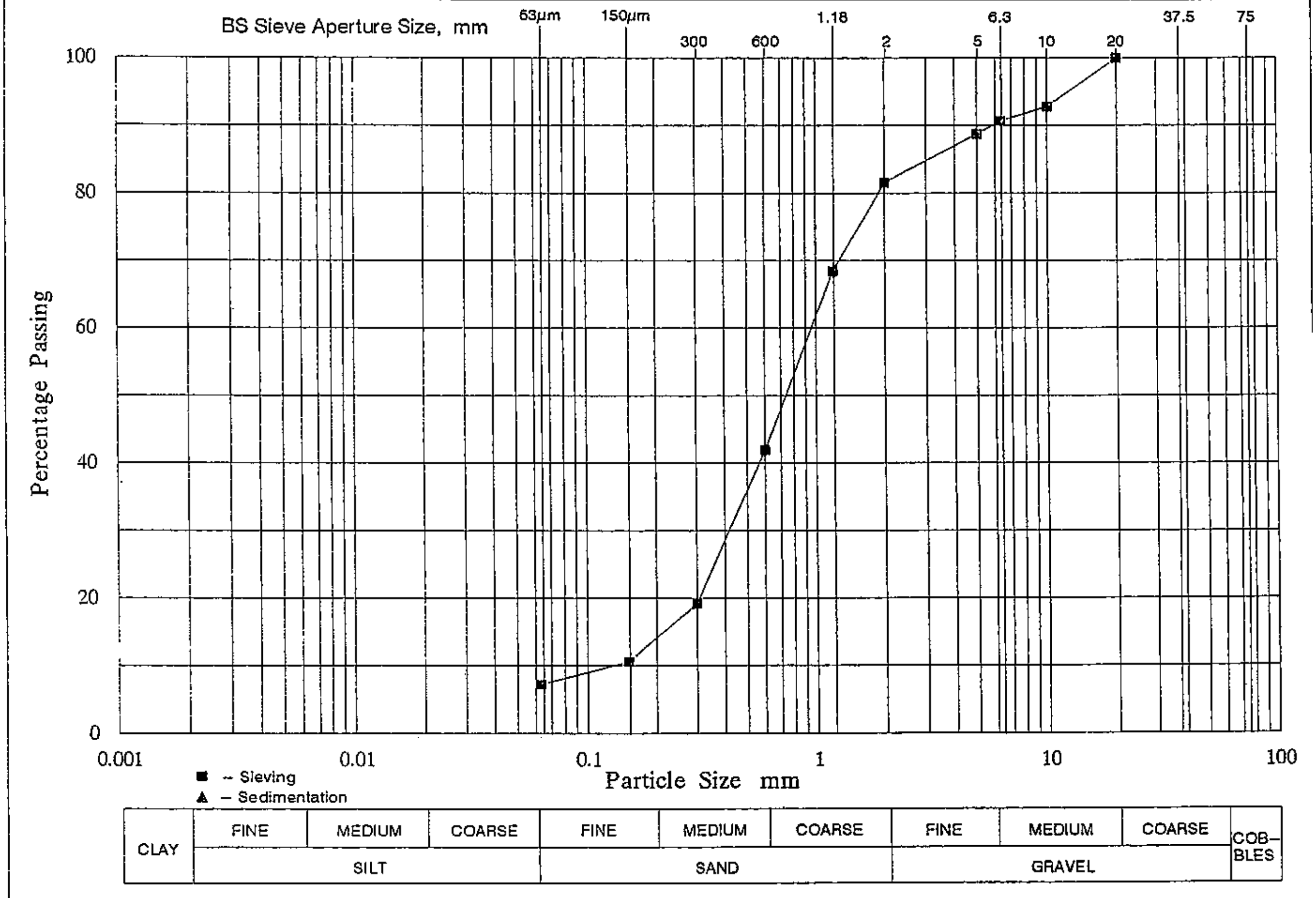
Client Ref. : SS8 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Light brown, grey, silty, gravelly with occasional shell fragments

Date Sample Received: 14/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	18 %
SAND	75 %
SILT & CLAY	7 %

Approved Signatory: Lo Kam chuen

Lo Kam–chuen

Date: 6 – 11 – 2006

Lam Laboratories Limited Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong Tel: 28973282

TEST\GEO36\PSDA (19970811)

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101702N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18236/3

Client Ref. : SS8 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Light brown, grey, silty, gravelly with occasional shell fragments

Date Sample Received: 14/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 200.70

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	200.70	*cum. mass ret. + m2 =*		*200.70*
Riffled m3 20.0	200.70	*difference from m1 % =*		*0.00*
Washed m4	186.07	Note: m4 = mass >63um		
10.0	14.53	14.53	7.2	92.8
6.3	4.18	4.18	2.1	90.7
Passing m5 6.3	167.36	*cum. mass ret. + m5 =*		*186.07*
Riffled m6 6.3	167.36	*difference from m4 % =*		*0.00*
5.00	3.88	3.88	1.9	88.7
2.00	14.41	14.41	7.2	81.6
1.18	26.39	26.39	13.1	68.4
0.600	53.22	53.22	26.5	41.9
0.300	45.63	45.63	22.7	19.2
0.150	17.25	17.25	8.6	10.6
0.063	6.42	6.42	3.2	7.3
Pan mE	0.03			
		cum. mass ret. + mE =		*167.23*
		difference from m6 % =		*0.08*

Approved Signatory: Lo Kam Chuen
Lo Kam-chuen

Date: 6-11-2006

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 101703N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments–
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18236/5

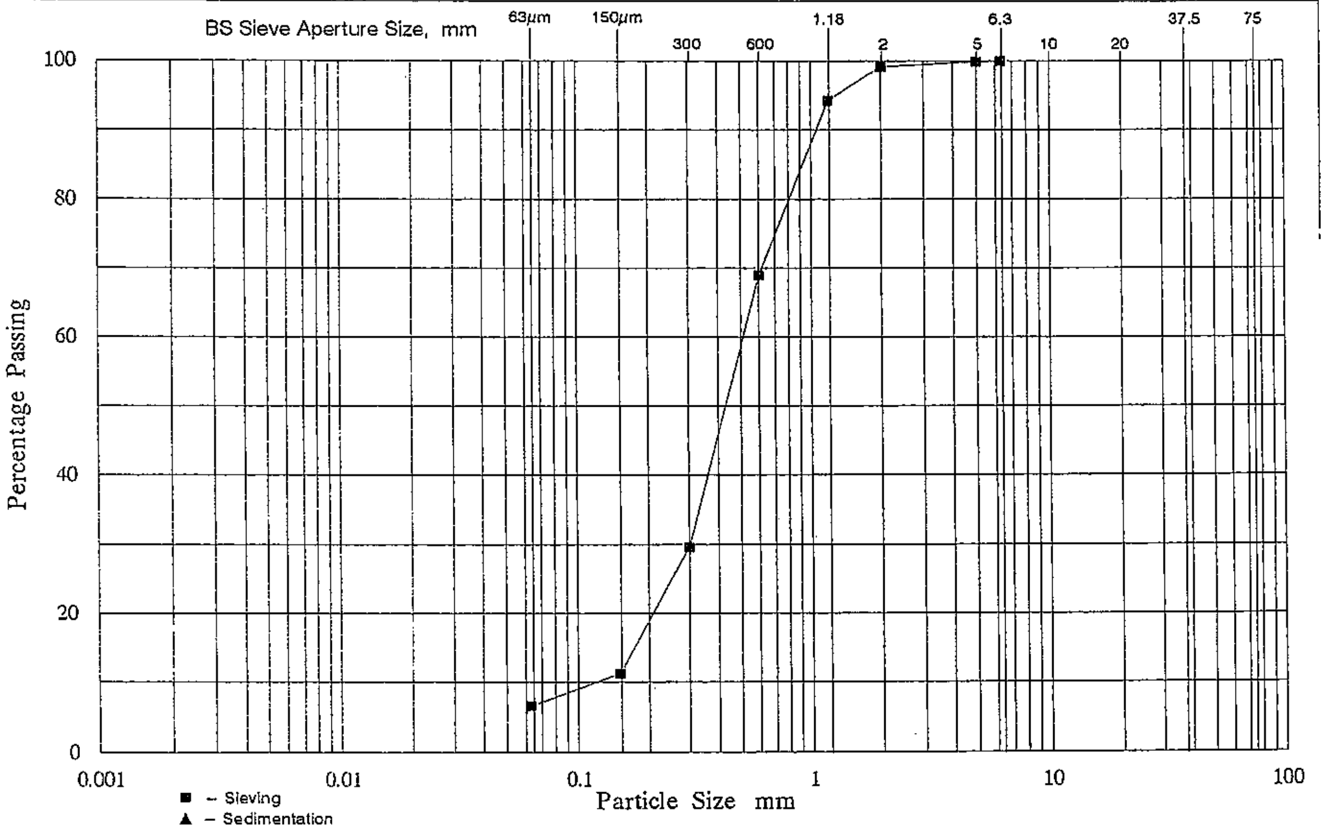
Client Ref. : SS9 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, silty SAND with some shell fragments

Date Sample Received: 14/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COB-BLES
	SILT			SAND			GRAVEL			

Remarks:

SUMMARY :

GRAVEL	1 %
SAND	92 %
SILT & CLAY	7 %

Approved Signatory: Lo Kam chuen

Lo Kam–chuen

Date: 6-11-2006

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 101703N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments–
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18236/5

Client Ref. : SS9 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, silty SAND with some shell fragments

Date Sample Received: 14/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 150.24

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	150.24	*cum. mass ret. + m2 =*		*150.24*
Riffled m3 20.0	150.24	*difference from m1 % =*		*0.00*
Washed m4	140.37	Note: m4 = mass >63um		
10.0		0.00	0.0	100.0
6.3		0.00	0.0	100.0
Passing m5 6.3	140.37	*cum. mass ret. + m5 =*		*140.37*
Riffled m6 6.3	140.37	*difference from m4 % =*		*0.00*
5.00	0.11	0.11	0.1	99.9
2.00	1.10	1.10	0.7	99.2
1.18	7.42	7.42	4.9	94.3
0.600	37.91	37.91	25.2	69.0
0.300	59.19	59.19	39.4	29.6
0.150	27.65	27.65	18.4	11.2
0.063	6.88	6.88	4.6	6.6
Pan mE	0.04			
		cum. mass ret. + mE =		*140.30*
		difference from m6 % =		*0.05*

Approved Signatory: Lo Kam-chuen

Lo Kam–chuen

Date: 6-11-2006

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 101704N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18249/3

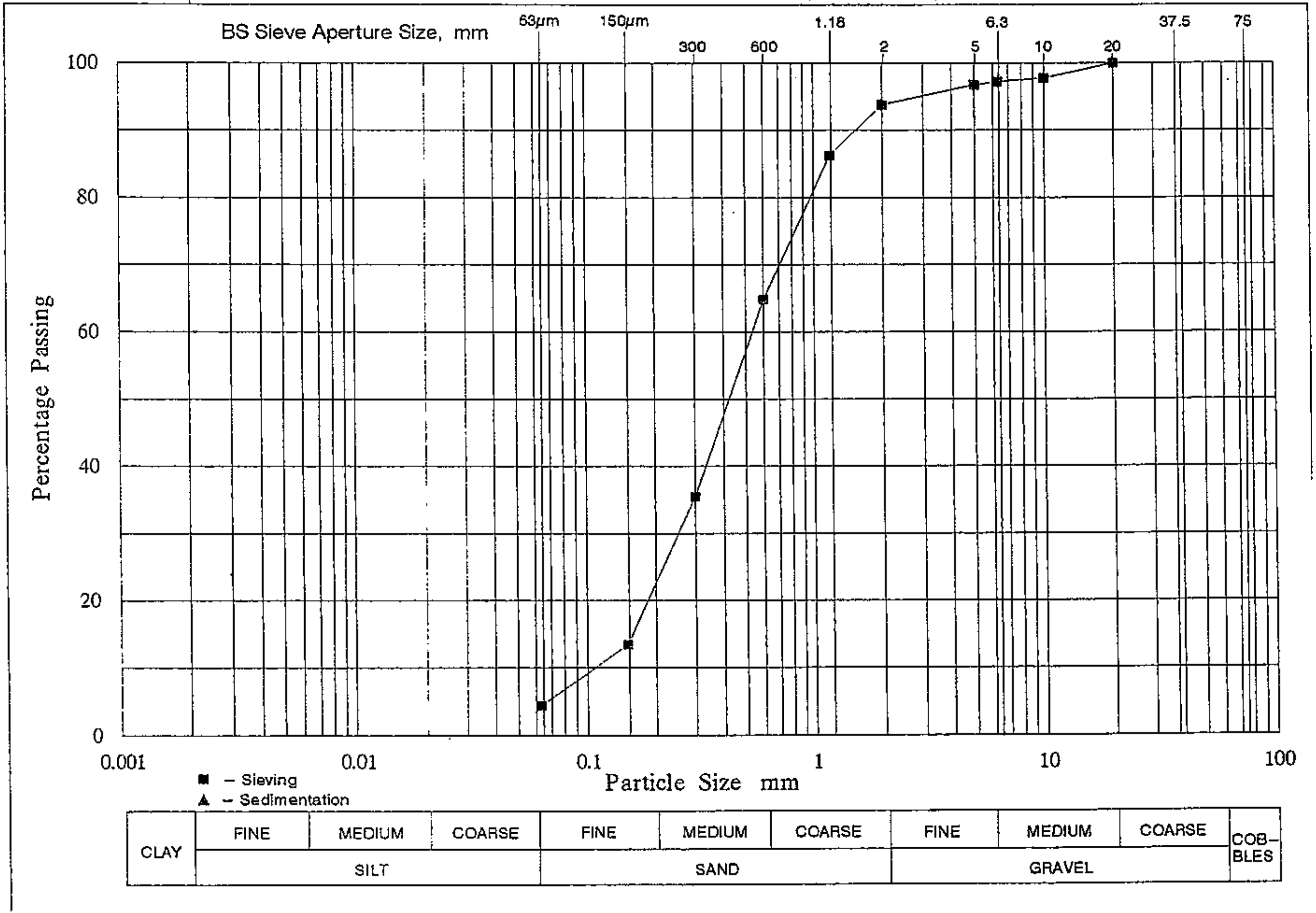
Client Ref. : SS5 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Olive grey, slightly silty, gravelly SAND with occasional shell fragments

Date Sample Received: 18/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	6 %
SAND	90 %
SILT & CLAY	4 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 101704N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18249/3

Client Ref. : SS5 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Olive grey, slightly silty, gravelly SAND with occasional shell fragments

Date Sample Received: 18/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 210.33

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	210.33	*cum. mass ret. + m2 =*		*210.33*
Riffled m3 20.0	210.33	*difference from m1 % =*		*0.00*
Washed m4	201.26	Note: m4 = mass >63um		
10.0	4.70	4.70	2.2	97.8
6.3	1.15	1.15	0.5	97.2
Passing m5 6.3	195.41	*cum. mass ret. + m5 =*		*201.26*
Riffled m6 6.3	147.00	*difference from m4 % =*		*0.00*
5.00	0.67	0.89	0.4	96.8
2.00	4.70	6.25	3.0	93.8
1.18	11.99	15.94	7.6	86.2
0.600	33.89	45.05	21.4	64.8
0.300	46.40	61.68	29.3	35.5
0.150	34.87	46.35	22.0	13.5
0.063	13.78	18.32	8.7	4.4
Pan mE	0.09			
		cum. mass ret. + mE =		*146.39*
		difference from m6 % =		*0.41*

Approved Signatory: Lo Kam chuen
Lo Kam – chuen

Date: 6 – 11 – 2006

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TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101705N

Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)

Project : Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments– Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18249/6

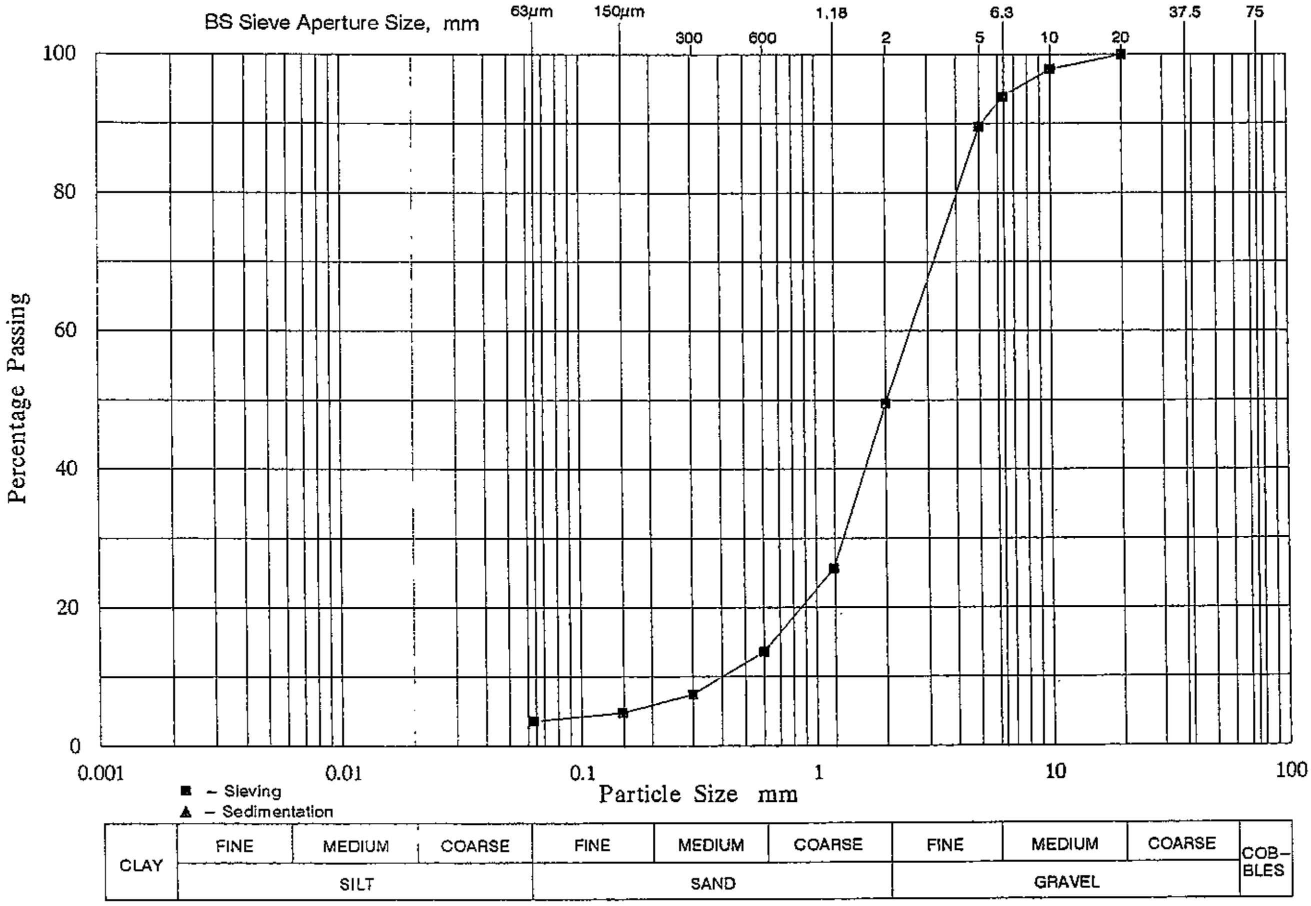
Client Ref. : SS7 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Olive brown, slightly silty, very gravelly SAND with occasional shell fragments

Date Sample Received: 18/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	50 %
SAND	46 %
SILT & CLAY	4 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 101705N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18249/6

Client Ref. : SS7 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Olive brown, slightly silty, very gravelly SAND with occasional shell fragments

Date Sample Received: 18/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 212.08

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	212.08	*cum. mass ret. + m2 =*		*212.08*
Riffled m3 20.0	212.08	*difference from m1 % =*		*0.00*
Washed m4	204.61	Note: m4 = mass >63um		
10.0	4.51	4.51	2.1	97.9
6.3	8.35	8.35	3.9	93.9
Passing m5 6.3	191.75	*cum. mass ret. + m5 =*		*204.61*
Riffled m6 6.3	144.79	*difference from m4 % =*		*0.00*
5.00	6.93	9.18	4.3	89.6
2.00	64.19	85.01	40.1	49.5
1.18	38.22	50.62	23.9	25.7
0.600	19.33	25.60	12.1	13.6
0.300	9.83	13.02	6.1	7.5
0.150	4.35	5.76	2.7	4.7
0.063	1.79	2.37	1.1	3.6
Pan mE	0.05			
		cum. mass ret. + mE =		*144.69*
		difference from m6 % =		*0.07*

Approved Signatory: Lo Kam chuen
Lo Kam-chuen

Date: 6-11-2006

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 101706N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18249/7

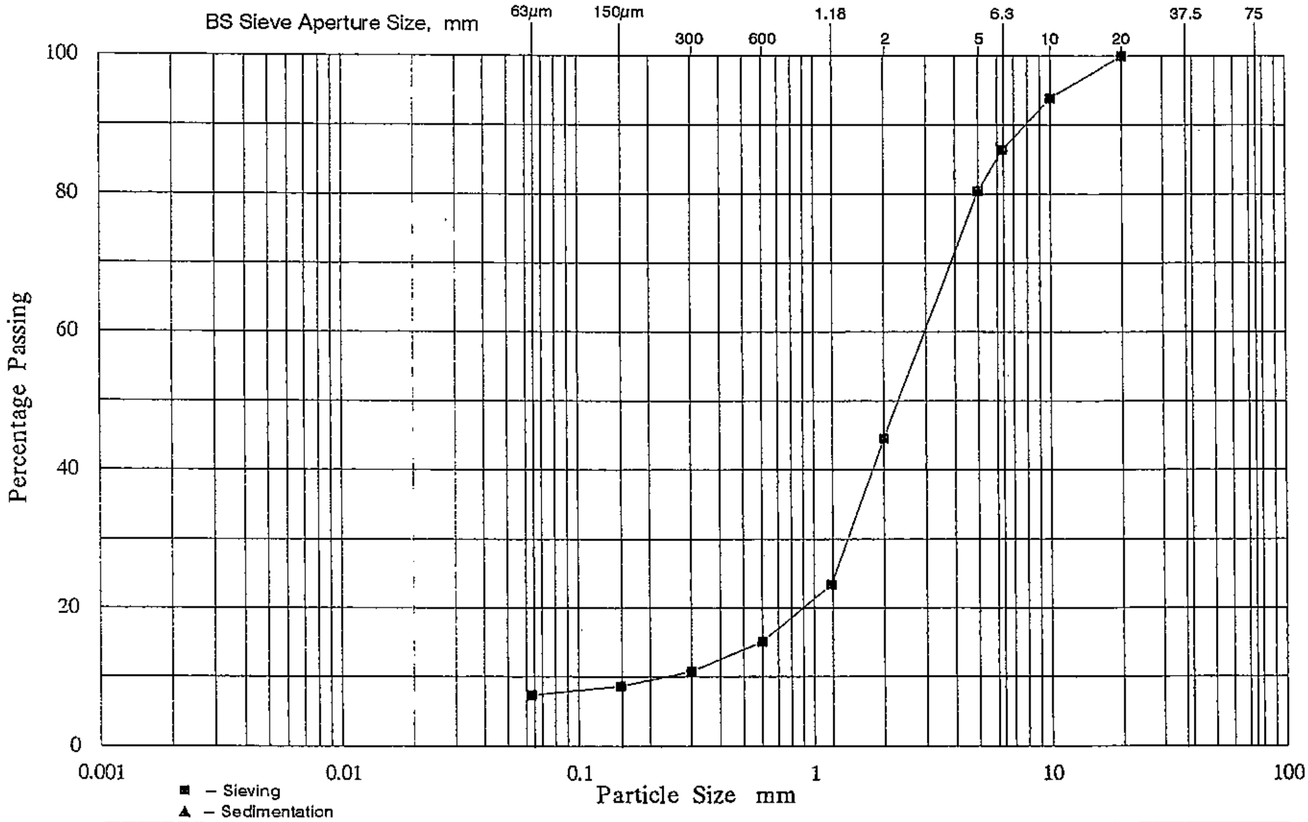
Client Ref. : SS7 **Sample No:** **Depth m:** 0.90 – 1.30 **Specimen Depth m:**

Sample Type: Vibrocore Spec. Ref: **Geological Origin:** Not Specified

Description : Yellowish brown, silty, very sandy GRAVEL with occasional shell fragments

Date Sample Received: 18/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COB-BLES
	SILT			SAND			GRAVEL			

Remarks:

SUMMARY :

GRAVEL	55 %
SAND	38 %
SILT & CLAY	7 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101706N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18249/7

Client Ref. : SS7 **Sample No:** **Depth m:** 0.90 – 1.30 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Yellowish brown, silty, very sandy GRAVEL with occasional shell fragments

Date Sample Received: 18/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 210.42

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	210.42	*cum. mass ret. + m2 =*		*210.42*
Riffled m3 20.0	210.42	*difference from m1 % =*		*0.00*
Washed m4	195.02	Note: m4 = mass >63um		
10.0	12.83	12.83	6.1	93.9
6.3	15.79	15.79	7.5	86.4
Passing m5 6.3	166.40	*cum. mass ret. + m5 =*		*195.02*
Riffled m6 6.3	166.40	*difference from m4 % =*		*0.00*
5.00	12.51	12.51	5.9	80.5
2.00	75.52	75.52	35.9	44.6
1.18	44.49	44.49	21.1	23.4
0.600	17.52	17.52	8.3	15.1
0.300	9.12	9.12	4.3	10.8
0.150	4.42	4.42	2.1	8.7
0.063	2.55	2.55	1.2	7.3
Pan mE	0.02			
		cum. mass ret. + mE =		*166.15*
		difference from m6 % =		*0.15*

Approved Signatory: Lo Kam Chuen
Lo Kam – chuen

Date: 6-11-2006

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Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 101707N

Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)

Project : Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18255/3

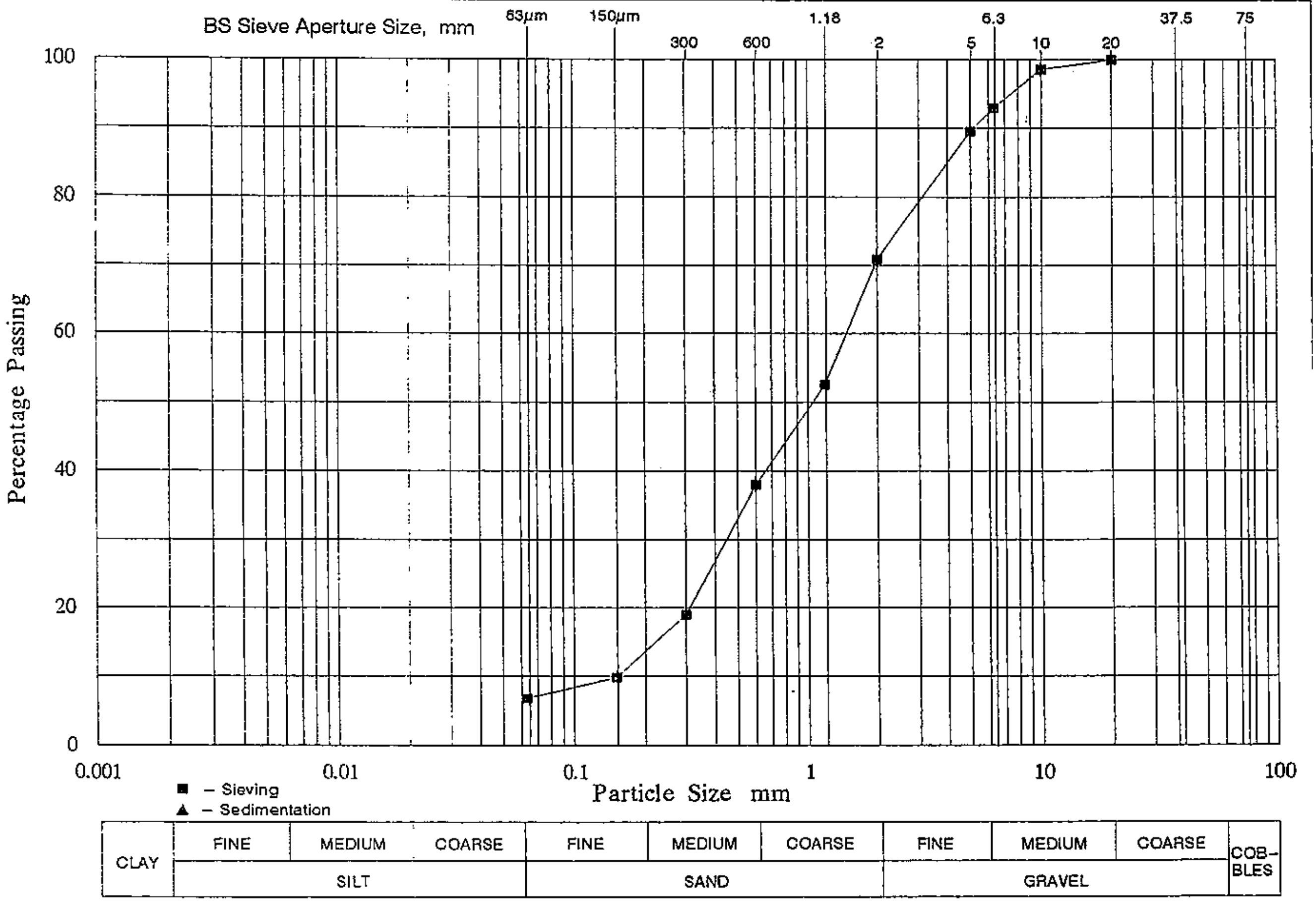
Client Ref. : SS2 **Sample No:** **Depth m:** 0.50 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Brown, silty, very gravelly SAND with occasional shell fragments

Date Sample Received: 19/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :	GRAVEL	29 %
	SAND	64 %
	SILT & CLAY	7 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

Lam Laboratories Limited Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong Tel: 28973282

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 101707N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18255/3

Client Ref. : SS2 **Sample No:** **Depth m:** 0.50 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Brown, silty, very gravelly SAND with occasional shell fragments

Date Sample Received: 19/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 204.79

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	204.79	*cum. mass ret. + m2 =*		*204.79*
Riffled m3 20.0	204.79	*difference from m1 % =*		*0.00*
Washed m4	190.89	Note: m4 = mass >63um		
10.0	2.81	2.81	1.4	98.6
6.3	11.54	11.54	5.6	93.0
Passing m5 6.3	176.54	*cum. mass ret. + m5 =*		*190.89*
Riffled m6 6.3	132.83	*difference from m4 % =*		*0.00*
5.00	5.24	6.96	3.4	89.6
2.00	28.83	38.32	18.7	70.9
1.18	28.22	37.51	18.3	52.6
0.600	22.42	29.80	14.6	38.0
0.300	29.27	38.90	19.0	19.0
0.150	14.09	18.73	9.1	9.9
0.063	4.24	5.64	2.8	6.8
Pan mE	0.02			
		cum. mass ret. + mE =		*132.33*
		difference from m6 % =		*0.38*

Approved Signatory: Lo Kam chuen
Lo Kam-chuen

Date: 6-11-2006

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101708N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments– Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18255/4

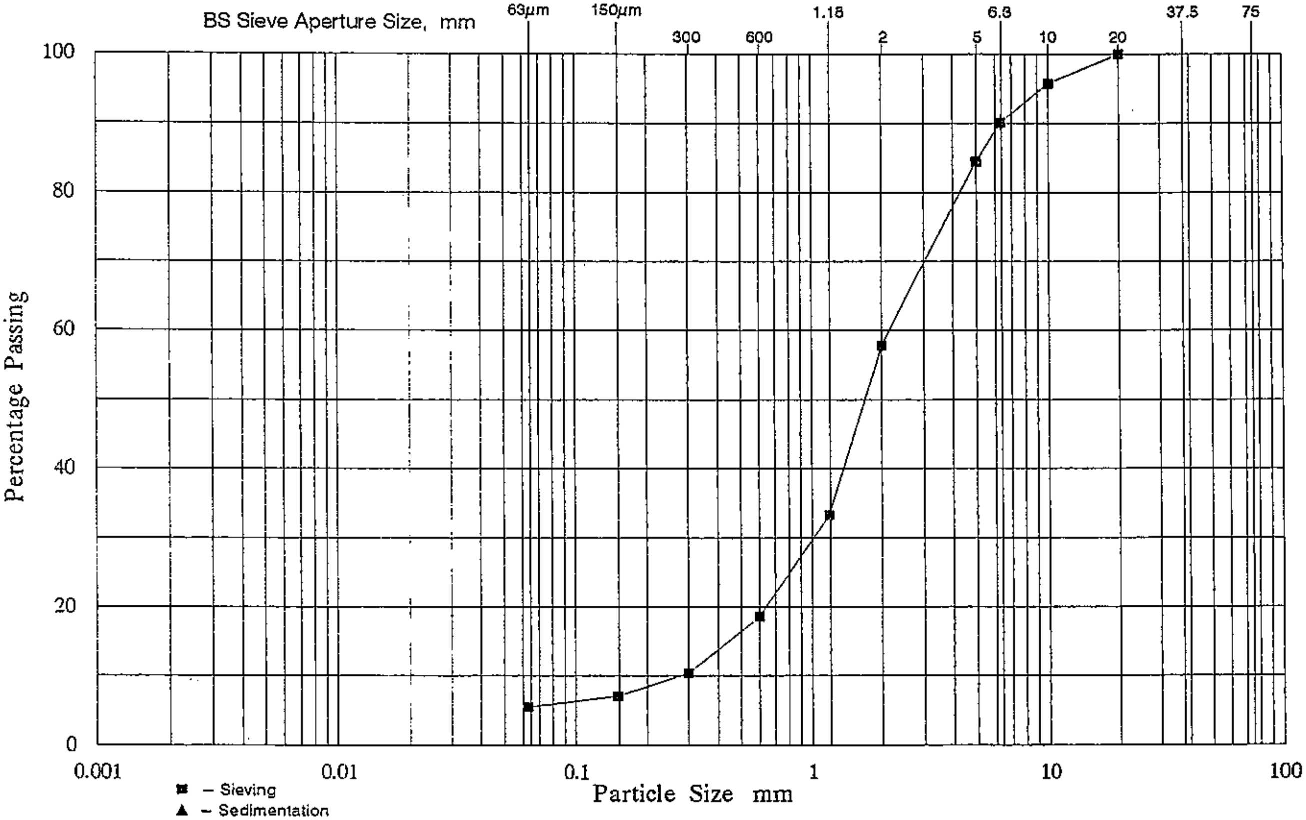
Client Ref. : SS2 **Sample No:** **Depth m:** 0.90 – 1.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Brown, silty, very gravelly SAND with occasional shell fragments

Date Sample Received: 19/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COB-BLES
	SILT			SAND			GRAVEL			

Remarks:

SUMMARY :

GRAVEL	42 %
SAND	52 %
SILT & CLAY	6 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

Lam Laboratories Limited Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong Tel: 28973282

TEST\GEO36\PSDA (19970811)

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101708N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18255/4

Client Ref. : SS2 **Sample No:** **Depth m:** 0.90 – 1.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Brown, silty, very gravelly SAND with occasional shell fragments

Date Sample Received: 19/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 211.94

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	211.94	*cum. mass ret. + m2 =*		*211.94*
Riffled m3 20.0	211.94	*difference from m1 % =*		*0.00*
Washed m4	200.34	Note: m4 = mass >63um		
10.0	9.07	9.07	4.3	95.7
6.3	11.92	11.92	5.6	90.1
Passing m5 6.3	179.35	*cum. mass ret. + m5 =*		*200.34*
Riffled m6 6.3	134.27	*difference from m4 % =*		*0.00*
5.00	8.93	11.93	5.6	84.5
2.00	42.25	56.44	26.6	57.8
1.18	38.92	51.99	24.5	33.3
0.600	23.30	31.12	14.7	18.6
0.300	13.09	17.48	8.2	10.4
0.150	5.21	6.96	3.3	7.1
0.063	2.13	2.85	1.3	5.6
Pan mE	0.14			
		cum. mass ret. + mE =		*133.97*
		difference from m6 % =		*0.22*

Approved Signatory: Lo Kam chuen
Lo Kam – chuen

Date: 6 – 11 – 2006

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101709N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments– Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18255/8

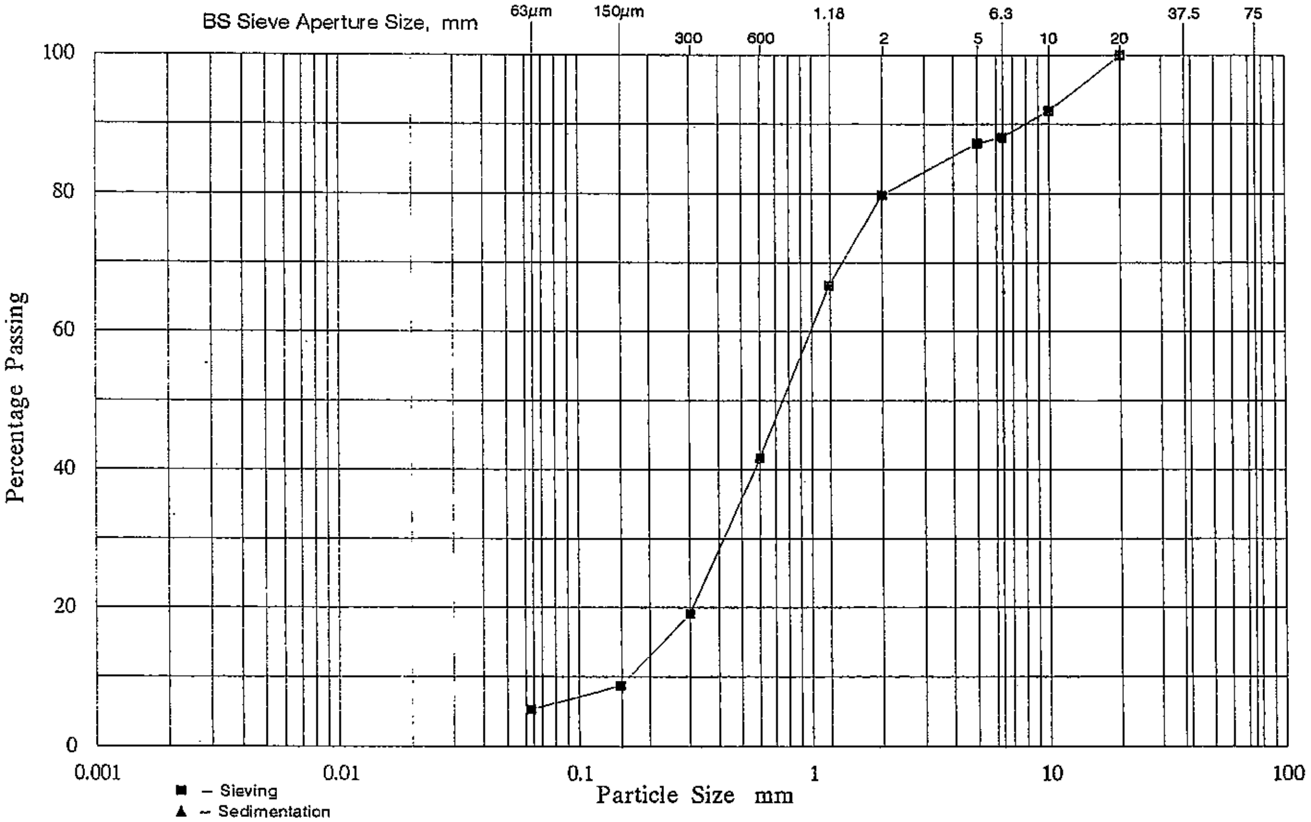
Client Ref. : SS4 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore Spec. Ref: **Geological Origin:** Not Specified

Description : Yellowish brown, silty, gravelly SAND with some shell fragments

Date Sample Received: 19/10/2006 Date Tested: 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COB–BLES
	SILT			SAND			GRAVEL			

Remarks:

SUMMARY :

GRAVEL	20 %
SAND	75 %
SILT & CLAY	5 %

Approved Signatory: Lo Kam-chuen
Lo Kam–chuen

Date: 6-11-2006

Lam Laboratories Limited Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong Tel: 28973282

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101709N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments–
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18255/8

Client Ref. : SS4 **Sample No:** **Depth m:** 0.00 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Yellowish brown, silty, gravelly SAND with some shell fragments

Date Sample Received: 19/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 207.62

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	207.62	*cum. mass ret. + m2 =*		*207.62*
Riffled m3 20.0	207.62	*difference from m1 % =*		*0.00*
Washed m4	196.59	Note: m4 = mass >63um		
10.0	16.58	16.58	8.0	92.0
6.3	8.07	8.07	3.9	88.1
Passing m5 6.3	171.94	*cum. mass ret. + m5 =*		*196.59*
Riffled m6 6.3	128.80	*difference from m4 % =*		*0.00*
5.00	1.29	1.72	0.8	87.3
2.00	11.70	15.62	7.5	79.8
1.18	20.37	27.19	13.1	66.7
0.600	38.94	51.98	25.0	41.6
0.300	35.07	46.82	22.5	19.1
0.150	16.11	21.51	10.4	8.7
0.063	5.05	6.74	3.2	5.3
Pan mE	0.03			
		cum. mass ret. + mE =		*128.56*
		difference from m6 % =		*0.19*

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101710N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No:CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18273/3

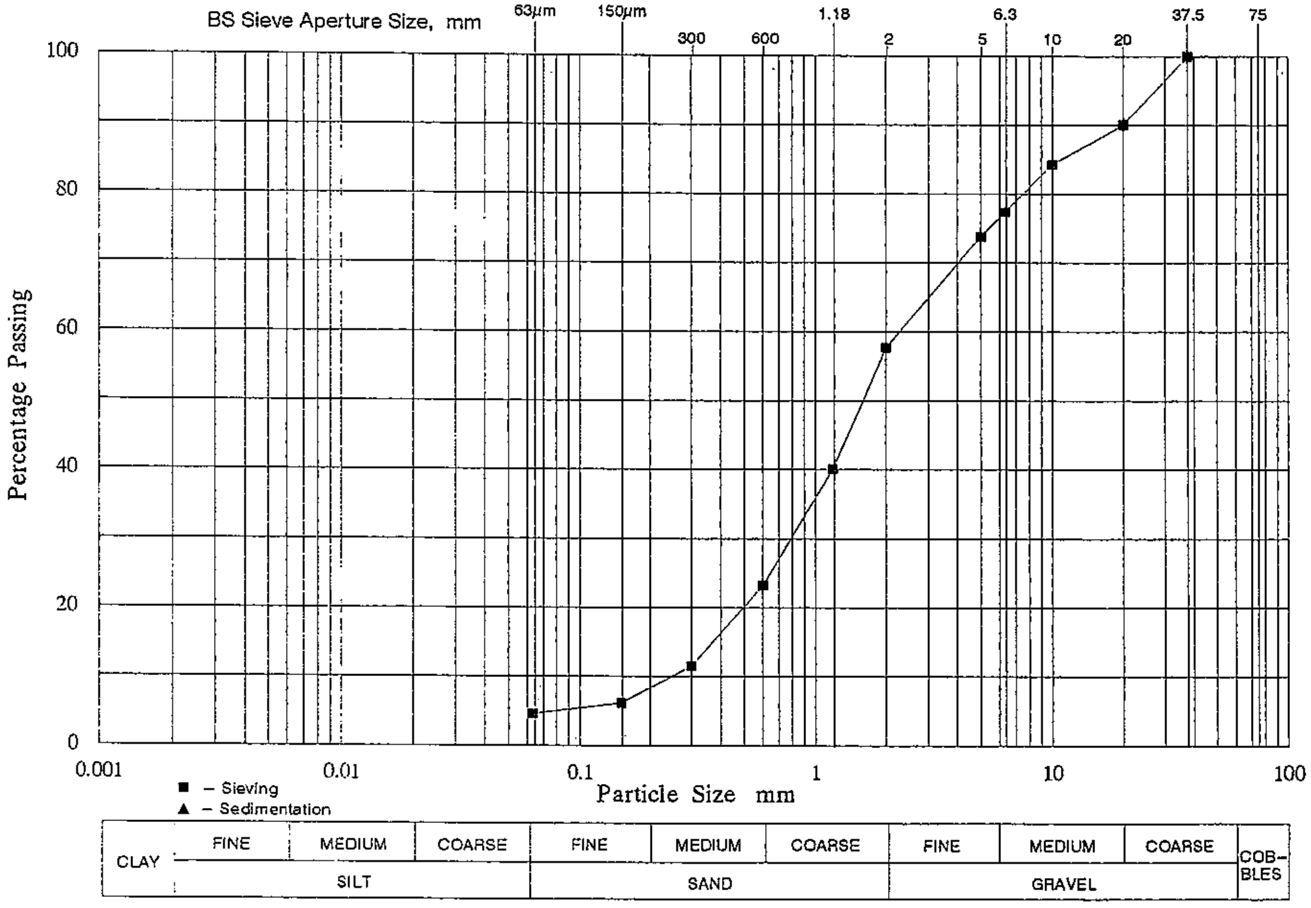
Client Ref. : SS1 **Sample No:** **Depth m:** 0.20 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Yellowish brown, silty, very gravelly SAND with occasional shell fragments

Date Sample Received: 20/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :	GRAVEL	42 %
	SAND	53 %
	SILT & CLAY	5 %

Approved Signatory: Lo Kam-chuen

Lo Kam–chuen

Date: 6-11-2006

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101710N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments– Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18273/3

Client Ref. : SS1 **Sample No:** **Depth m:** 0.20 – 0.90 **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Yellowish brown, silty, very gravelly SAND with occasional shell fragments

Date Sample Received: 20/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 510.50

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0	50.23	50.23	9.8	90.2
Passing m2 20.0	460.27	*cum. mass ret. + m2 =*		*510.50*
Riffled m3 20.0	460.27	*difference from m1 % =*		*0.00*
Washed m4	436.93	Note: m4 = mass >63um		
10.0	30.05	30.05	5.9	84.3
6.3	35.13	35.13	6.9	77.4
Passing m5 6.3	371.75	*cum. mass ret. + m5 =*		*436.93*
Riffled m6 6.3	147.39	*difference from m4 % =*		*0.00*
5.00	7.19	18.13	3.6	73.8
2.00	32.59	82.20	16.1	57.7
1.18	35.73	90.12	17.7	40.1
0.600	34.04	85.86	16.8	23.3
0.300	23.73	59.85	11.7	11.5
0.150	10.81	27.27	5.3	6.2
0.063	3.24	8.17	1.6	4.6
Pan mE	0.01			
		cum. mass ret. + mE =		*147.34*
		difference from m6 % =		*0.03*

Approved Signatory: Lo Kam-chuen
Lo Kam–chuen

Date: 6-11-2006

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 101711N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18286/1

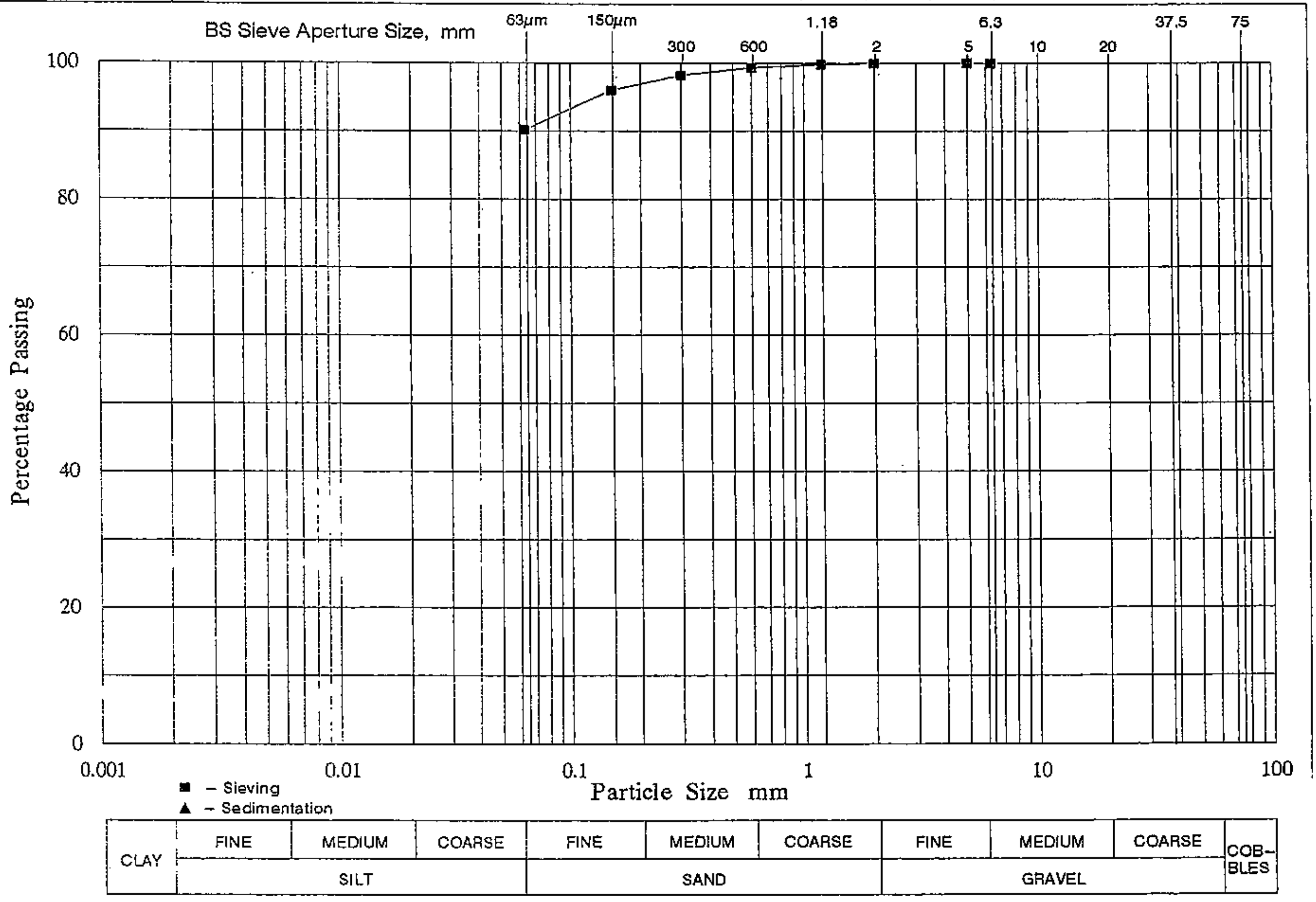
Client Ref. : Reference Sediment **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, slightly sandy CLAY

Date Sample Received: 24/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	0 %
SAND	10 %
SILT & CLAY	90 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 101711N

Project : Chemical and Biological Testing of Sediment (Service Contract) Agreement No.CE 59/2005(EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments–
Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18286/1

Client Ref. : Reference Sediment **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Vibrocore **Spec. Ref:** **Geological Origin:** Not Specified

Description : Grey, slightly sandy CLAY

Date Sample: Received 24/10/2006 **Date Tested:** 25/10/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 107.43

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	107.43	*cum. mass ret. + m2 =*		*107.43*
Riffled m3 20.0	107.43	*difference from m1 % =*		*0.00*
Washed m4	10.57	Note: m4 = mass >63um		
10.0		0.00	0.0	100.0
6.3		0.00	0.0	100.0
Passing m5 6.3	10.57	*cum. mass ret. + m5 =*		*10.57*
Riffled m6 6.3	10.57	*difference from m4 % =*		*0.00*
5.00	0.04	0.04	0.0	100.0
2.00	0.03	0.03	0.0	99.9
1.18	0.13	0.13	0.1	99.8
0.600	0.53	0.53	0.5	99.3
0.300	1.15	1.15	1.1	98.3
0.150	2.35	2.35	2.2	96.1
0.063	6.28	6.28	5.8	90.2
Pan mE	0.02			
		cum. mass ret. + mE =		*10.53*
		difference from m6 % =		*0.38*

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 6-11-2006

Appendix B

Records of Vibrcores

FUGRO GEOTECHNICAL SERVICES LTD

CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT
GEOTECHNICAL ENGINEERING OFFICE
CONTRACT NO. GE/2005/28
GROUND INVESTIGATION-MARINE WORKS (TERM CONTRACT)

Works Order No. GE/2005/28.10

Agreement No. CE 59/2005 (EP)
Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation

Final Factual Fieldwork Report

Document No: 05-0460-05-10/R001

Checked in accordance with
Contract No. GE/2005/28
requirements and accepted.

Signed ________ Date 18.12.2006

REVISION STATUS INDEX

0	21- November-2006	Final	PM	GW	YY
Rev	*Date*	*Description*	*Prepared*	*Checked*	*Approved*

CONTRACT DATA SUMMARY

Project Name & No. : Ground Investigation - Marine Works (Term Contract)	Site Name : Agreement No CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation	Date : 10/10/2006 to 09/12/2006 Official only G.E.O Data Bank No.
G.I. Contractor : Fugro Geotechnical Services Ltd.	Client: GEO - Geotechnical Project Division	
Contract No. : GE/2005/28	W.O. No. GE/2005/28.10	File Ref.

FIELD WORK SUMMARY

Drillhole Nos. : 2	Method : Rotary	Date : 13/10/2006 to 21/10/2006
Vibrocore Nos. : 9	Trial Pit Nos. : NIL	Slope Stripping Nos. : NIL
Probe Nos. : NIL	Trial Trenches Nos. : NIL	Strip Windows Nos. : NIL
Piezometer/Standpipe Nos. : NIL		Halcrow Bucket Nos. : NIL
Insitu Test Nos. : NIL	Types NIL	
Geophysics : NIL	Type NIL	

LABORATORY TESTING SUMMARY

Total No. of Tests :			Date :	to	
Soil	Physical Properties	LL	PL	PSD	MC
		SG	γ_m/γ_d		
	Strength Tests	CU	CD	UU	Shear Box
	Compaction & CBR Tests	Standard	Modified		CBR
	Oedometer & Perm. Test	Cv	k		
	Others				
Rock	γ	Pt load	UC	Shear Box	US Vel.

Location Plan

Scale 1: 20 000 Derived from: Sheet 3, Series HM20C, Edition 7, 1998

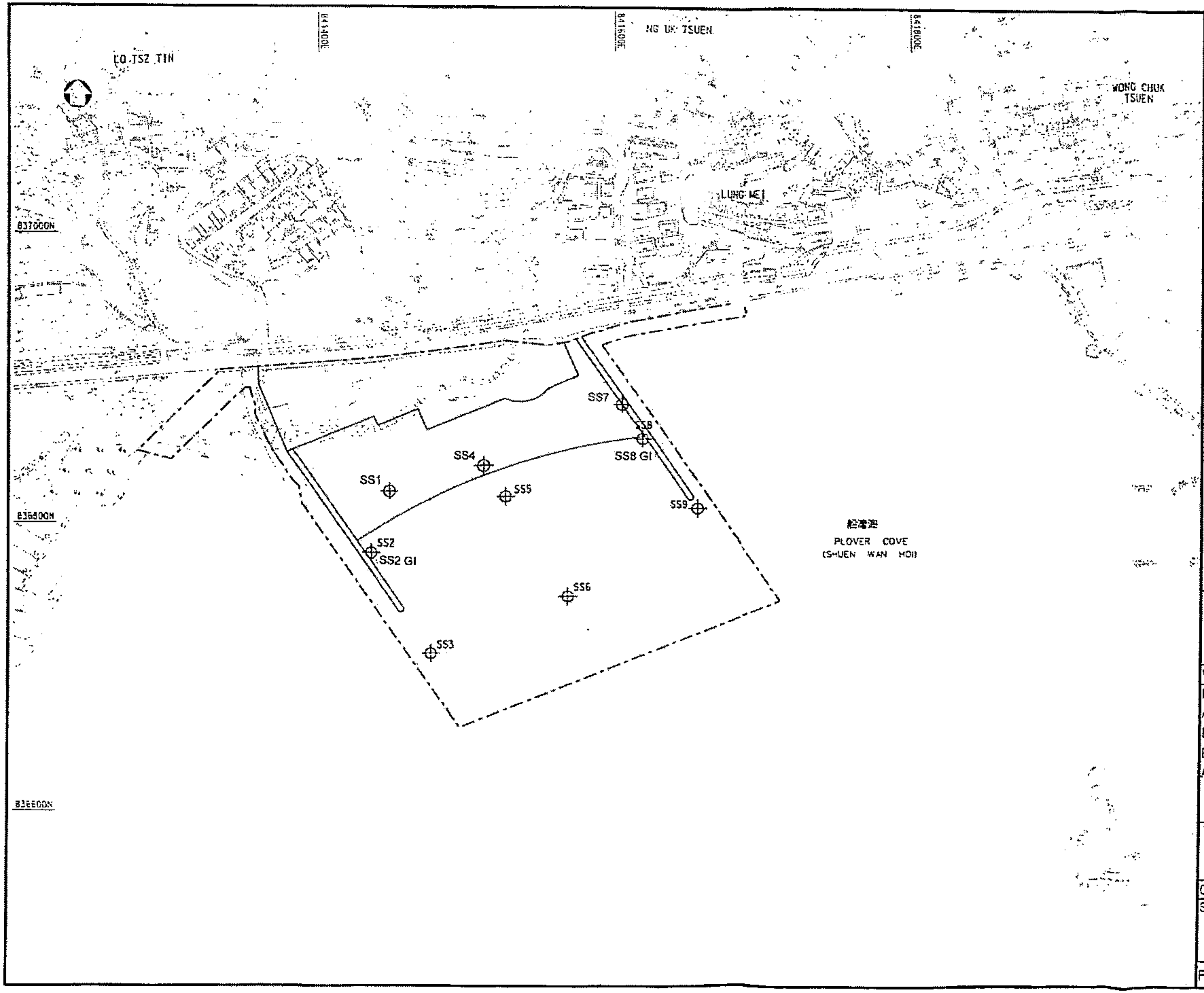
	Ground Investigation	Laboratory	GEOTECHNICAL ENGINEERING OFFICE
CONTRACTOR	Fugro Geotechnical Services Ltd.		CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT
WORKS ORDER NO.	GE/2005/28.10		

Table 2

Survey Record of Investigation Locations

Vibrocore / Drillhole No.	As-Built Co-ordinates		Seabed Level (mPD)
	Easting (m)	Northing (m)	
SS1	841448.00	836819.00	+0.55
SS2	841435.00	836779.00	+0.35
SS2 GI	841437.00	836779.00	+0.35
SS3	841476.00	836709.00	-3.25
SS4	841509.00	836837.00	+0.45
SS5	841526.00	836817.00	+0.45
SS6	841568.00	836748.00	-3.15
SS7	841604.00	836879.00	+0.20
SS8	841618.00	836856.00	-0.30
SS8 GI	841618.00	836857.00	-0.30
SS9	841656.00	836809.00	-1.85

FGS T002: 18-02-05



Legend:

⊕ Vibrocore / Drillhole

FUGRO GEOTECHNICAL SERVICES LTD

WORKS ORDER No. GE/2005/28.10

PROJECT:

Agreement No. CE 59/2005 (EP)
Development of a Bathing Beach at Lung Mei, Tai Po
Environmental Drainage and Traffic Impact
Assessments - Investigation

TITLE:

Ground Investigation Plan

CLIENT: CEDD-GEO

SCALE:

1 : 2500

FIGURE No: 1

FUGRO GEOTECHNICAL SERVICES LTD

VIBROCORE RECORD

HOLE No. SS1

CONTRACT No.: GE/2005/28

SHEET: 1 of 1

PROJECT: Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation

METHOD: Vibrocoring

CO-ORDINATES:
E 841448.00
N 836819.00

WORKS ORDER No. GE/2005/28.10

MACHINE & No.: FDR-17

DATE from: 20/10/2006 to 20/10/2006

FLUSHING MEDIUM: N/A

ORIENTATION: Vertical

SEABED LEVEL + 0.55 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/ end	Water Return %	T C R %	S C R %	R Q D %	F I	Tests	Samples No.	Samples Type	Samples Depth	Reduced Level	Depth (m)	Legend	Grade	Description
												0.55	0.00			
20/10/2006				83					1	V100	0.00					Yellowish brown (10YR/5/8) to brown (10YR/5/3), slightly silty, fine to coarse SAND with occasional subangular, fine to coarse gravel and cobbles of moderately strong, tuff and occasional shell fragments. (ESTUARINE DEPOSIT / ALLUVIUM?)
1									2		0.90					
20/10/2006									3		1.20	-0.75	1.30			
																End of investigation hole at 1.30m.
2																
3																
4																
5																
6																
7																
8																
9																
10													10.00			

┆	Small Disturbed Sample	↓	Standard Penetration Test
▤	Piston sample	V	In-situ Vane Shear Test
▨	U76 Undisturbed Sample	I	Permeability Test
▧	Vibrocore sample	↓	Impression Packer Test
I	Vibrocore sub-sample	↓	Packer Test
▯	SPT Liner Sample	▲	Piezometer Tip
▲	Water Sample	♁	Standpipe

LOGGED W.S. Tsang

DATE 21/10/2006

CHECKED S.C. Wong

DATE 23/10/2006

REMARKS

1. 20L water sample was collected.
2. 12L grab sample was collected.
3. Vibrocore sub samples were taken for chemical testing from 0.00 - 0.90m and 0.90 - 1.20m.

FUGRO FUGRO GEOTECHNICAL SERVICES LTD	# VIBROCORE RECORD	HOLE No. **SS2**
	CONTRACT No.: **GE/2005/28**	SHEET: **1** of **1**

PROJECT: **Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation**

METHOD: **Vibrocoring**	CO-ORDINATES:	WORKS ORDER No. **GE/2005/28.10**
MACHINE & No.: **FDR-17**	E **841435.00** N **836779.00**	DATE from: **19/10/2006** to **19/10/2006**
FLUSHING MEDIUM: **N/A**	ORIENTATION: **Vertical**	SEABED LEVEL **+ 0.35** mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/ end	Water Return %	TCR %	SCR %	RQD %	FI	Tests	Samples No.	Samples Type	Samples Depth	Reduced Level 0.35	Depth (m) 0.00	Legend	Grade	Description
19/10/2006				80					1		0.00					Yellowish brown (10YR/5/8), slightly silty, fine to coarse SAND with occasional subangular, fine to medium gravel and some shell and shell fragments. (MARINE DEPOSIT)
1									2	WOO	0.90	-0.55	0.90			Yellowish brown (10YR/5/4) to brown (10YR/5/3), silty, fine to coarse SAND with some angular to subangular, fine to coarse gravel and cobbles of moderately strong, tuff. (ALLUVIUM)
2									3		1.90					
19/10/2006									4		2.50 2.60	-2.25	2.60			End of investigation hole at 2.60m.
3																
4																
5																
6																
7																
8																
9																
10															10.00			

- Small Disturbed Sample
- Piston sample
- U76 Undisturbed Sample
- Vibrocore sample
- Vibrocore sub-sample
- SPT Liner Sample
- ▲ Water Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe

LOGGED W.S. Tsang
DATE 21/10/2006
CHECKED S.C. Wong
DATE 23/10/2006

REMARKS
1. 30L water sample was collected.
2. 12L grab sample was collected.
3. Vibrocore sub samples were taken for chemical testing from 0.00 - 0.90m, 0.90 - 1.90m and 1.90 - 2.50m.

FUGRO GEOTECHNICAL SERVICES LTD

VIBROCORE RECORD

HOLE No.	SS3
CONTRACT No.: GE/2005/28	SHEET: 1 of 1

PROJECT: Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po
Environmental Drainage and Traffic Impact Assessments - Investigation

METHOD: Vibrocoring	CO-ORDINATES:	WORKS ORDER No. GE/2005/28.10
MACHINE & No.: FDR-17	E 841476.00 N 836709.00	DATE from: 13/10/2006 to 13/10/2006
FLUSHING MEDIUM: N/A	ORIENTATION: Vertical	SEABED LEVEL -3.25 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/ end	Water Return %	T C R %	S C R %	R Q D %	F I	Tests	Samples No.	Samples Type	Samples Depth	Reduced Level	Depth (m)	Legend	Grade	Description
												-3.25	0.00			
13/10/2006				100					1	V100	0.00	-4.15	0.90			Light yellowish brown (2.5Y/6/4), silty clayey, fine to coarse SAND with occasional subangular, fine to medium gravel and some shell fragments. (MARINE DEPOSIT)
									2		0.90	-5.15	1.90			Firm, light yellowish brown (2.5Y/6/4) to light brown (7.5YR/6/4), slightly sandy to sandy, clayey SILT with occasional subangular to subrounded, fine to coarse gavel. (ALLUVIUM)
									3		1.90	-6.15	2.90			1.90 - 2.90m: With some angular, subrounded to rounded, fine to coarse gravel and cobbles of moderately strong, tuff.
13/10/2006									4		2.80 2.90					End of investigation hole at 2.90m.
													10.00			

Small Disturbed Sample	Standard Penetration Test
Piston sample	In-situ Vane Shear Test
U76 Undisturbed Sample	Permeability Test
Vibrocore sample	Impression Packer Test
Vibrocore sub-sample	Packer Test
SPT Liner Sample	Piezometer Tip
▲ Water Sample	Standpipe

LOGGED W.S. Tsang
DATE 13/10/2006
CHECKED S.C. Wong
DATE 16/10/2006

REMARKS
1. 30L water sample was collected.
2. 12L grab sample was collected.
3. Vibrocore sub samples were taken for chemical testing from 0.00 - 0.90m, 0.90 - 1.90m and 1.90 - 2.80m.

FUGRO
FUGRO GEOTECHNICAL SERVICES LTD

VIBROCORE RECORD

HOLE No. SS4

CONTRACT No.: GE/2005/28

SHEET: 1 of 1

PROJECT: Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po
Environmental Drainage and Traffic Impact Assessments - Investigation

METHOD: Vibrocoring

MACHINE & No.: FDR-17

FLUSHING MEDIUM: N/A

CO-ORDINATES:
E 841509.00
N 836837.00

ORIENTATION: Vertical

WORKS ORDER No. GE/2005/28.10

DATE from: 19/10/2006 to 19/10/2006

SEABED LEVEL + 0.45 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/ end	Water Return %	T C R %	S C R %	R Q D %	F I	Tests	Samples No.	Samples Type	Samples Depth	Reduced Level	Depth (m)	Legend	Grade	Description
												0.45	0.00			
19/10/2006				100					1	V100	0.00					Yellowish brown (10YR/5/8), slightly silty, fine to coarse SAND with occasional angular to subangular, fine to coarse gravel and cobbles of moderately strong, tuff and occasional shell fragments. (ESTUARINE DEPOSIT / ALLUVIUM?)
									2		0.90					
19/10/2006									3		1.30 1.40	-0.05	1.40			End of investigation hole at 1.40m.
													10.00			

ǀ	Small Disturbed Sample	↓	Standard Penetration Test
▤	Piston sample	V	In-situ Vane Shear Test
▨	U76 Undisturbed Sample	I	Permeability Test
▨	Vibrocore sample	‡	Impression Packer Test
I	Vibrocore sub-sample	‡	Packer Test
▯	SPT Liner Sample	▲	Piezometer Tip
▲	Water Sample	⍙	Standpipe

LOGGED W.S. Tsang
DATE 21/10/2006
CHECKED S.C. Wong
DATE 23/10/2006

REMARKS
1. 20L water sample was collected.
2. 17L grab sample was collected.
3. Vibrocore sub samples were taken for chemical testing from 0.00 - 0.90m and 0.90 - 1.30m.

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FUGRO GEOTECHNICAL SERVICES LTD

VIBROCORE RECORD

CONTRACT No.: GE/2005/28	HOLE No. SS5	SHEET: 1 of 1	

PROJECT: Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation

METHOD: Vibrocoring	CO-ORDINATES:	WORKS ORDER No. GE/2005/28.10
MACHINE & No.: FDR-17	E 841526.00 N 836817.00	DATE from: 18/10/2006 to 18/10/2006
FLUSHING MEDIUM: N/A	ORIENTATION: Vertical	SEABED LEVEL + 0.45 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/ end	Water Return %	T C R %	S C R %	R Q D %	F I	Tests	Samples No.	Samples Type	Samples Depth	Reduced Level	Depth (m)	Legend	Grade	Description
												0.45	0.00			
10/10/2006				100					1 2	W00	0.00 0.90 1.00	-0.55	1.00			Yellowish brown (10YR/5/8) to brown (10YR/5/3), slightly silty, fine to coarse SAND with occasional subangular, fine to coarse gravel of moderately strong to strong, granite and tuff and occasional shell fragments. (FILL / MARINE DEPOSIT?)
18/10/2006																End of investigation hole at 1.00m.
													10.00			

1
2
3
4
5
6
7
8
9
10

Small Disturbed Sample	Standard Penetration Test
Piston sample	In-situ Vane Shear Test
U76 Undisturbed Sample	Permeability Test
Vibrocore sample	Impression Packer Test
Vibrocore sub-sample	Packer Test
SPT Liner Sample	Piezometer Tip
Water Sample	Standpipe

LOGGED W.S. Tsang
DATE 21/10/2006
CHECKED S.C. Wong
DATE 23/10/2006

REMARKS
1. 10L water sample was collected.
2. 17L grab sample was collected.
3. Vibrocore sub samples were taken for chemical testing from 0.00 - 0.90m.

FGS Job No.: 05 0400 05 010

FUGRO

FUGRO GEOTECHNICAL SERVICES LTD

VIBROCORE RECORD

HOLE No. SS6

CONTRACT No.: GE/2005/28

SHEET: 1 of 1

PROJECT: Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation

METHOD: Vibrocoring

CO-ORDINATES:
E 841568.00
N 836748.00

WORKS ORDER No. GE/2005/28.10

MACHINE & No.: FDR-17

DATE from: 13/10/2006 to 13/10/2006

FLUSHING MEDIUM: N/A

ORIENTATION: Vertical

SEABED LEVEL -3.15 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/ end	Water Return %	T C R %	S C R %	R Q D %	F I	Tests	Samples No.	Samples Type	Samples Depth	Reduced Level	Depth (m)	Legend	Grade	Description
13/10/2006				100					1	V100	0.00	-3.15	0.00			
																Soft, grey (7.5YR/6/1), sandy SILT/CLAY with occasional shell fragments. (MARINE DEPOSIT)
									2		0.90	-4.05	0.90			Brown (7.5YR/5/4), slightly silty, fine to coarse SAND with much angular to subangular, fine to coarse gravel and cobbles of moderately strong, tuff. (ALLUVIUM)
13/10/2006									3		1.60 1.70	-4.85	1.70			End of investigation hole at 1.70m.

Small Disturbed Sample	Standard Penetration Test
Piston sample	In-situ Vane Shear Test
U76 Undisturbed Sample	Permeability Test
Vibrocore sample	Impression Packer Test
Vibrocore sub-sample	Packer Test
SPT Liner Sample	Piezometer Tip
▲ Water Sample	Standpipe

LOGGED W.S. Tsang

DATE 13/10/2006

CHECKED S.C. Wong

DATE 16/10/2006

REMARKS
1. 20L water sample was collected.
2. 17L grab sample was collected.
3. Vibrocore sub samples were taken for chemical testing from 0.00 - 0.90m and 0.90 - 1.60m.

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VIBROCORE RECORD

HOLE No. SS7

CONTRACT No.: GE/2005/28

SHEET: 1 of 1

PROJECT: **Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation**

METHOD: **Vibrocoring**

CO-ORDINATES:
E **841604.00**
N **836879.00**

WORKS ORDER No. **GE/2005/28.10**

MACHINE & No.: **FDR-17**

DATE from: **18/10/2006** to **18/10/2006**

FLUSHING MEDIUM: **N/A**

ORIENTATION: **Vertical**

SEABED LEVEL **+ 0.20** mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/ end.	Water Return %	T C R %	S C R %	R Q D %	F I	Tests	Samples No.	Samples Type	Samples Depth	Reduced Level	Depth (m)	Legend	Grade	Description
												0.20	0.00			
18/10/2006				100					1	VIOO	0.00					Yellowish brown (10YR/5/8), slightly silty, sandy, subangular to subrounded, fine to coarse GRAVEL and COBBLES of tuff and coral and occasional shell fragments. (ESTUARINE DEPOSIT / ALLUVIUM ?)
									2		0.90					
18/10/2006									3		1.30 1.40	-1.20	1.40			
																End of investigation hole at 1.40m.
													10.00			

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

↕	Small Disturbed Sample	↓	Standard Penetration Test
▤	Piston sample	V	In-situ Vane Shear Test
◪	U76 Undisturbed Sample	I	Permeability Test
▯	Vibrocore sample	‡	Impression Packer Test
I	Vibrocore sub-sample	‡	Packer Test
▯	SPT Liner Sample	▲	Piezometer Tip
▲	Water Sample	▯	Standpipe

LOGGED W.S. Tsang

DATE 21/10/2006

CHECKED S.C. Wong

DATE 23/10/2006

REMARKS
1. 20L water sample was collected.
2. 12L grab sample was collected.
3. Vibrocore sub samples were taken for chemical testing from 0.00 - 0.90m and 0.90 - 1.30m.

FGS Job No.. 05 0460 05 010

FUGRO
FUGRO GEOTECHNICAL SERVICES LTD

VIBROCORE RECORD

HOLE No. SS8

CONTRACT No.: GE/2005/28

SHEET: 1 of 1

PROJECT: Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation

METHOD: Vibrocoring

MACHINE & No.: FDR-17

FLUSHING MEDIUM: N/A

CO-ORDINATES:
E 841618.00
N 836856.00

ORIENTATION: Vertical

WORKS ORDER No. GE/2005/28.10

DATE from: 14/10/2006 to 14/10/2006

SEABED LEVEL -0.30 mPD

Drilling Progress	Casing depth/size	Water Level (m) Shift start/ end	Water Return %	T C R %	S C R %	R Q D %	F I	Tests	Samples No.	Samples Type	Samples Depth	Reduced Level	Depth (m)	Legend	Grade	Description
												-0.30	0.00			
14/10/2006				100					1		0.00					Yellowish brown (10YR/5/8) to brown (10YR/5/3), silty, fine to coarse SAND with occasional subangular, fine to coarse gravel and occasional shell fragments. (MARINE DEPOSIT)
1									2	VI00	0.90	-1.20	0.90			Firm, yellowish brown (10YR/5/8), mottled pink and pale grey, sandy clayey SILT with occasional subangular to subrounded, fine to coarse gravel. (ALLUVIUM)
14/10/2006									3		1.70 1.80	-2.10	1.80			End of investigation hole at 1.80m.
2																
3																
4																
5																
6																
7																
8																
9																
10											10.00					

Small Disturbed Sample	Standard Penetration Test
Piston sample	In-situ Vane Shear Test
U76 Undisturbed Sample	Permeability Test
Vibrocore sample	Impression Packer Test
Vibrocore sub-sample	Packer Test
SPT Liner Sample	Piezometer Tip
▲ Water Sample	Standpipe

LOGGED W.S. Tsang

DATE 21/10/2006

CHECKED S.C. Wong

DATE 23/10/2006

REMARKS
1. 20L water sample was collected.
2. 12L grab sample was collected.
3. Vibrocore sub samples were taken for chemical testing from 0.00 - 0.90m and 0.90 - 1.70m.

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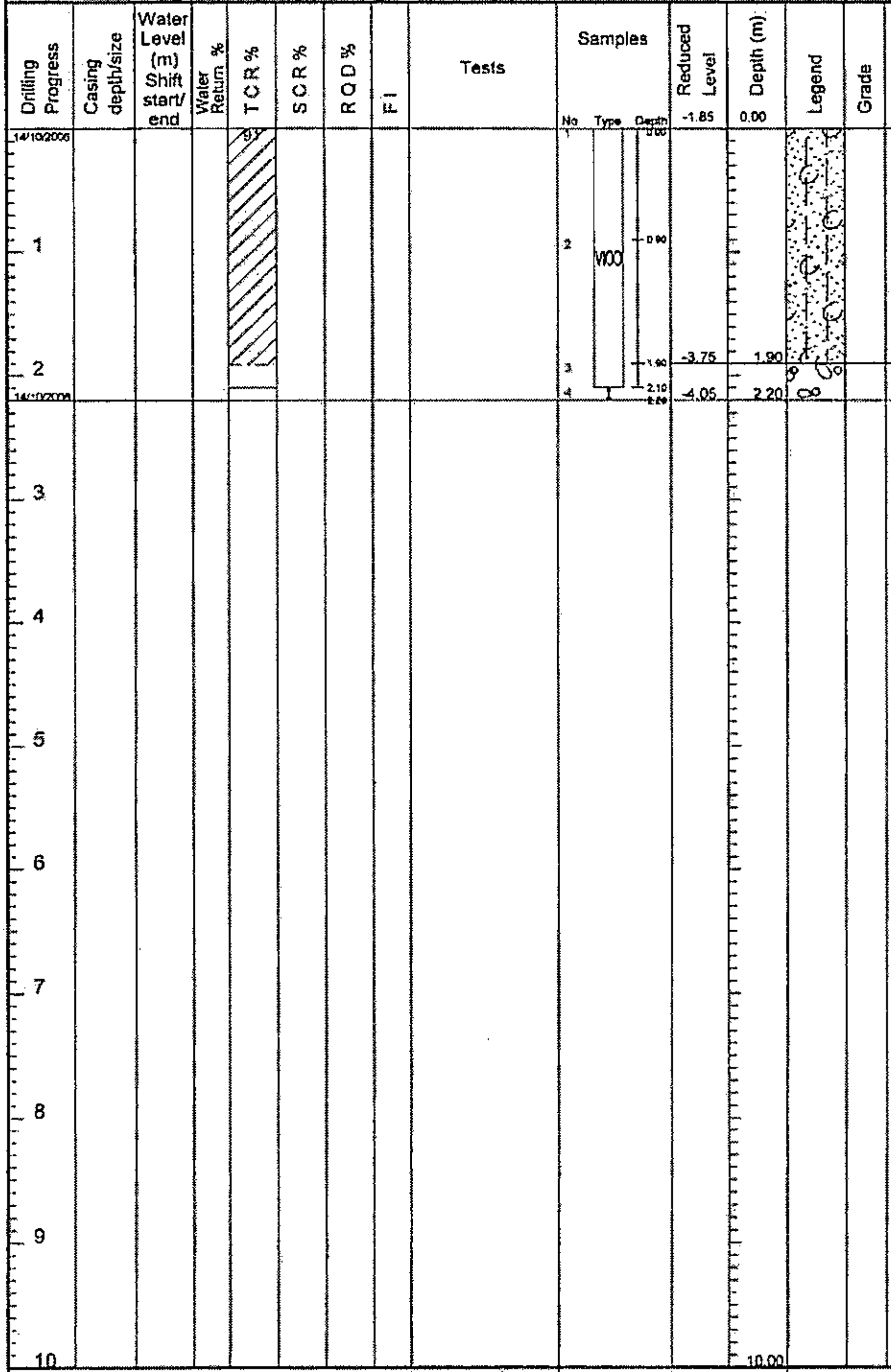
FUGRO GEOTECHNICAL SERVICES LTD

VIBROCORE RECORD

HOLE No.	**SS9**
CONTRACT No.: **GE/2005/28**	SHEET: **1** of **1**

PROJECT: **Agreement No. CE 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation**

METHOD: **Vibrocoring**	CO-ORDINATES: E **841656.00** N **836809.00**	WORKS ORDER No. **GE/2005/28.10**
MACHINE & No.: **FDR-17**		DATE from: **14/10/2006** to **14/10/2006**
FLUSHING MEDIUM: **N/A**	ORIENTATION: **Vertical**	SEABED LEVEL **-1.85** mPD



Description

Yellowish brown (10YR/5/8), spotted white, slightly silty, fine to coarse SAND with much shell fragments. (MARINE DEPOSIT)

Yellowish brown (10YR/5/8) to brownish yellow (10YR/6/8), subangular to subrounded, fine to coarse GRAVEL and COBBLES of moderately strong, tuff in matrix of sand silt. (ALLUVIUM)

End of investigation hole at 2.20m.

Small Disturbed Sample	Standard Penetration Test		
Piston sample	In-situ Vane Shear Test		
U76 Undisturbed Sample	Permeability Test		
Vibrocore sample	Impression Packer Test		
Vibrocore sub-sample	Packer Test		
SPT Liner Sample	Piezometer Tip		
▲ Water Sample	Standpipe		

LOGGED W.S. Tsang
DATE 21/10/2006
CHECKED S.C. Wong
DATE 23/10/2006

REMARKS

1. 30L water sample was collected.
2. 12L grab sample was collected.
3. Vibrocore sub samples were taken for chemical testing from 0.00 - 0.90m, 0.90 - 1.90m and 1.90 - 2.10m.

FGS Job No.: 05 0460 05 010

Appendix C

Record of Sediment Sampling & Collection under ETWB TC(W) No. 34/2002

RECORD OF SEDIMENT SAMPLING & COLLECTION UNDER ETWB TC(W) NO. 34/2002

(Sheet 1 of 2)

Project Name: Agreement No. CE 59/2005 (EP), Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Traffic Impact Assessments - Investigation

Contract No.: GE/2005/28

Name of Project Proponent: Civil Engineering and Development Department, Port Works Division

Address: 4/F, Civil Engineering and Development Building, 101, Princess Margaret Road, Homantin, Kowloon, Hong Kong

Contract Person: Mr Ricky Wong

Telephone No.: 2762 5564

E-mail address: rickycpwong@cedd.gov.hk

Fax No.: 2714 2054

Sediment Sampling

Sample ID No.	Sampling Date & Time	Sampling Location (latitude/ longitude or Northing /Easting)	Sampling Depth (starting & finishing levels)	Method of Collection (e.g. grab, vibrocore, etc)	Analysis requested																		Remarks
					Metals	Metalloid	LMW PAHs	HMW PAHs	Total PCBs	TBT	Others (please specify)												
											Chlorinated Pesticides	Particle Size	Redox Potential	TOC	TKN	Nitrite	Nitrate	Ammonia Nitrogen	Ortho -phosphate	Total phosphorus	SOD	COD	
SS1	20/10/2006	E 841448.00 N 836819.00	+0.55 to -0.35mPD, & -0.35 to -0.65mPD	Vibrocore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20L water sample and 12L grab samples were also collected
SS2	19/10/2006	E 841435.00 N 836779.00	+0.35 to -0.55mPD, -0.55 to -1.55mPD & -1.55 to -2.15mPD	Vibrocore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	30L water sample and 12L grab samples were also collected
SS3	13/10/2006	E 841476.00 N 836709.00	-3.25 to -4.15mPD, -4.15 to -5.15mPD & -5.15 to -6.05mPD	Vibrocore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	30L water sample and 12L grab samples were also collected
SS4	19/10/2006	E 841509.00 N 836837.00	+0.45 to -0.45mPD, & -0.45 to -0.85mPD	Vibrocore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20L water sample and 17L grab samples were also collected
SS5	18/10/2006	E 841526.00 N 836817.00	+0.45 to -0.45mPD	Vibrocore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	10L water sample and 17L grab samples were also collected
SS6	13/10/2006	E 841568.00 N 836748.00	-3.15 to -4.05mPD, & -4.05 to -4.75mPD	Vibrocore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20L water sample and 17L grab samples were also collected

RECORD OF SEDIMENT SAMPLING & COLLECTION UNDER ETWB TC(W) NO. 34/2002

(Sheet 2 of 2)

SS7	18/10/2006	E 841604.00 N 836879.00	+0.20 to -0.70mPD, & -0.70 to -1.10mPD	Vibrocore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20L water sample and 12L grab samples were also collected
SS8	14/10/2006	E 841618.00 N 836856.00	-0.30 to -1.20mPD, & -1.20 to -2.00mPD	Vibrocore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20L water sample and 12L grab samples were also collected
SS9	14/10/2006	E 841656.00 N 836809.00	-1.85 to -2.75mPD, -2.75 to -3.75mPD & -3.75 to -3.95mPD	Vibrocore	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	30L water sample and 12L grab samples were also collected
PS6	24/10/2006	E 850234.00 N 820057.00	-	Grab	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	-

Sampling Conducted by:		**Sampling Supervised by (if any):**		**Samples Received by:**	
Company Name: Fugro Geotechnical Services Ltd		Company Name: CEDD – Port Works Division		Name of Laboratory: Lam Laboratories Limited	
Units 8-11, 10/F Worldwide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, Hong Kong		Address: 4/F, Civil Engineering and Development Building, 101, Princess Margaret Road, Homantin, Kowloon, Hong Kong		Address: Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chai Wan, Hong Kong	
Person-in-charge: Mr Y Y Ho	Signature:	Responsible Person: Mr S C Ho	Signature:	Responsible Person: Maureen Chang	Signature:
Phone No.: 2697 1126	Date & Time: 25/10/2006	Phone No.: 6208 3156	Date & Time: 25/10/2006	Phone No.: 2975 3372	Date & Time: 25/10/2006

Appendix D

Final Report on Biological Testing and Chemical Ancillary

Amphipod Test

TEST REPORT

Report No.	:	102240N
Project Name	:	Agreement No. EP 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation
Customer Name	:	Geotechnical Projects Division, Geotechnical Engineering Office, Civil Engineering and Development Department
Customer Address	:	8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong
Contract No.	:	GE/2005/47
Works Order No.	:	GE/2005/47.22
Lab. Job No.	:	J469
Lab. Sample Ref. No.	:	18507/1-4
No. of Sample(s) & Description	:	9 no. of samples were received on chilled condition. The samples are said to be sediment, however contain large amount of sand and stone. 4 no. of samples were tested including Composite Sample No. CS1-CS3[5] and Reference Sediment prepare as per customer's instruction
Sample Receive Date	:	14 - 24 Oct, 2006
Test Date	:	6 - 16 Dec, 2006

Test Parameter

Parameter	Test Method
Amphipod Sediment Bioassay	USEPA 1994

Note(s):
1. Results related to sample(s) as received.
2. NA = Not applicable.
3. Uncertainty is calculated as 2 SD.
4. Standard Method: Methods for Assessing Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods. EPA/600/R-94/025, USEPA, 1994.
5. The composite samples were mixed in unequal portion due to the stony nature of the samples.
6. This is the final report and supersedes the draft report with the same report number.

Authorized signatory: ____________________
Yi Zhang
(Ecotoxicologist)

Date: 30-Jan-2007

Remark(s): This report shall not be reproduced, except in full, without prior written approval from Lam Laboratories Ltd.

Test report

Report no.: 102240N

1. Method

This 10-day toxicity test with Leptocheirus plumulosus was conducted using the USEPA method (1994) "Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods". Leptocheirus plumulosus is exposed to the test sediment overlaid with seawater for a 10-day test period and survival rate is determined as the primary endpoint.

2. Sample storage and pretreatment

All samples were homogenized thoroughly. Debris and indigenous organisms present in the sediment were removed and the sediment samples were stored at 4°C in dark until analyzed.

3. Test organism

Species:	*Leptocheirus plumulosus*
Source:	Purchased from research organism supplier from USA, mortality during shipping was 1.91%
Size/age:	3-4 mm in length
Acclimation:	under test conditions with feeding provided, as per USEPA 1994, mortality during acclimation was 2.44%
Health condition:	healthy

4. Summary of test particulars

Type of test:	static
Duration:	6 - 16 Dec, 2006
Control sediment:	mud and sand collected from a clean area on the eastern coast of the New Territories and Hong Kong Island respectively, shipped to the laboratory on the same day, sieved through 425 micrometer mesh sieve, mixed and stored at 4°C in dark dark until use
Control seawater:	reconstituted seawater prepared with the Instant Ocean salt at 20 ppt, aerated for two days after preparation
Test temperature:	25±1°C
Lighting:	continuous
Aeration:	provided (around 100 bubbles/min)
Test vessel:	1000ml glass jars
Volume of sediment:	175ml
Volume of overlying water:	775 ml
No. of replicates:	5
No. of organisms/replicate:	20
Feeding:	none
Monitoring:	temperature, DO, pH and salinity in overlying water everyday, ammonia in overlying water at test initiation and termination
Reference toxicant test:	96 hour water only test with $CdCl_2$

Report no.: 102240N

5. Summary of test results

Table 1. Survival of amphipods on Day 10

Sample ID	Number of living amphipod on Day 10						
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	Mean	SD
Negative Control with sediment	18	19	18	18	20	18.6	0.9
Composite Sample No.CS1	14	17	20	16	20	17.4	2.6
Composite Sample No.CS2	17	17	15	16	18	16.6	1.1
Composite Sample No.CS3	15	16	17	14	14	15.2	1.3
Reference sediment	17	19	16	18	17	17.4	1.1

Table 2. Survival percentage of amphipods on Day 10

Sample ID	Survival percentage of amphipod on Day 10 (%)						
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	Mean	SD
Negative Control with sediment	90	95	90	90	100	93.0	4.5
Composite Sample No.CS1	70	85	100	80	100	87.0	13.0
Composite Sample No.CS2	85	85	75	80	90	83.0	5.7
Composite Sample No.CS3	75	80	85	70	70	76.0	6.5
Reference sediment	85	95	80	90	85	87.0	5.7

Table 3. Summary of the amphipod survival in relation to the reference sediment

Sample ID	Survival in relation to reference site (%)	Difference between sample and reference sediment (t-test)
Composite Sample No.CS1	100.0	NA[1]
Composite Sample No.CS2	95.4	NA[1]
Composite Sample No.CS3	87.4	NA[1]
NA [1]. As the average survival of the amphipods for the test sediment was no less than 80% of that of the reference sediment, statistical analysis is not required.		

End of Page

Report no.: 102240N

6. Test validity

Table 4. Test validity criteria and water quality ranges in the amphipod test

Parameter	Minimum during the test period	Maximum during the test period	Acceptable Range in USEPA 1994
Overlying salinity	19 ppt	21 ppt	19-21 ppt
Dissolved oxygen	6.5 mg/L	7.3 mg/L	>4.7 mg/L [1]
Overlying pH	6.8	8.0	NA [2]
Temperature	24.3 °C	25.3 °C	22.0-28.0 °C time-average 24.0-26.0 °C
Total ammonia in overlying water (initiation/termination)	0.01 mg/L	0.22 mg/L	<60 mg/L [3]
Interstitial salinity (initiation)	30 ppt	31 ppt	1.5-32 ppt
Interstitial pH (initiation)	7.9	8.1	NA [2]
Amphipod survival in the negative control	90-100% , averagely 93.0 %		≥ 90% average ≥ 80% in any individual replicate
96-h LC_{50} obtained from the reference toxicant test	0.77 mg/L		0.92±0.38 mg/L

1. 60% of saturation level at 20 ppt
2. pH is not adjusted or controlled
3. The acceptance level for overlying ammonia was < 20 mg/L in ETWB TCW 34/2002. When this level is exceeded, additional set of amphipod test is conducted with purging of sediment.

As shown in Table 4, the water quality parameters during the test period ranged within acceptable limits: temperature ranged from 24.3 to 25.3 °C, the dissolved oxygen level ranged from 6.5 to 7.3 mg/L, pH ranged from 6.8 to 8.0, the salinity ranged from 19 to 21 ppt. As a result, the data are interpretable.

The tests were validated by acceptable survival of control organisms. The average survival rate in controls was greater than 90% and survival rate in any control replicates greater than 80%.

The organisms also demonstrated comparable sensitivity to the reference toxicant (cadmium). The 96-hr LC_{50} for *Leptocheirus plumulosus* obtained was 0.77 mgCd/L and found within the laboratory control limits (Mean±2STD, i.e., 0.92 ±0.38 mgCd/L). Therefore, the data are acceptable.

End of report

Data entry checked by:
Y.M. Choy / ~~W.K. Cheuk~~

Polychaete Test

TEST REPORT

Report No.	:	102242N
Project Name	:	Development of a Bathing Beach at Lung Mei, Tai Po Environmental, Drainage and Tracffic of Marine Sediment and
Customer Name	:	Geotechnical Projects Division, Geotechnical Engineering Office, Civil Engineering and Development Department
Customer Address	:	8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong
Contract No.	:	GE/2005/47
Works Order No.	:	GE/2005/47.22
Lab. Job No.	:	J469
Lab. Sample Ref. No.	:	18507/1-4
No. of Sample(s) & Description	:	9 no. of samples were received on chilled condition. The samples are said to be sediment, however contain large amount of sand and stone. 4 no. of samples were tested including Composite Sample No. CS1-CS3[5] and Reference Sediment prepa as per customer's instruction
Sample Receive Date	:	14 - 24 Oct, 2006
Test Date	:	7 - 27 Dec, 2006

Test Parameter

Parameter	Test Method
Polychaete Sediment Bioassay	PSEP 1995

Note(s):
1. Results related to sample(s) as received.
2. NA = Not applicable.
3. Uncertainty is calculated as 2 SD.
4. Standard method: Puget Sound Estuary Program Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments, USEPA, Revised July 1995.
5. The composite samples were mixed in unequal portion due to the stony nature of the samples.
6. This is the final report and supersedes the draft report with the same report number.

Authorized signatory: ____________________ **Date:** 30-Jan-2007

Yi Zhang
(Ecotoxicologist)

Remark(s): This report shall not be reproduced, except in full, without prior written approval from Lam Laboratorie

Test report

Report No.: 102242N

1. Method

This 20-day toxicity test on sediment with Neanthes arenaceodentata was conducted using the PSEP method (1995) "Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments". *Neanthes arenaceodentata* is exposed to the test sediment overlaid with seawater for a 20-day test period. The endpoints are survival and growth.

2. Sample storage and pretreatment

All samples were homogenized thoroughly. Debris and indigenous organisms present in the sediment were removed and the sediment samples were stored at 4oC in dark until analyzed.

3. Test organism

Species:	*Neanthes arenaceodentata*
Source:	Purchased from research organism supplier from USA, mortality during shipping was 0%
Age/size:	2-3 weeks post emergence
Acclimation:	under test conditions with feeding provided, as per USEPA 1994, mortality during acclimation was 0%
Health condition:	healthy
Mean initial dry weight:	0.85mg/worm

4. Summary of test particulars

Type of test:	renewal every three days
Duration:	7 - 27 Dec, 2006
Control sediment:	mud and sand collected from a clean area on the eastern coast of the New Territories and Hong Kong Island respectively, shipped to the laboratory on the same day, sieved through 425 micrometer mesh sieve, mixed and stored at 4°C in dark dark until use
Control seawater:	reconstituted seawater prepared with the Instant Ocean salt at 28 ppt, aerated for two days after preparation
Test temperature:	20±1°C
Lighting:	continuous
Aeration:	provided (around 100 bubbles/min)
Test vessel:	1000ml glass jars
Volume of sediment:	175ml
Volume of overlying water:	775 ml
No. of replicates:	5
No. of organisms/replicate:	5
Feeding:	Tetramarin powder, 8 mg per worm each time, once every two days
Monitoring:	temperature, DO, pH and salinity in overlying water everyday, ammonia in overlying water at test initiation and termination
Reference toxicant test:	96 hour water only test with $CdCl_2$

Test report

Report No.: 102242N

5. Summary of test results

Table 1. Survival of polychaetes on Day 20

Sample ID	Number of living polychaete on Day 20						
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	Mean	SD
Negative control with sediment	5	5	5	5	5	5.0	0.0
Composite Sample No. CS1	5	5	5	5	5	5.0	0.0
Composite Sample No. CS2	5	5	5	5	5	5.0	0.0
Composite Sample No. CS2	5	5	5	5	5	5.0	0.0
Reference sediment	5	5	5	5	5	5.0	0.0

Table 2. Survival percentage of polychaetes on Day 20

Sample ID	Survival percentage of polychaete on Day 20 (%)						
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	Mean	SD
Negative control with sediment	100	100	100	100	100	100.0	0.0
Composite Sample No. CS1	100	100	100	100	100	100.0	0.0
Composite Sample No. CS2	100	100	100	100	100	100.0	0.0
Composite Sample No. CS3	100	100	100	100	100	100.0	0.0
Reference sediment	100	100	100	100	100	100.0	0.0

Table 3. Total dry weight of polychaetes on Day 20

Sample ID	Total dry weight of polychaete on Day 20 (mg)						
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	Mean	SD
Negative control with sediment	96.92	81.02	97.20	79.05	85.70	88.0	8.6
Composite Sample No. CS1	57.03	38.22	66.32	47.41	82.52	58.3	17.1
Composite Sample No. CS2	81.01	54.46	70.45	70.91	96.13	74.6	15.3
Composite Sample No. CS3	75.07	69.29	64.24	83.02	63.73	71.1	8.1
Reference sediment	74.22	64.33	88.72	96.21	73.53	79.4	12.8

Table 4. Summary of the total dry weight of polychaetes in relation to the reference sediments

Sample ID	Total dry weight in relation to reference site (%)	Difference between sample and reference sediment (t-test)
Composite Sample No. CS1	73.4	Significantly different, t critical=1.86, t stat=-2.205, p<0.05 (one tail)
Composite Sample No. CS2	93.9	NA [1]
Composite Sample No. CS3	89.5	Insignificantly different, t critical=1.86, t stat=-1.228, p=0.127 (one tail)
NA[1] - As the average total dry weight for the test sediment was no less than 90% of that of the reference sediment, statistical analysis is not required.		

Test report

Report No.: 102242N

6. Test validity

Table 5. Test validity criteria and water quality ranges in the polychaete test

Parameter	Minimum during the test period	Maximum during the test period	Control Limit
Overlying salinity	26 ppt	30 ppt	26-30 ppt
Dissolved oxygen	6.5 mg/L	7.3 mg/L	not specified
Overlying pH	6.8	8.0	NA [1]
Temperature	19.7 °C	20.3 °C	19-21°C
Unionized ammonia in overlying water (initiation/termination)	<0.002 mg/L	0.01 mg/L	NA [2]
Interstitial salinity (initiation/termination)	28 ppt	29 ppt	>20ppt
Interstitial pH (initiation/termination)	6.7	7.4	NA [1]
Polychaete survival in the negative control	All 100% , averagely 100.0%		≥ 90% average ≥ 80% in any individual replicate
96-h LC_{50} obtained from the reference toxicant test	11.53 mg/L		10.54±2.13 mg/L

1. pH is not adjusted or controlled
2. Overlying ammonia is not controlled. Results could be qualified as possible false positive when unionized ammonia greater than 0.7 mg/L

As shown in Table 5, the water quality parameters during the test period ranged within acceptable limits: temperature ranged from 19.7 to 20.3 °C, the salinity ranged from 26 to 30 ppt. As a result, the data are interpretable.

The tests were validated by acceptable survival of control organisms. The average survival rate in controls was greater than 90% and survival rate in any control replicates greater than 80%.

The organisms also demonstrated comparable sensitivity to the reference toxicant (cadmium). The 96-hr LC_{50} for *Neanthes arenaceodentata* obtained was 11.53 mgCd/L and found within the laboratory control limits (Mean±2STD, i.e., 10.54±2.13 mgCd/L). Therefore, the data are acceptable.

End of report

Data entry checked by:
Y.M.Choy ~~W.K.Cheuk~~

Bivalve Test

TEST REPORT

Report No.	:	102241N
Project Name	:	Agreement No. EP 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation
Customer Name	:	Geotechnical Projects Division, Geotechnical Engineering Office, Civil Engineering and Development Department
Customer Address	:	8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong
Contract No.	:	GE/2005/47
Works Order No.	:	GE/2005/47.22
Lab. Job No.	:	J469
Lab. Sample Ref. No.	:	18507/1-4
No. of Sample(s) & Description	:	9 no. of samples were received on chilled condition. The samples are said to be sediment, however contain large amount of sand and stone. 4 no. of samples were tested including Composite Sample No. CS1-CS3[5] and Reference Sediment prepa as per customer's instruction
Sample Receive Date	:	14 - 24 Oct, 2006
Test Date	:	27 - 29 Nov, 2006

Test Parameter

Parameter	Test Method
Bivalve Larvae Sediment Bioassay	PSEP 1995

Note(s):
1. Results related to sample(s) as received.
2. NA = Not applicable.
3. Uncertainty is calculated as 2 SD.
4. Standard method: Puget Sound Estuary Program Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments, USEPA, Revised July 1995.
5. The composite samples were mixed in unequal portion due to the stony nature of the samples.
6. This is the final report and supersedes the draft report with the same report number.

Authorized signatory: ______________________ **Date:** 30-Jan-2007

Yi Zhang
(Ecotoxicologist)

Remark(s): This report shall not be reproduced, except in full, without prior written approval from Lam Laboratories Ltd

Test report

Report No.: 102241N

1. Method

This bivalve larvae test with Crassostrea gigas was conducted using the PSEP method (1995) "Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments". Bivalve adults are induced to spawn and gametes are fertilized. After fertilization the embryos are immediately exposed to the test sediment overlaid with seawater and allowed to develop for 48-60 hours. The normality survival of larvae is determined as endpoint.

2. Sample storage and pretreatment

All samples were homogenized thoroughly. Debris and indigenous organisms present in the sediment were removed and the sediment samples were stored at 4oC in dark until analyzed.

3. Test organism

Species:	*Crassostrea gigas*
Source:	purchased from a research organism supplier in UK
Acclimation:	24 hours under test conditions, as per PSEP 1995, mortality during acclimation was 0 %
Conditions of eggs:	mature and clean
Conditions of sperms:	active
Fertilization rate:	89.9%
Mean initial stocking:	37398 fertilized eggs per test chamber

4. Summary of test particulars

Type of test:	static and non-renewal
Duration:	27 -29 November, 2006, 48 hours in total
Control seawater:	collected from a clean area on the eastern coast of the Hong Kong Island, filtered through 0.45 mm filter paper, adjusted to 28 ppt, aerated for two days after preparation
Test temperature:	20±1°C
Lighting:	14h light : 10h dark cycle
Aeration:	provided (around 100 bubbles/min)
Test vessel:	1000ml glass jars
Volume of sediment:	18g
Volume of overlying water:	900 ml
No. of replicates:	5
Feeding:	none
Monitoring:	temperature, DO, pH and salinity in overlying water everyday, and termination ammonia in overlying water at test initiation
Reference toxicant test:	48 hour water only test with $CdCl_2$

Report No.: 102241N

5. Summary of test results

Table 1. Total number of normal larvae in each test chamber at test termination

Sample ID	Number of normal larvae in each test chamber at test termination						
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	Mean	SD
Negative Control with Seawater I	26000	25400	24500	26000	27500	25880.0	1094.1
Negative Control with Seawater II	26000	27800	24500	28000	26500	26560.0	1429.3
Composite Sample No. CS 1	18700	17900	18100	18900	19000	18520.0	491.9
Composite Sample No. CS 2	17900	17800	19100	19900	20100	18960.0	1080.7
Composite Sample No. CS 3	17400	17600	16900	17900	18100	17580.0	465.8
Reference sediment	21100	20900	23100	22400	19700	21440.0	1333.4

Table 2. Combined normality/survival of the bivalve larvae at test termination

Sample ID	Normality survival of bivalve larvae at test termination (%)						
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	Mean	SD
Negative Control with Seawater I	69.5	67.9	65.5	69.5	73.5	69.2	2.9
Negative Control with Seawater II	69.5	74.3	65.5	74.9	70.9	71.0	3.8
Composite Sample No. CS 1	50.0	47.9	48.4	50.5	50.8	49.5	1.3
Composite Sample No. CS 2	47.9	47.6	51.1	53.2	53.7	50.7	2.9
Composite Sample No. CS 3	46.5	47.1	45.2	47.9	48.4	47.0	1.2
Reference sediment	56.4	55.9	61.8	59.9	52.7	57.3	3.6

Table 3. Summary of the normality survival of bivalve larvae in relation to the reference sediments

Sample ID	Normality survival in relation to reference site (%)	Difference between sample and reference sediment (t-test)
Composite Sample No. CS 1	86.4	NA [1]
Composite Sample No. CS 2	88.4	NA [1]
Composite Sample No. CS 3	82.0	NA [1]
NA[1] - As the average normality survival of the bivalve larvae for the test sediment was no less than 80% of that of the reference sediment, statistical analysis is not required.		

Report No.: 102241N

6. Test validity

Table 4. Test validity criteria and water quality ranges in the bivalve test

Parameter	Minimum during the test period	Maximum during the test period	Control Limit
Overlying salinity	27 ppt	29 ppt	27-29ppt
Dissolved oxygen	6.4 mg/L	7.2 mg/L	>4.5mg/L [1]
Overlying pH	6.8	7.9	NA [2]
Temperature	19.8 °C	20.5 °C	19.0-21.0°C
Unionized ammonia in overlying water (initiation/termination)	<0.002 mg/L	0.004 mg/L	NA [3]
Larvae normality survival in the negative control	65.5 - 74.9% , averagely 70.1%		≥ 70% averagely
48-h EC_{50} obtained from the reference toxicant test	1.35 mg/L		1.45 ± 0.36 mg/L

1. 60% of saturation level at 28 ppt
2. pH is not adjusted or controlled
3. Overlying ammonia is not controlled. Results could be qualified as possible false positive when ammonia (unionized) is greater than 0.13 mg/L

As shown in Table 4, the water quality parameters during the test period ranged within control limits: temperature ranged from 19.8 to 20.5 °C, the dissolved oxygen level ranged from 6.4 to 7.2 mg/L, pH ranged from 6.8 to 7.9, the salinity ranged from 27 to 29 ppt. As a result, the data are interpretable.

The tests were validated by acceptable normality survival of control organisms. The average normality survival rate in controls was greater than 70%.

The organisms also demonstrated comparable sensitivity to the reference toxicant (cadmium). The 48-hr EC_{50} for *Crassostrea gigas* obtained was 1.35 mgCd/L and found within the laboratory control limits (Mean±2STD, i.e., 1.45±0.36 mgCd/L). Therefore, the data are acceptable.

End of Report

Data entry checked by:
Y.M.Choy/~~W.K.Cheuk~~

Ancillary Tests

Interstitial Ammonia

TEST REPORT

Report No.	:	102243N
Project Name	:	Agreement No. EP 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact
Customer Name	:	Geotechnical Projects Division, Geotechnical Engineering Office, Civil Engineering and Development Department
Customer Address	:	8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong
Contract No.	:	GE/2005/47
Works Order No.	:	GE/2005/47.22
Lab. Job No.	:	J469
Lab. Sample Ref. No.	:	18507/1-4
No. of Sample(s) & Description	:	9 no. of samples were received on chilled condition. The samples are said to be sediment, however contain large amount of sand and stone. 4 no. of samples were tested including Composite Sample No. CS1-CS3[3] and Reference Sediment prepared as per customer's instruction
Sample Receive Date	:	14 - 24 Oct, 2006
Test Date	:	8-Dec-06

Test Parameter

Parameter	Test Method
Interstitial ammonia	APHA 4500-NH3 F. Phenate Method

Note(s):
1. Results related to sample(s) as received.
2. NA = Not applicable.
3. The composite samples were mixed in unequal portion due to the stony nature of the samples.
4. This is the final report and supersedes the draft report with the same report number.

Authorized signatory: **Date:** 30-Jan-2007

Yi Zhang
(Ecotoxicologist)

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Test report

Report no.: 102243N

Sample ID	Interstitial ammonia (mgNH_3/L)
Composite Sample No. CS1	See Note 1
Composite Sample No. CS2	See Note 1
Composite Sample No. CS3	See Note 1
Reference Sediment	0.5
Detection limit	0.03
Note 1 - Analysis was not performed due to insufficient amount of porewater obtained.	

Sample duplicate

Sample ID	Relative deviation (%)
Reference Sediment	1.2
Control limits	±20% from the mean

Sample Spike

Sample ID	Spike recovery (%)
Reference Sediment	101.0
Control limits	80-120% from the nominal value

End of Report

Data entry checked by:

~~W.K. Cheuk~~ / Y.M.Choy

Interstitial Salinity

TEST REPORT

Report No.	:	102244N
Project Name	:	Agreement No. EP 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation
Customer Name	:	Geotechnical Projects Division, Geotechnical Engineering Office, Civil Engineering and Development Department
Customer Address	:	8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong
Contract No.	:	GE/2005/47
Works Order No.	:	GE/2005/47.22
Lab. Job No.	:	J469
Lab. Sample Ref. No.	:	18507/1-4
No. of Sample(s) & Description	:	9 no. of samples were received on chilled condition. The samples are said to be sediment, however contain large amount of sand and stone. 4 no. of samples were tested including Composite Sample No. CS1-CS3[3] and Reference Sediment prepared as per customer's instruction
Sample Receive Date	:	14 - 24 Oct, 2006
Test Date	:	6-Dec-06

Test Parameter

Parameter	Test Method
Interstitial salinity	APHA 2502 B

Note(s):
1. Results related to sample(s) as received.
2. NA = Not applicable.
3. The composite samples were mixed in unequal portion due to the stony nature of the samples.
4. This is the final report and supersedes the draft report with the same report number.

Authorized signatory: Date: 30-Jan-2007

Yi Zhang
(Ecotoxicologist)

Test report

Report no.: 102244N

Sample ID	Interstitial salinity (ppt)
Composite Sample No. CS 1	See Note 1
Composite Sample No. CS 2	See Note 1
Composite Sample No. CS 3	See Note 1
Reference sediment	34
Detection limit	NA
Note 1 - Analysis was not performed due to insufficient amount of porewater obtained.	

Sample duplicate

Sample ID	Relative deviation (%)
Reference sediment	-2.7
Control limits	±20% from the mean

Standard check

Sample ID	Recovery (%)
Reference standard	99.4
Control limits	80-120% from the nominal value

End of Report

Data entry checked by: ~~W.K. Cheuk~~ / Y.M.Choy

TOC, Grains Size & Moisture Content

TEST REPORT

Report No.	:	102245N
Project Name	:	Agreement No. EP 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation
Customer Name	:	Geotechnical Projects Division, Geotechnical Engineering Office, Civil Engineering and Development Department
Customer Address	:	8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong
Contract No.	:	GE/2005/47
Works Order No.	:	GE/2005/47.22
Lab. Job No.	:	J469
Lab. Sample Ref. No.	:	18507/1-4
No. of Sample(s) & Description	:	9 no. of samples were received on chilled condition. The samples are said to be sediment, however contain large amount of sand and stone. 4 no. of samples were tested including Composite Sample No. CS1-CS3[4] and Reference Sediment prepared as per customer's instruction
Sample Receive Date	:	14 - 24 Oct, 2006
Test Date	:	6 Dec 2006 - 11 Jan 2007

Test Parameter

Parameter	Test Method
Grain size	Geospec 3: Test 8.1
Moisture content	Geospec 3: Test 5.2
Total Organic Carbon	ALS Method Code EP-009

Note(s):
1. Results related to sample(s) as received.
2. NA = Not applicable.
3. The TOC samples were subcontracted to ALS Technichem (HK) Pty Ltd.
4. The composite samples were mixed in unequal portion due to the stony nature of the samples.
5. This is the final report and supersedes the draft report with the same report number.

Authorized signatory: ____________ **Date:** 30-Jan-2007

Yi Zhang
(Ecotoxicologist)

Test report

Report No. : 102245N
Project Name : Agreement No. EP 59/2005 (EP) Development of a Bathing Beach at Lung Mei, Tai Po Environmental Drainage and Traffic Impact Assessments - Investigation
Customer Name : Geotechnical Projects Division, Geotechnical Engineering Office, Civil Engineering and Development Department
Contract No. : GE/2005/47
Works Order No. : GE/2005/47.22
Lab. Sample Ref. No. : 18507/1-4

Sample ID	Grain Size < 63 mm (%)	Moisture Content [1] (%)	TOC (% Wet Weight)	TOC (% Dry Weight) [2]
Composite Sample No. CS1	4	12	<0.05	<0.1
Composite Sample No. CS2	5	10	<0.05	<0.1
Composite Sample No. CS3	22	12	<0.05	<0.1
Reference sediment	90	116	0.37	0.80
Detection Limit	NA	NA	0.05	0.1
Note 1. Moisture content is calculated as: (Sample Wet Weight – Sample Dry Weight) / Sample Dry Weight x 100%				

End of Report

Data entry checked by: ~~W. K. Cheuk~~ / Y.M.Choy

TEST REPORT ON
DETERMINATION OF MOISTURE CONTENT

(By oven drying at 105°C ± 5°C)

Report No: 102235N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No :** GE/2005/47.22

Date Samples Received : 29/11/2006

Tested in Accordance With : GEOSPEC 3: 2001 Test 5.2

Composite Sample No.	Sample				Lab. Sample Ref. No.	Date Tested	Tested By	Description	Geological Origin	Moistur Conter %
	No.	Depth m	Type	Specimen Depth m						
CS1			Bulk		18507/1	4/12/06	HWC	Brown, slightly silty, very gravelly SAND with some shell fragments	Sediment	1
CS2			Bulk		18507/2	4/12/06	HWC	Brown, silty, very gravelly SAND with some shell fragments	Sediment	1
CS3			Bulk		18507/3	4/12/06	HWC	Yellowish brown, silty, clayey, very gravelly SAND	Sediment	1
Reference Sediment			Bulk		18507/4	4/12/06	HWC	Grey, slightly sandy CLAY with occasional shell fragments	Sediment	11

Remarks:

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 1 of 2)

Report No: 102236N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Client Name & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/1

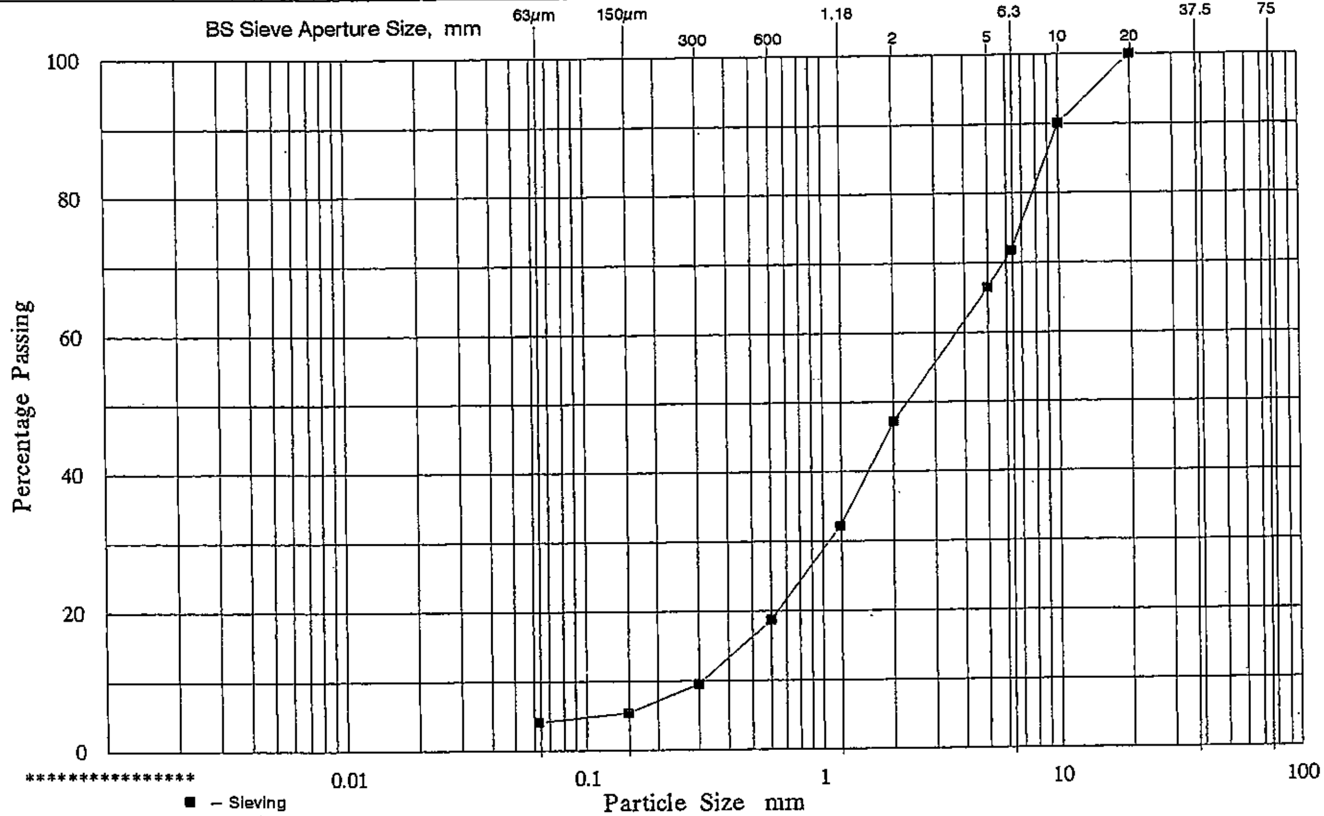
Composite Sample No. : CS1 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Brown, slightly silty, very gravelly SAND with some shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COB-BLES
	SILT			SAND			GRAVEL			

Remarks:

SUMMARY :

GRAVEL	53 %
SAND	43 %
SILT & CLAY	4 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

Lam Laboratories Limited Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong Tel: 28973282

TEST|GEO36|PSDA (19970811)

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 102236N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/1

Composite Sample No. : CS1 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Brown, slightly silty, very gravelly SAND with some shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 202.90

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	202.90	*cum. mass ret. + m2 =*		*202.90*
Riffled m3 20.0	202.90	*difference from m1 % =*		*0.00*
Washed m4	194.57	Note: m4 = mass >63um		
10.0	20.07	20.07	9.9	90.1
6.3	37.21	37.21	18.3	71.8
Passing m5 6.3	137.29	*cum. mass ret. + m5 =*		*194.57*
Riffled m6 6.3	137.29	*difference from m4 % =*		*0.00*
5.00	10.73	10.73	5.3	66.5
2.00	39.00	39.00	19.2	47.3
1.18	30.79	30.79	15.2	32.1
0.600	27.19	27.19	13.4	18.7
0.300	18.53	18.53	9.1	9.6
0.150	8.30	8.30	4.1	5.5
0.063	2.58	2.58	1.3	4.1
Pan mE	0.03			
		cum. mass ret. + mE =		*137.15*
		difference from m6 % =		*0.10*

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 112237N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Client Name & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/2

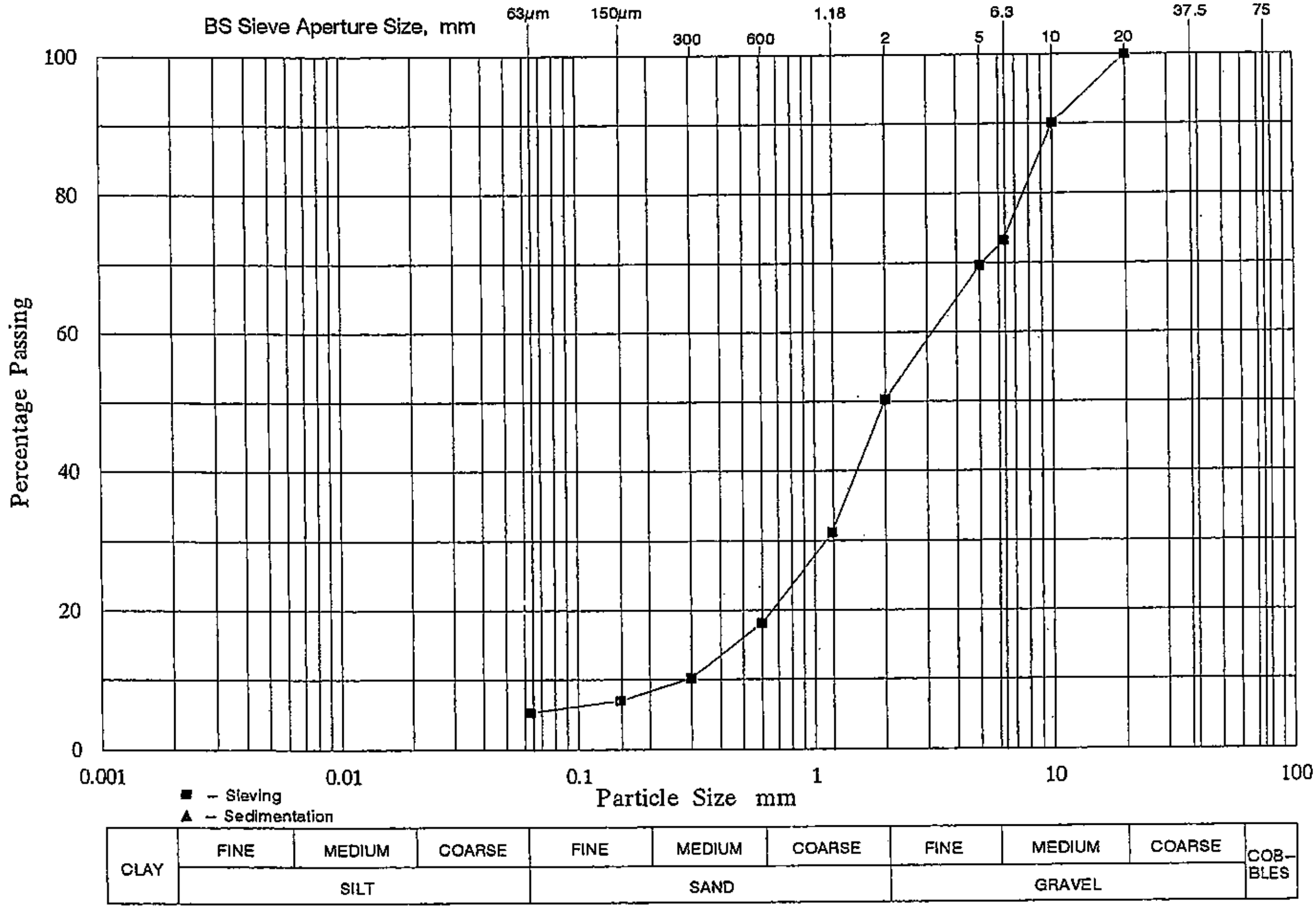
Composite Sample No. : CS2 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Brown, silty, very gravelly SAND with some shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :

GRAVEL	50 %
SAND	45 %
SILT & CLAY	5 %

Approved Signatory: Lo Kam chuen

Lo Kam–chuen

Date: 11-1-2007

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 112237N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments – Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/2

Composite Sample No. : CS2 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Brown, silty, very gravelly SAND with some shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 201.70

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	201.70	*cum. mass ret. + m2 =*		*201.70*
Riffled m3 20.0	201.70	*difference from m1 % =*		*0.00*
Washed m4	191.11	Note: m4 = mass >63um		
10.0	19.84	19.84	9.8	90.2
6.3	34.04	34.04	16.9	73.3
Passing m5 6.3	137.23	*cum. mass ret. + m5 =*		*191.11*
Riffled m6 6.3	137.23	*difference from m4 % =*		*0.00*
5.00	7.31	7.31	3.6	69.7
2.00	39.15	39.15	19.4	50.3
1.18	38.58	38.58	19.1	31.1
0.600	26.17	26.17	13.0	18.2
0.300	16.07	16.07	8.0	10.2
0.150	6.50	6.50	3.2	7.0
0.063	2.40	2.40	1.2	5.3
Pan mE	0.10			
		cum. mass ret. + mE =		*136.28*
		difference from m6 % =		*0.69*

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 102238N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Client Name & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/3

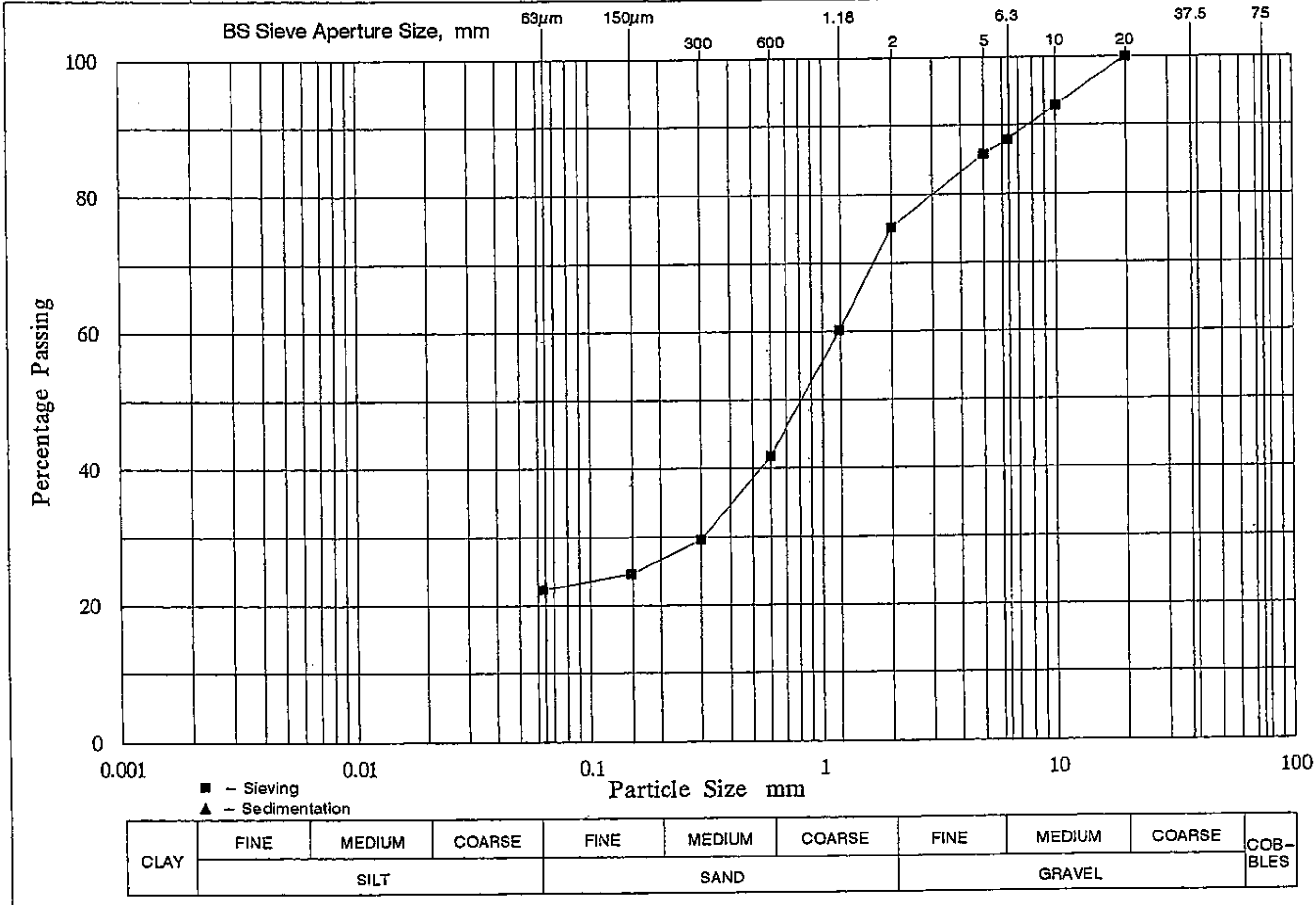
Composite Sample No. : CS3 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Yellowish brown, silty, clayey, very gravelly SAND

Date Sample: Received 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



Remarks:

SUMMARY :	GRAVEL	25 %
	SAND	53 %
	SILT & CLAY	22 %

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 102238N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/3

Composite Sample No. : CS3 **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Yellowish brown, silty, clayey, very gravelly SAND

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 201.53

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	201.53	*cum. mass ret. + m2 =*		*201.53*
Riffled m3 20.0	201.53	*difference from m1 % =*		*0.00*
Washed m4	156.62	Note: m4 = mass >63um		
10.0	14.27	14.27	7.1	92.9
6.3	10.13	10.13	5.0	87.9
Passing m5 6.3	132.22	*cum. mass ret. + m5 =*		*156.62*
Riffled m6 6.3	132.22	*difference from m4 % =*		*0.00*
5.00	4.20	4.20	2.1	85.8
2.00	21.38	21.38	10.6	75.2
1.18	30.18	30.18	15.0	60.2
0.600	37.20	37.20	18.5	41.8
0.300	24.50	24.50	12.2	29.6
0.150	10.01	10.01	5.0	24.6
0.063	4.62	4.62	2.3	22.3
Pan mE	0.01			
		cum. mass ret. + mE =		*132.10*
		difference from m6 % =		*0.09*

Approved Signatory: Lo Kam chuen
Lo Kam–chuen

Date: 11-1-2007

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

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Report No: 102239N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Client Name & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/4

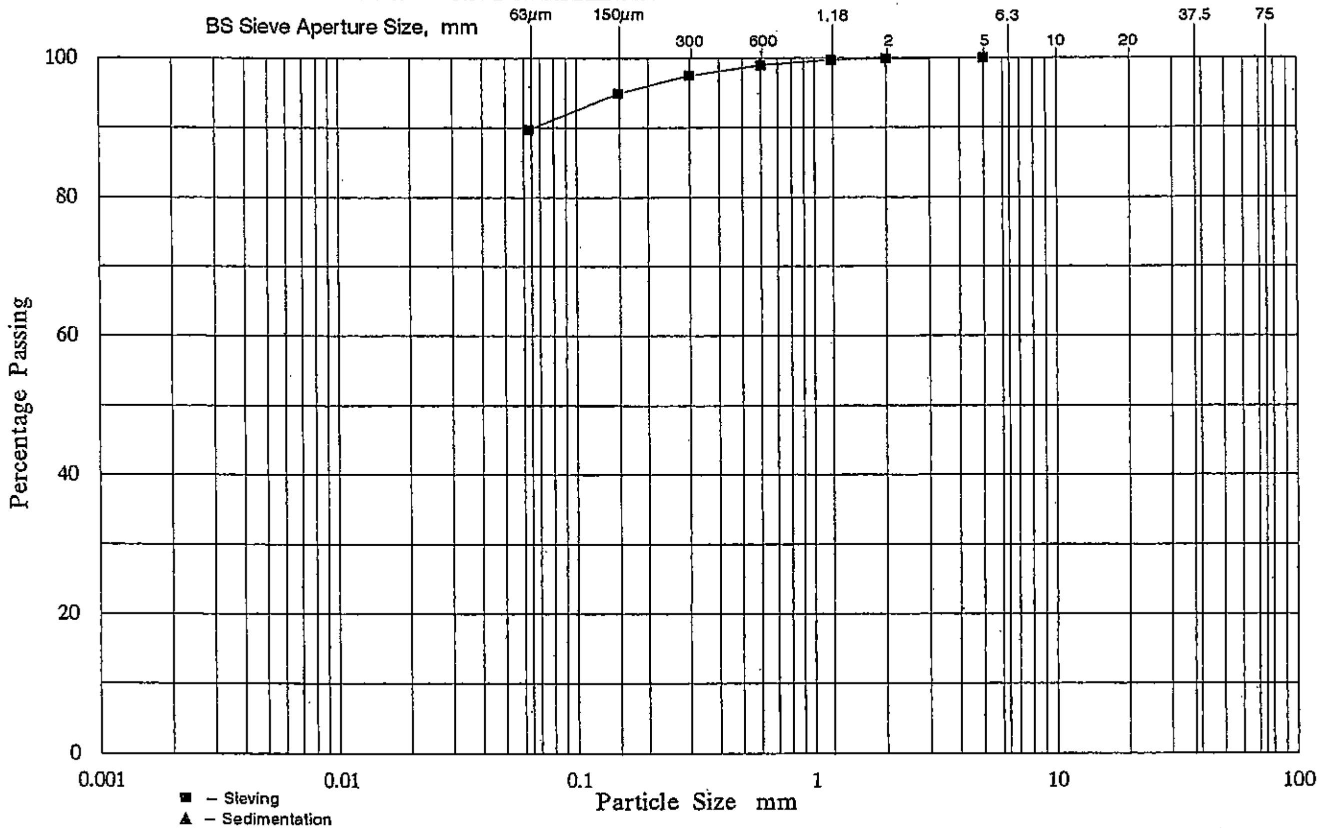
Composite Sample No. : Reference Sediment **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Grey, slightly sandy CLAY with occasional shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COB-BLES
	SILT			SAND			GRAVEL			

Remarks:

SUMMARY :

GRAVEL	0 %
SAND	10 %
SILT & CLAY	90 %

Approved Signatory: Lo Kam chuen
Lo Kam-chuen

Date: 11-1-2007

Lam Laboratories Limited Rm 1412, Honour Industrial Centre, 6 Sun Yip Street, Chaiwan, Hong Kong Tel: 28973282

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Lam Laboratories Limited

TEST REPORT ON DETERMINATION OF PARTICLE SIZE DISTRIBUTION

(Page 2 of 2)

Report No: 102239N

Project : Agreement No.CE59/2005 (EP) – Development of a Bathing Beach at Lung Mei, Tai Po Enviromental, Drainage and Traffic Impact Assessments–Investigation Chemical, Elutriate and Biological Testing of Marine Sediment and Water

Customer & Address : Geotechnical Projects Division, Geotechnical Engineering office, Civil Engineering and Development Department
8/F Civil Engineering and Development Building, 101 Princess Margaret Road, Kowloon, Hong Kong

Lab Job No : J469 **Works Order No:** GE/2005/47.22 **Lab. Sample Ref. No:** 18507/4

Composite Sample No. : Reference Sediment **Sample No:** **Depth m:** – **Specimen Depth m:**

Sample Type: Bulk **Spec. Ref:** **Geological Origin:** Sediment

Description : Grey, slightly sandy CLAY with occasional shell fragments

Date Sample Received: 29/11/2006 **Date Tested:** 4/12/2006 **Tested By:** H. W. Chu

Tested in Accordance With: GEOSPEC 3:2001 Test 8.1 / ~~8.2 / 8.5 / 8.6 / 8.7~~ Method A

SIEVE ANALYSIS

Initial Dry Mass of Soil m1 g: 102.72

BS Test Sieve mm	Mass Retained g	Corr. Mass Retained g	Percent Retained %	Percent Passing %
75.0			0.0	100.0
37.5			0.0	100.0
20.0			0.0	100.0
Passing m2 20.0	102.72	*cum. mass ret. + m2 =*		*102.72*
Riffled m3 20.0	102.72	*difference from m1 % =*		*0.00*
Washed m4	10.58	Note: m4 = mass >63um		
10.0		0.00	0.0	100.0
6.3		0.00	0.0	100.0
Passing m5 6.3	10.58	*cum. mass ret. + m5 =*		*10.58*
Riffled m6 6.3	10.58	*difference from m4 % =*		*0.00*
5.00		0.00	0.0	100.0
2.00	0.10	0.10	0.1	99.9
1.18	0.18	0.18	0.2	99.7
0.600	0.73	0.73	0.7	99.0
0.300	1.59	1.59	1.5	97.5
0.150	2.59	2.59	2.5	94.9
0.063	5.32	5.32	5.2	89.7
Pan mE	0.03			
		cum. mass ret. + mE =		*10.54*
		difference from m6 % =		*0.38*

Approved Signatory: Lo Kam-chuen
Lo Kam–chuen

Date: 11-1-2007

TEST\GEO36\PSDA (19970811)

CERTIFICATE OF ANALYSIS

Client	: LAM LABORATORIES LIMITED	*Laboratory*	: ALS Technichem (HK) Pty Ltd	*Page*	: 1 of 3
Contact	: MS MAUREEN CHANG	*Contact*	: Alice Wong / Ivan Leung	*Work Order*	: **HK0607412**
Address	: RM 1412-16, HONOUR INDUSTRIAL CENTRE, 6 SUN YIP STREET, CHAI WAN, HONG KONG	*Address*	: 11/F., Chung Shun Knitting Centre, 1 - 3 Wing Yip Street, Kwai Chung, N.T., Hong Kong		
E-mail	: maureenchang@lamlab.com	*E-mail*	: alice.wong@alsenviro.com		
Telephone	: +852 2975 3372	*Telephone*	: +852 2610 1044		
Facsimile	: +852 2897 5509	*Facsimile*	: +852 2610 2021		
Project	: J469 SO22	*Quote number*	: ----	*Date received*	: 6 Dec 2006
Order number	: ----			*Date of issue*	: 12 Dec 2006
C-O-C number	: ----			*No. of samples*	- *Received* : 4
Site	: ----				*Analysed* : 4

Report Comments

This report for ALS Technichem (HK) Py Ltd work order reference HK0607412 supersedes any previous reports with this reference. The completion date of analysis is 11 Dec 2006. Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number. LOR = Limit of reporting.

Specific comments for Work Order HK0607412 : **Sample(s) analysed and reported on an as received basis.**
Samples were received in an ambient condition.

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the 'Electronic Transactions Ordinance' o Hong Kong, Chapter 553, Section 6.

Signatory	*Position*	*Authorised results for:-*
Fung Lim Chee, Richard	General Manager	Inorganics

Analytical Results

Submatrix: SOIL

Method: Analysis Description	CAS number	LOR	Units	Client Sample ID: 18507/1	18507/2	18507/3	18507/4
			Laboratory Sample ID:	HK0607412-001	HK0607412-002	HK0607412-003	HK0607412-004
			Sample Date / Time:	[6 Dec 2006]	[6 Dec 2006]	[6 Dec 2006]	[6 Dec 2006]
EP: Aggregate Organics							
EP009: Total Organic Carbon	----	0.05	%	<0.05	<0.05	<0.05	**0.37**

Quality Control - Laboratory Duplicate (DUP) Results

Matrix Type: SOIL

				Duplicate (DUP) Results				
Laboratory Sample ID	*Client Sample ID*	*Method: Analysis Description*	*CAS number*	*LOR*	*Units*	*Original Result*	*Duplicate Result*	*RPD (%)*
EP: Aggregate Organics (QC Lot: 321857)								
HK0607412-002	18507/2	EP009: Total Organic Carbon	----	0.05	%	<0.05	<0.05	0.0

Quality Control - Method Blank (MB), Single Control Spike (SCS) and Duplicate Control Spike (DCS) Results

Matrix Type: SOIL

		Method Blank (MB) Results			*Single Control Spike (SCS) and Duplicate Control Spike (DCS) Results*						
					Spike	*Spike Recovery (%)*		*Recovery Limits (%)*		*RPDs (%)*	
Method: Analysis Description	*CAS number*	*LOR*	*Units*	*Result*	*Concentration*	*SCS*	*DCS*	*Low*	*High*	*Value*	*Control Limit*
EP: Aggregate Organics (QCLot: 321857)											
EP009: Total Organic Carbon	----	0.05	%	<0.05	40 %	98.0	----	85	115	----	----

Quality Control - Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Results

Matrix Type: SOIL

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Results						
				Spike	*Spike Recovery (%)*		*Recovery Limits (%)*		*RPDs (%)*	
Laboratory Sample ID	*Client Sample ID*	*Method: Analysis Description*	*CAS number*	*Concentration*	*MS*	*MSD*	*Low*	*High*	*Value*	*Control Li*
EP: Aggregate Organics (QCLot: 321857)										
HK0607412-001	18507/1	EP009: Total Organic Carbon	----	40 %	87.6	----	75	125	----	----

Appendix G

Ecological Baseline Data

Appendix G - Ecological Baseline Data

Table 1 Bird Recorded in the Vicinity of the Study Area (from Literature Review)

Common Name	**Species Name**	**Commonness**	**Main Status in HK**	**National Protected Status/CITES Status/IUCN Status**	**Sources of Information**	**Remark**
Little Grebe	*Tachybaptus ruficollis*	U	R, PM	LC	1, 2,5, 7, 8, 11	Bred at Shuen Wan
Great Cormorant	*Phalacrocorax carbo*	U	WV	LC	6, 8,10, 11	Over 1000 roosting at Plover Cove Reservoir Up to 392 at Shuen Wan (94)
Great Bitten	*Botaurus stellaris*	R	WV, PM	LC	4, 5, 7,	
Yellow Bittern	*Ixobrychus sinensis*	U	SV	LC	1, 5, 6,7,	Up to 5 at Shuen Wan
Schrenck's Bittern	*Ixobrychus eurythmus*	VR	SV	LC	7,	
Chestnut Bittern	*Ixobrychus cinnamomeus*	R	SV	LC	8	
Little Egret	*Egretta garzetta*	CW	R, PM	LC	1, 3, 5, 6,7, 11	Up to 413 at Shuen Wan (94) 20 pairs bred at Shuen Wan
Intermediate Egret	*Egretta intermedia*	R	PM	LC	5,6,8, 11	Up to 7 at Shuen Wan (96)
Great Egret	*Ardea alba*	CW	R, PM	LC	1, 3, 4, 5, 6, 7, 10, 11	Up to 102 at Shuen Wan 20 pairs bred at Shuen Wan (94)
Cattle Egret	*Bubulcus ibis*	CW	R, PM	LC	1, 3,6, 11	Up to 300 pairs bred at Shuen Wan (91)
Reef Egret	*Egretta sacra*	U	R	Class II, LC	3	1 at Shuen Wan
Grey Heron	*Ardea cinerea*	U	WV	LC	1, 4, 5, 6,7,8, 11	Up to 44 at Shuen Wan (96)
Chinese Pond Heron	*Ardeola bacchus*	CW	R	LC	1, 4, 6,7,8, 11	Up to 25 pairs bred at Shuen Wan (92) Up to 42 at Shuen Wan (96)
Black-crowned Night Heron	*Nycticorax nycticorax*	U	R, WV	LC	1, 4,5,6,7	Up to 25 pairs bred at Shuen Wan (92)
Straited Heron	*Butorides striatus*	U	R	LC	1, 6, 7, 11	Up to two at Shurn Wan (94)
Purple Heron	*Ardea purpurea*	R	PM	LC	3, 5	
Common Shelduck	*Tadorna tadorna*	R	WV	LC	5	
Falcated Teal	*Anas falcata*	R	WV	NT	4	1 at Shuen Wan (92)
Common Teal	*Anas crecca*	U	WV	LC	4, 5, 6, 7, 11	Up to 80 at Shuen Wan (92)
Spot-billed Duck	*Anas poecilofhyncha*	U	WV	LC	5	
Garganey	*Anas querquedula*	U	WV, PM	LC	5,	
Northern Pintail	*Anas acuta*	U	WV	LC	8	1 at Shuen Wan
Northern Shoveler	*Anas clypeata*	U	WV	LC	11	2 at Shuen Wan (99)
Greater Scaup	*Aythya marila*	VR	WV	LC	4	1 at Shuen Wan (92)
Red-breasted Merganser	*Mergus serrator*	R	WV, PM	LC	6	2 at Shuen Wan (94)
Black Baza	*Aviceda leuphotes*	R	SV, PM	Class II, LC	1, 4	1 at Tai Mei Tuk (92)
White-bellied Sea Eagle	*Haliaeetus leucogaster*	U	R	Class II, LC	1, 11	

Common Name	**Species Name**	**Commonness**	**Main Status in HK**	**National Protected Status/CITES Status/IUCN Status**	**Sources of Information**	**Remark**
Crested Serpent Eagle	*Spilornis cheela*	R	R, PM	Class II, LC	8	7 at Pat Sing Leng
Bonelli's Eagle	*Hieraaetus fasciatus*	R	R	Class II, LC	1, 4	Bred at Shuen Wan (92)
Osprey	*Pandion haliaetus*	U	WV	Class II, LC	7, 10, 11	
Crested Goshawk	*Accipiter trivirgatus*	R	R	Class II, LC	4	1 at Tai Mei Tuk (92)
Chinese Goshawk	*Accipiter soloensis*	R	PM	Class II, LC	3,8	1 at Shuen Wan
Bersa	*Accipiter virgatus*	R	R	Class II, LC	7, 10, 11	M & F at Shuen Wan
Grey-faced Buzzard	*Butastur indicus*	R	PM	Class II, LC	8	1 at Shuen Wan
Eurasian Hobby	*Falco subbuteo*	R	SV, PM	Class II, LC	8	1 at Shuen Wan
Peregrine Falcon	*Falco peregrinus*	R	WV	Class II, CITES I, LC	7, 10, 11	
Black Kite	*Milvus migrans*	CW	R, WV	Class II, LC	1, 5	Up to 37 at Shuen Wan
Common Buzzard	*Buteo buteo*	U	WV	Class II, LC	5,6, 11	
Japanese Quail	*Coturnix japonica*	R	WV, PM	LC	5	
Slaty-breasted Rail	*Gallirallus striatus*	R	R	LC	5	
Slaty-legged Crake	*Rallina eurizonoides*	VR	SV,WV,PM	LC	6, 8,10, 11	1 at Shuen Wan
Common Moorhen	*Gallinula chloropus*	U	R	LC	5, 10	Bred at Shuen Wan
Eurasian Coot	*Fulica atra*	U	WV	LC	2,5,10	Up to 12 at Shuen wan
Black-winged Stilt	*Himantopus himantopus*	R	WV, PN, R	LC	6, 7	Up to 2 at Shuen Wan
Northern Lapwing	*Vanellus vanellus*	R	WV	LC	11	2 at Shuen Wan (2000)
Pacific Golden Plover	*Pluvialis fulva*	R	PM	LC	5,8,10, 11	Up to 3 at Sheun Wan
Eurasian Woodcock	*Scolopax rusticola*	R	WV	LC	7	
Swinhoe's Snipe	*Gallinago megala*	R	PM	LC	5	
Red-necked Stint	*Calidris ruficollis*	U	PM	LC	6, 8,10	Up to 9 at Shuen Wan (98)
Temminck's Stint	*Calidris temminckii*	U	WV, PM	LC	6	7 at Shuen Wan (94)
Long-toed Stint	*Calidris subminuta*	R	WV, PM	LC	6	1 at Shuen Wan (94)
Sharp-tailed Sandpiper	*Calidris acuminate*	R	PM	LC	6	1 at Shuen Wan (94)
Curlew Sandpiper	*Calidris ferruginea*	U	PM	LC	8	Up to 6 at Shuen Wan (96)
Little-ringed Plover	*Charadrius dubius*	U	WV, PM, R	LC	5, 6, 7, 11	Up to 33 at Shuen Wan
Kentish Plover	*Charadrius alexandrinus*	U	WV, PM	LC	8, 11	Up to 22 at Shuen Wan (2000)
Lesser Sand Plover	*Charadrius mongolus*	R	PM	LC	5	4 at Shuen Wan
Whimbrel	*Numenius phaeopus*	U	PM	LC	11	1 at Shuen Wan
Common Redshank	*Tringa totanus*	U	WV, PM	LC	7, 10, 11	
Common Greenshank	*Tringa nebularia*	U	WV, PM	LC	7, 8,10	Up to 3 at Shuen Wan (96)
Marsh Sandpiper	*Tringa stagnatilis*	U	PM	LC	7	
Wood Sandpiper	*Tringa glareola*	U	WV, PM	LC	5, 6, 7	
Common Sandpiper	*Actitis hypoleucos*	CW	WV, PM	LC	6, 7,8, 11	Up to 10 at Shuen Wan (2000)
Grey-tailed Tattler	*Heteroscelus brevipes*	R	PM	LC	4, 6, 8, 11	Up to 19 at Shuen Wan (94)

Common Name	**Species Name**	**Commonness**	**Main Status in HK**	**National Protected Status/CITES Status/IUCN Status**	**Sources of Information**	**Remark**
Black-headed Gull	*Larus ridibundus*	CW	WV	LC	4, 5, 10, 11	Up to 1200 Shuen Wan (93)
Gull-billed Tern	*Gelochelidon nilotica*	R	PM	LC	5, 8	1 at Shuen Wan (93) and Tolo Channel (96)
Aleutian Tern	*Sterna aleutica*	VR	PM	LC	5	
Little Tern	*Sterna albifrons*	R	PM	LC	5, 11	2 at Shuen Wan (99)
Whiskered Tern	*Chlidonias hybrida*	R	WV, PM	LC	5, 11	Up to 33 at Shuen Wan (99)
		R	PM	LC	3, 6	Up to 145 at Tolo Channel (91)
White-winged Black Tern	*Chlidonias leucopterus*					1 at Shuen Wan (94)
Red Turtle Dove	*Streptopelia tranquebarica*	R	WV, PM	LC	11	
Emerald Dove	*Chalcophaps indica*	R	R	LC	1, 5	
Lesser Coucal	*Centropus bengalensis*	U	R	Class II, LC	1, 8	Up to 2 at Shuen Wan (96)
Chestnut-winged Cuckoo	*Clamator coromandus*	R	SV,PM	LC	1, 3,4,10	Heard at Tai Mei Tuk (92)
		CW	SV,PM	LC	1,5,8	1 at Tai Mei Tuk (93)
Large Hawk Cuckoo	*Hierococcyx sparverioides*					Up to 3 at Shuen Wan (96)
Indian Cuckoo	*Cuculus micropterus*	U	SV	LC	1, 10, 11	
Oriental Cuckoo	*Cuculus saturatus*	R	PM	LC	8	
Plaintive Cuckoo	*Cacomantis merulinus*	U		LC	7, 8,10	1 at Shuen Wan
Common Koel	*Eudynamys scolopacea*	CW	R	LC	1,8,10	
Collared Scops Owl	*Otus bakkamoena*	U	R	Class II, LC	8,10	
Asian Barred Owlet	*Glaucidium cuculoides*	R	R	Class II, LC	7, 8,10	
Savanna Nightjar	*Caprimulgus affinis*	R	R	LC	4, 5,8	
Silver-backed Needletail	*Hirundapus cochinchinensis*	VR	PM	LC	4	20 at Shuen Wan (92)
House Swift	*Apus affinis*	CW	R, PM	LC	7, 11	Up to 100 at Shuen Wan (99)
Pacific Swift	*Apus pacificus*	CW	PM	LC	6	1 at Shuen Wan
White-throated Kingfisher	*Halcyon smyrnensis*	CW	R	LC	6, 7, 8	Bred at Shuen Wan (95)
Black-capped Kingfisher	*Halcyon pileata*	U	PM, WV	LC	6, 8, 11	Up to 3 at Shuen Wan (2000)
Common Kingfisher	*Alcedo atthis*	R	WV, PM, R	LC	8,10, 11	Up to 3 at Shuen Wan (96)
Pied Kingfisher	*Ceryle rudis*	U	R	LC	5, 6, 7, 8,10, 11	
Crested Kingfisher	*Ceryle lugubris*	VR	R	LC	4, 8, 11	1 at Plover Cove Reservoir (92, 96, 99)
Dollarbird	*Eurystomus orientalis*	R	PM	LC	6, 8, 11	1 at Shuen Wan
Eurasian Hoopoe	*Upupa epops*	VR	WV	LC	6	1 at Shuen Wan
Red-rumped Swallow	*Hirundo daurica*	R	PM	LC	4	
Asian House Martin	*Delichon dasypus*	R	WV, PM	LC	8	1 at Shuen Wan
Olive-backed Pipit	*Anthus hodgsoni*	CW	WV, PM	LC	7	Up to 20 ay Shuen Wan
Richard's Pipit	*Anthus novaeseelandiae*	CW	WV, PM, R	LC	5, 6	
Pechora Pipit	*Anthus gustavi*	VR	PM	LC	5	

Common Name	**Species Name**	**Commonness**	**Main Status in HK**	**National Protected Status/CITES Status/IUCN Status**	**Sources of Information**	**Remark**
Yellow Wagtail	*Motacilla flava*	U	WV, PM	LC	5,6,7,8, 11	Up to 250 at Shuen Wan (96)
White Wagtail	*Motacilla alba*	CW	WV, PM	LC	5,6,7,8, 11	Up to 12 at Shuen Wan
Grey Wagtail	*Motacilla cinerea*	CW	WV, PM	LC	7	
Plumbeous Water Redstart	*Rhyacornis fuliginosus*	VR	WV	LC	4	A pair at Plover Cove (92)
Brown Shrike	*Lanius cristatus*	U	PM	LC	2, 6	1 at Tai Mei Tuk (90) and Shuen Wan (94)
Bluethroat	*Luscinia svecica*	R	WV, PM	LC	6, 10	
Common Black Bird	*Turdus merula*	U	WV, PM	LC	4, 8,10	Up to 34 at Shuen Wan (98)
Eyebrowed Thrush	*Turdus obscurus*	R	WV, PM	LC	8	1 at Shuen Wan
Rufous-capped Babbler	*Stachyris ruficeps*	VR	F	LC	10	
Greater Necklaced Laughing Thrush	*Garrulax pectoralis*	R	F	LC	11	17 at Tak Mei Tuk (2000)
Brownish-flanked Bush Warbler	*Cettia fortipes*	R	WV	LC	11	I at Shuen Wan
Russet Bush Warbler	*Bradypterus seebohmi*	R	WV,PM	LC	7, 11	Up to 2 at Shuen Wan (2000)
Pallas's Grasshopper Warbler	*Locustella certhiola*	R	PM	LC	11	
Black-browed Reed Warbler	*Acrocephalus bistrigiceps*	R	WV, PM	LC	11	
Oriental Reed Warbler	*Acrocephalus orientalis*	U	WV,PM	LC	6	15 at Shuen Wan
Zitting Cisticola	*Cisticola juncidis*	U	WV,PM	LC	11	
Dusky Warbler	*Phylloscopus fuscatus*	U	WV, PM	LC	10, 11	
Eastern Crowned Warbler	*Phylloscopus coronatus*	R	PM	LC	5	
Verditer Flycatcher	*Eumyias thalassina*	R	WV	LC	8	1 at Shuen Wan (96)
Buff-bellied Flowerpecker	*Dicaeum ignipectus*	R	WV, R	LC	8	2 juveniles at Sheun Wan (96)
Little Bunting	*Emberiza pusilla*	U	WV,PM	LC	8	
Yellow-breasted Bunting	*Emberiza aureola*	R	WV,PM	NT	8	
White-rumped Munia	*Lonchura striata*	CW	R	LC	8	Up to 23 at Shuen Wan
Scaly-breasted Munia	*Lonchura punctulata*	U	R	LC	7, 8	
Red-billed Starling	*Sturnus sericeus*	U	WV	LC	3,5,7, 8,10	Up to 250 at Shuen Wan (91)
White-shouldered Starling	*Sturnus sinensis*	U	WV, PM, R	LC	6	1 at Shuen Wan
Common Myna	*Acridotheres tristis*	R	F	LC	8	1 at Shuen Wan
Large-billed Crow	*Corvus macrorhynchos*	CW	R	LC	1, 4, 6	Up to 112 at Shuen Wan (94)
Collared Crow	*Corvus torquatus*	U	R	LC	1, 4, 5, 6, 7, 8,10, 11	Up to 62 at Shuen Wan

Commonness & Distribution:	CW = common and widespread, U = uncommon and localised, R = rare and localized, VR = very rare
Status in Hong Kong:	R = Resident, WV = Winter Visitor, SV = Summer Visitor, PM = Passage Migrant, E = Records treaded as escaped birds, F = Feral
IUCN Status:	LC = Least Concern, NT = Near Threatened

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Table 2 Plant Species Recorded Within the Study Area

				Relative Abundance						
Species	**Growth Form**	**Origin**	**Status**	**Secondary Woodland**	**Shrubland**	**Mangrove**	**Stream/ Channel**	**Village/ Modified Area**	**Sandy Shore with Backshore Vegetation**	**Project Site**
Acacia auriculiformis	T	E	C	S				O		
Acacia confusa	T	E	VC	O				F		O
Acacia mangium	T	E	VC					F		
Acronychia pedunculata	T	N	VC	F						
Aegiceras corniculatum	S	N	C			A			S	S
Ageratum conyzoides	H	N	VC		F					F
Alangium chinensis	S	N	VC	S	S		S			
Albizia lebbeck	T	N	C					F		D
Alchornea trewioides	S	N	VC	F						
Aleurites moluccana	T	N	VC					O		O
Alocasia macrorrhiza	H	N	VC	S			F	F		
Aporusa dioica	S	N	VC	F						
Araucaria heterophylla	T	E	C					F		
Aquilaria sinensis	T	N	C	O						
Avicennia marina	S	N	C			O			S	S
Baeckea frutescens	S	N	VC		F					
Bauhinia blackeana	T	N	VC					F		
Bauhinia galphinii	C	N	C		O					
Bidens bipinnata	H	N	VC		F					
Blechnum orientale	F	N	VC	F						
Breynia fruticosa	S	N	VC	F	F					
Bridelia tomentosa	S	N	VC	O	F			A		
Bruguiera gymnorrhiza	S	N	C			A				
Caesalpinia bonduc	S	E	VC			O				

				Relative Abundance						
Species	**Growth Form**	**Origin**	**Status**	**Secondary Woodland**	**Shrubland**	**Mangrove**	**Stream/ Channel**	**Village/ Modified Area**	**Sandy Shore with Backshore Vegetation**	**Project Site**
Caesalphinia vernalis	C	N	VC	F						
Calliandra haematocephala	S	E	VC					A		
Canthium dicoccum	S	N	C	S						
Carex chinensis	G	N	C		F					
Cassytha filiformis	C	N	VC	F						
Casuarina equisetifolia	T	E	VC					F		O
Celtis sinensis	T	N	C	A	O			F		F
Cerbera manghas	T	E	C					O		O
Chrysanthemum indicum	S	N	C					O		O
Cinnamomum camphora	T	N	C	O				O		O
Cocculus orbiculatus	C	N	VC	F						
Cratoxylum cochinchinensis	S	N	VC	F						
Daphniphyllum calycinum	T	N	C	F						
Delonix regia	T	E	VC	S				F		
Dicranopteris linearis	F	N	VC	O	O					
Digitaria sanquinalis	G	N	C				O			
Dimocarpus longan	T	N	C					O		
Diospyros morrisiana	T	N	C	S						
Duranta repens	S	E	C					F		
Embelia laeta	C	N	VC	O						
Eurya japonica	S	N	VC	F						
Excoecaria agallocha	S	N	C			A			S	
Ficus microcapus	T	N	VC	F			F			O
Ficus superba	T	N	VC	F						
Ficus hispida	T	N	VC	F			F	F		

Species	Growth Form	Origin	Status	Relative Abundance						
				Secondary Woodland	Shrubland	Mangrove	Stream/ Channel	Village/ Modified Area	Sandy Shore with Backshore Vegetation	Project Site
Ficus pumila	C	N	VC	F						
Ficus variegata	T	N	VC					F		
Ficus variolosa	S	N	VC	A						
Gahnia tristis	Se	N	VC	S						
Garcinia multiflora	T	N	C	O						
Gardenia jasminoides	S	N	VC	S	O					
Glochidion eriocarpum	S	N	C	F						
Glochidion lanceolarium	S	N	VC	O						
Gnetum montanum	C	N	C	O						
Gossampinus malabarica	T	E	VC					F		
Hibiscus rosa-sinensis	H	E	VC					F		
Hibiscus tiliaceus	T	N	VC					F	D	A
Homalium cochinchinensis	S	N	C	O						
Ilex asprella	S	N	VC	F						
Ilex pubescens	S	N	C	F						
Indocalamus sinicus	S	N	VC					O		
Ipomoea cairica	C	N	VC					F		O
Ipomoea hederacea	C	N	VC					O		
Ipomoea pescaprae	C	N	VC			F				
Ischaemum aristatum	G	N	VC		O					
Juniperus chinensis	S	E	VC					F		
Kandelia obovata	S	N	VC			A			S	S
Lagerstroemia speciosa	T	E	VC					O		
Lantana camara	S	E	VC	O	F					O
Launaea sarmentosa	H	N	C						S	

				Relative Abundance						
Species	**Growth Form**	**Origin**	**Status**	**Secondary Woodland**	**Shrubland**	**Mangrove**	**Stream/ Channel**	**Village/ Modified Area**	**Sandy Shore with Backshore Vegetation**	**Project Site**
Leucaena leucocephala	S	N	VC					A		A
Ligustrum sinensis	S	N	VC	O	O					
Limonium sinense	H	N	C			F			F	
Liquidamber confertus	T	N	VC	S	O					
Liriope spicata	H	N	C	F			A			
Litsea cubeba	T	N	C	O						
Litsea glutinosa	T	N	VC	O						
Litsea rotundifolia	S	N	VC	F	O					
Livistona chinensis	P	N	VC					O		
Lophostemon conferta	T	E	VC					O		O
Lygodium dichotomum	C	N	VC	F						
Macaranga tanarius	T	N	VC	O	F			F		A
Maesa perlarius	S	N	VC	F						
Mallotus paniculatus	T	N	C	F						
Melaleuca leucadendron	T	E	VC					F		F
Melastoma candidum	S	N	VC	F						F
Melia azedarach	T	E	C					O		
Melodinus monogynus	C	N	C	F						
Michelia alba	T	E	C					F		
Microcos paniculata	S	N	C	F	F					
Mikania micrantha	C	E	VC		O			F		F
Millettia reticulata	C	N	VC	F						
Mimosa pudica	S	N	VC		F					
Miscanthus sinensis	G	N	VC		F		O	F		F
Miscanthus floridulus	G	N	VC		F			F		
Mussaenda pubescens	S	N	VC	F						

Species	**Growth Form**	**Origin**	**Status**	**Relative Abundance**						
				Secondary Woodland	**Shrubland**	**Mangrove**	**Stream/ Channel**	**Village/ Modified Area**	**Sandy Shore with Backshore Vegetation**	**Project Site**
Neyraudia arundinacea	G	N	VC					F		F
Paederia scandens	C	N	C		F		O	F		F
Panicum maximum	G	N	C				O	F		F
Paspalum conjugatum	G	N	C							F
Phyllanthus emblica	T	N	C	O						
Phyllanthus cochinchinensis	S	N	VC	O						
Pinus massoniana	T	N	C	S						
Psychotria rubra	S	N	VC	O						
Psychotria serpens	C	N	VC	F						
Pueraria lobata	C	N	VC		F			A		O
Rapanea neriifolia	S	N	C	S						
Rhododendron simsii	S	N	P	S						
Rhodomyrtus tomentosa	S	N	VC	F						
Rhus succedanea	S	N	VC	F						
Sapium discolor	S	N	C	F	O					
Scaevola sericea	H	N	VC			F				
Schefflera heptaphylla	S	N	VC	F						
Schima superba	T	N	C	S						
Scleria harlandi	Se	N	VC				O			
Sesbania cochinchinensis	S	E	VC		O	O		O		F
Sesuvium portulacastrum	H	E	VC			F			F	
Smilax china	C	N	VC	O						
Sterculia lanceolata	T	N	C				F			
Strophanthus divaricatus	C	N	VC	O						
Syzygium jambos	T	N	VC	S				F		

				Relative Abundance						
Species	**Growth Form**	**Origin**	**Status**	**Secondary Woodland**	**Shrubland**	**Mangrove**	**Stream/ Channel**	**Village/ Modified Area**	**Sandy Shore with Backshore Vegetation**	**Project Site**
Tetracera asiatica	C	N	VC	F						
Thespesia populnea	T	N	C					F	D	
Uvaria microcarpa	S	N	VC	S						
Vitex rotundifolia	S	N	VC			F				
Wedelia chinensis	C	N	VC					F		O
Zoysia sinica	G	N	VC			O			O	
Total no. of Species				**71**	**26**	**13**	**11**	**46**	**10**	**30**

Abundance: A=Abundant; D=Dominant=; F=Frequent; O=Occasional; S=Scarce

Status: C=Common; VC=Very Common; P=Protected

Plant Form: G=Grass; C= Climber; H=Herb; Se=Sedge, P=Palm; S=Shrub; T=Tree,

Origin: N=Native; E=Exotic

Table 3 Bird Species Recorded within the Study Area

Common Name	Species Name	Commonness	Status in Hong Kong	Habitats Recorded in Dry Season	Habitats Recorded in Wet Season
Asian Brown Flycather	*Muscicapa dauurica*	U	WV, PM	Sh	W
Barn Swallow	*Hirudo rustica*	CW	SV, PM		Sh
Black Kite	*Milvus migrans*	CW	R, WV	D, Sh	D, PS, S
Black-collared Starling	*Sturnus nigricollis*	CW	R	Pd, PS, S, Sh	D, Pd, PS, S, Sh
Chestnut Bulbul	*Hypsipetes castanonotus*	CW	R	W	
Chinese Pond Heron	*Ardeola bacchus*	CW	R	S	S
Collared Crow	*Corvus torquatus*	U	R	S	S
Common Black Bird	*Turdus merula*	CW	WV	Pd, Sh, W	
Common Kingfisher	*Alcedo atthis*	CW	WV, PM	PS	Sh
Common Magpie	*Pica pica*	CW	R	D, S	D, S
Common Sandpiper	*Actitis hypoleucos*	CW	WV, PM	S	PS
Common Tailorbird	*Orthotomus sutorius*	CW	R	PS, S, Sh, W	S, Sh, W
Crested Goshawk	*Accipiter trivirgatus*	R	R		W
Crested Myna	*Acridotheres cristatellus*	CW	R	D, PS, S, Sh	D, Sh
Dusky Warbler	*Phylloscopus fuscatus*	CW	WV, PM	Sh	
Eurasian Tree Sparrow	*Passer montanus*	CW	R	D, Sh	D, Pd, S, Sh
Fork-tailed Sunbird	*Aethopyga christinae*	CW	R	Sh	Pd, W
Great Tit	*Parus major*	CW	R	D, Pd, S, Sh, W	D, Sh, W
Greater Necklanced LT	*Garrulax pectoralis*	CW	R	W	
Grey Wagtail	*Motacilla cinerea*	CW	WV, PM	Sh	
Grey-backed Thrush	*Turdus hortulorum*	CW	WV	W	
Grey-tailed Tattler	*Heteroscelus brevipes*	R	PM		S
House Swift	*Apus affinis*	CW	R, PM	W	
Japanese White-eye	*Zosterops japonicus*	CW	R	Pd, Sh, W	D, Pd, S, Sh, W
Large-billed Crow	*Corvus macrorhynchos*	CW	R	Sh	Pd, S
Light-vented Bulbul	*Pycnonotus sinensis*	CW	R	D, Pd, S, Sh, W	D, Pd, PS, S, Sh, W
Little Egret	*Egretta garzetta*	CW	R	PS, S	D, PS, S, Sh
Long-tailed Shrike	*Lanius schach*	CW	R		W
Masked Laughing Thrush	*Garrulax perspicillatus*	CW	R	D, S, Sh, W	S, Sh
Olive-backed Pipit	*Anthus hodgsoni*	CW	WV, PM	Sh	
Oriental Magpie Robin	*Copsychus saularis*	CW	R	PS, S, Sh, W	Pd, S, Sh, W
Osprey	*Pandion haliaetus*	R	WV	S	
Pacific Swift	*Apus pacificus*	CW	SV, PM		W
Red-billed Starling	*Sturnus sericeus*	R	WV	D, PS, S, Sh	
Red-whiskered Bulbul	*Pycnonotus jocosus*	CW	R	Sh, W	D, Pd, Sh, W
Richard's Pipit	*Anthus richardi*	CW	WV, PM	S	
Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	R	R	S, Sh, W	Sh, W

Common Name	**Species Name**	**Commonness**	**Status in Hong Kong**	**Habitats Recorded in Dry Season**	**Habitats Recorded in Wet Season**
Spotted Dove	*Streptopelia chinensis*	CW	R	D, Pd, PS, Sh, W	D, Pd, PS, S, Sh, W
Violet Whistling Thrush	*Myiophoneus caeruleus*	CW	R	W	
White Wagtail	*Motacilla alba*	CW	WV, PM	Pd, S, Sh	D, Pd, PS, S, Sh
White-bellied Sea Eagle	*Haliaeetus leucogaster*	U	R		S, Sh
White-throated Kingfisher	*Halcyon smyrnensis*	CW	R	S	Pd
Yellow-bellied Prinia	*Prinia flaviventris*	CW	R	Sh	
Yellow-browed Warbler	*Phylloscopus inornatus*	CW	WV, PM	Pd, Sh, W	Pd
			Total Species	**38**	**31**

Habitats: W = Secondary Woodland, Sh = Shrubland, S = Sandy Shore with Backshore Vegetation, Pd =Pond, PS = Project Site, D = Village/Modified Area

Commonness & Distribution: CW = common and widespread, U = uncommon and localised, R = rare and localized, VR = very rare

Main Status: R = Resident, WV = Winter Visitor, SV = Summer Visitor; PM = Passage/Seasonal Migrant

Table 4 Bird Species Recorded within Study Area in Dry Season

Common Name	Species Name	Study Area					
		Secondary Woodland	Shrubland	Sandy Shore with Backshore Vegetation	Pond	Village/ Modified Area	Project Site
Asian Brown Flycather	*Muscicapa dauurica*	0	1	0	0	0	0
Black Kite	*Milvus migrans*	0	1	0	0	1	0
Black-collared Starling	*Sturnus nigricollis*	0	3	11	2	0	2
Chestnut Bulbul	*Hypsipetes castanonotus*	4	0	0	0	0	0
Chinese Pond Heron	*Ardeola bacchus*	0	0	1	0	0	0
Collared Crow	*Corvus torquatus*	0	0	2	0	0	0
Common Black Bird	*Turdus merula*	33	3	0	1	0	0
Common Kingfisher	*Alcedo atthis*	0	0	0	0	1	1
Common Magpie	*Pica pica*	0	0	3	0	1	0
Common Sandpiper	*Actitis hypoleucos*	0	0	3	0	0	0
Common Tailorbird	*Orthotomus sutorius*	8	5	2	0	0	2
Crested Myna	*Acridotheres cristatellus*	0	2	0	0	3	1
Dusky Warbler	*Phylloscopus fuscatus*	0	2	0	0	0	0
Eurasian Tree Sparrow	*Passer montanus*	0	14	0	0	8	0
Fork-tailed Sunbird	*Aethopyga christinae*	0	1	0	0	0	0
Great Tit	*Parus major*	3	2	1	2	1	0
Greater Necklanced LT	*Garrulax pectoralis*	6	0	0	0	0	0
Grey Wagtail	*Motacilla cinerea*	0	6	0	0	0	0
Grey-backed Thrush	*Turdus hortulorum*	2	0	0	0	0	0
House Swift	*Apus affinis*	5	0	0	0	0	0
Japanese White-eye	*Zosterops japonicus*	27	5	0	21	0	0

Common Name	**Species Name**	**Study Area**					
		Secondary Woodland	**Shrubland**	**Sandy Shore with Backshore Vegetation**	**Pond**	**Village/ Modified Area**	**Project Site**
Large-billed Crow	*Corvus macrorhynchos*	0	1	0	0	0	0
Light-vented Bulbul	*Pycnonotus sinensis*	4	8	7	2	6	0
Little Egret	*Egretta garzetta*	0	0	2	0	0	2
Masked Laughing Thrush	*Garrulax perspicillatus*	2	5	5	0	0	0
Olive-backed Pipit	*Anthus hodgsoni*	0	5	0	0	0	0
Oriental Magpie Robin	*Copsychus saularis*	1	3	2	0	0	1
Osprey	*Pandion haliaetus*	0	0	1	0	0	0
Red-billed Starling	*Sturnus sericeus*	0	14	18	0	8	68
Red-whiskered Bulbul	*Pycnonotus jocosus*	6	4	0	0	0	0
Richard's Pipit	*Anthus richardi*	0	0	1	0	0	0
Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	1	1	1	0	0	0
Spotted Dove	*Streptopelia chinensis*	1	4	0	4	3	2
Violet Whistling Thrush	*Myiophoneus caeruleus*	1	0	0	0	0	0
White Wagtail	*Motacilla alba*	0	5	1	2	0	0
White-throated Kingfisher	*Halcyon smyrnensis*	0	0	1	0	0	0
Yellow-bellied Prinia	*Prinia flaviventris*	0	1	0	0	0	0
Yellow-browed Warbler	*Phylloscopus inornatus*	4	1	0	1	0	0
	Total Species	**16**	**24**	**17**	**8**	**9**	**8**

Table 5 Bird Species Recorded Quantitatively within Study Area in Wet Season

Common Name	Species Name	Study Area					
		Secondary Woodland	Shrubland	Sandy Shore with Backshore Vegetation	Pond	Village/ Modified Area	Project Site
Asian Brown Flycather	*Muscicapa dauurica*	1	0	0	0	0	0
Barn Swallow	*Hirudo rustica*	0	1	0	0	0	0
Black Kite	*Milvus migrans*	0	0	2	0	2	1
Black-collared Starling	*Sturnus nigricollis*	0	2	6	5	2	5
Chinese Pond Heron	*Ardeola bacchus*	0	0	2	0	0	0
Collared Crow	*Corvus torquatus*	0	0	2	0	0	0
Common Kingfisher	*Alcedo atthis*	0	1	0	0	0	0
Common Magpie	*Pica pica*	0	0	2	0	2	0
Common Sandpiper	*Actitis hypoleucos*	0	0	4	0	0	1
Common Tailorbird	*Orthotomus sutorius*	8	2	1	0	0	0
Crested Goshawk	*Accipiter trivirgatus*	2	0	0	0	0	0
Crested Myna	*Acridotheres cristatellus*	0	1	0	0	9	0
Eurasian Tree Sparrow	*Passer montanus*	0	16	2	6	20	0
Fork-tailed Sunbird	*Aethopyga christinae*	2	0	0	2	0	0
Great Tit	*Parus major*	2	2	0	0	2	0
Grey-tailed Tattler	*Heteroscelus brevipes*	0	0	1	0	0	0
Japanese White-eye	*Zosterops japonicus*	16	6	6	11	5	0
Large-billed Crow	*Corvus macrorhynchos*	0	0	5	2	0	0
Light-vented Bulbul	*Pycnonotus sinensis*	15	7	5	3	12	4
Little Egret	*Egretta garzetta*	0	1	4	0	2	1
Long-tailed Shrike	*Lanius schach*	1	0	0	0	0	0

Common Name	**Species Name**	**Study Area**					
		Secondary Woodland	**Shrubland**	**Sandy Shore with Backshore Vegetation**	**Pond**	**Village/ Modified Area**	**Project Site**
Masked Laughing Thrush	*Garrulax perspicillatus*	0	6	5	0	0	0
Oriental Magpie Robin	*Copsychus saularis*	3	2	2	1	0	0
Pacific Swift	*Apus pacificus*	1	0	0	0	0	0
Red-whiskered Bulbul	*Pycnonotus jocosus*	6	20	0	9	4	0
Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	3	1	0	0	0	0
Spotted Dove	*Streptopelia chinensis*	2	2	6	2	2	2
White Wagtail	*Motacilla alba*	0	4	2	1	2	1
White-bellied Sea Eagle	*Haliaeetus leucogaster*	0	1	1	0	0	0
White-throated Kingfisher	*Halcyon smyrnensis*	0	0	0	1	0	0
Yellow-browed Warbler	*Phylloscopus inornatus*	0	0	0	2	0	0
	Total Species	**13**	**17**	**18**	**12**	**12**	**7**

Table 6 Butterfly Species Recorded within the Study Area

Common Name	Species Name	Status	Habitat Recorded in Dry Season	Habitat Recorded in Wet Season
Angled Castor	*Ariadne ariadne*	C	Sh	Sh
Blue-spotted Crow	*Euploea midamus*	VC	S, Sh	Sh, W
Brown Pansy	*Junonia iphita*	UC		W
Ceylon Blue Tiger	*Ideopsis similis*	VC	W	Sh
Chinese Peacock	*Papilio bianor*	VC		W
Colour Sergeant	*Athyma nefte*	C	Sh	W
Common Bluebottle	*Graphium sarpedon*	VC	Sh	D, Pd, S, W
Common Five-ring	*Ypthima baldus*	VC	Sh, W	Sh, W
Common Grass Yellow	*Eurema hecabe*	VC	Sh, W	D, Sh, W
Common Hedge Blue	*Acytolepis puspa*	C	Sh	Sh
Common Indian Crow	*Euploea core*	VC		D, Sh, W
Common Jay	*Graphium doson*	C		Sh
Common Jester	*Symbrenthia lilaea*	C	Sh	
Common Mine	*Chilasa clytia*	C		W
Common Mormon	*Papilio polytes*	VC	D, Sh	D, Pd, S, Sh, W
Common Nawab	*Polyura athamas*	UC		Pd, W
Common Palmfly	*Elymnias hypermnestra*	C	Sh	
Common Sailer	*Neptis hylas*	VC	Sh, W	Sh, W
Common Tiger	*Danaus genutia*	VC	W	Pd, Sh
Danaid Egg-fly	*Hypolimnas misippus*	UC	Sh	
Dark Cerulean	*Jamides bochus*	C	Sh	
Dark Evening Brown	*Melanitis phedima*	UC		Sh
Dark-band Bush Brown	*Mycalesis mineus*	VC	Sh, W	Sh, W
Five-bar Swordtail	*Pathysa antiphates*	C		W
Forest Hopper	*Astictopterus jama*	C		W
Glassy Tiger	*Parantica aglea*	VC	Sh	
Great Egg-fly	*Hypolimnas bolina*	C	W	Sh, W
Great Mormon	*Papilio memnon*	VC	Sh	W
Great Orange Tip	*Hebomoia glaucippe*	C		W
Great Swift	*Pelopidas assamensis*	UC		Sh
Indian Cabbage White	*Pieris canidia*	VC	Sh	
Indian Palm Bob	*Suastus gremius*	UC		W
Indian Red Admiral	*Vanessa indica*	C	W	Sh
Large Faun	*Faunis eumeus*	C	W	W
Lemon Emigrant	*Catopsilia prmona*	C	Sh	Pd, W
Lime Blue	*Chilades lajus*	VC	Sh	W
Long-tailed Blue	*Lampides boeticus*	C	Sh	
Painted Jezebel	*Delias hyparete*	UC	Sh	W
Pale Grass Blue	*Zizeeria maha*	VC	Sh	
Paris Peacock	*Papilio paris*	VC		D
Plain Tiger	*Danaus chrysippus*	UC	Sh	

Common Name	**Species Name**	**Status**	**Habitat Recorded in Dry Season**	**Habitat Recorded in Wet Season**
Plum Judy	*Abisara echerius*	VC	Sh, W	W
Punchinello	*Zemeros flegyas*	C	Sh	
Purple Sapphire	*Heliophorus epicles*	C		S, Sh
Red Helen	*Papilio helenus*	VC	D, Sh	W
Red-based Jezebel	*Delias pasithoe*	VC	S, Sh, W	
Rustic	*Cupha erymanthis*	VC	Sh	Sh, W
Slate Flash	*Rapala manea*	C	Sh	W
Sliver Streak Blue	*Iraota timoleon*	UC		W
South China Bush Brown	*Mycalesis zonata*	UC	Sh, W	
South Sullied Sailer	*Neptis clinia*	C	S, Sh	
Spangle	*Papilio protenor*	VC	Sh	Sh
Tailed Jay	*Graphium agamemnon*	VC	Sh	Sh
Tailed Sulphur	*Dercas verhuelli*	UC		W
White-edged Blue Baron	*Euthalia phemius*	UC	Sh	
Yellow Orange Tip	*Ixias pyrene*	UC	Sh	
		Total Species	**40**	**41**

VC = Very Common, C = Common, UC = Uncommon, R = Rare
W = Secondary Woodland, S =Sandy Shore with Backshore Vegetation, Sh = Shrubland, Pd = Pond, D = Village/Modified Area

Table 7 Butterfly Species Recorded within the Study Area in Dry Season

Common Name	Species Name	Study Area					
		Secondary Woodland	Shrubland	Sandy Shore with Backshore Vegetation	Pond	Village/ Modified Area	Project Site
Angled Castor	*Ariadne ariadne*	0	2	0	0	0	0
Blue-spotted Crow	*Euploea midamus*	0	1	1	0	0	0
Ceylon Blue Tiger	*Ideopsis similis*	1	0	0	0	0	0
Colour Sergeant	*Athyma nefte*	0	1	0	0	0	0
Common Bluebottle	*Graphium sarpedon*	0	1	0	0	0	0
Common Five-ring	*Ypthima baldus*	3	2	0	0	0	0
Common Grass Yellow	*Eurema becabe*	5	5	0	0	0	0
Common Hedge Blue	*Acytolepis puspa*	0	3	0	0	0	0
Common Jester	*Symbrenthia lilaea*	0	1	0	0	0	0
Common Mormon	*Papilio polytes*	0	3	0	0	1	0
Common Palmfly	*Elymnias hypermnestra*	0	1	0	0	0	0
Common Sailer	*Neptis hylas*	2	3	0	0	0	0
Common Tiger	*Danaus genutia*	3	0	0	0	0	0
Danaid Egg-fly	*Hypolimnas misippus*	0	1	0	0	0	0
Dark Cerulean	*Jamides bochus*	0	1	0	0	0	0
Dark-band Bush Brown	*Mycalesis mineus*	2	2	0	0	0	0
Glassy Tiger	*Parantica aglea*	0	1	0	0	0	0
Great Egg-fly	*Hypolimnas bolina*	3	0	0	0	0	0
Great Mormon	*Papilio memnon*	0	2	0	0	0	0
Indian Cabbage White	*Pieris canidia*	0	2	0	0	0	0
Indian Red Admiral	*Vanessa indica*	1	0	0	0	0	0

Common Name	**Species Name**	**Study Area**					
		Secondary Woodland	**Shrubland**	**Sandy Shore with Backshore Vegetation**	**Pond**	**Village/ Modified Area**	**Project Site**
Large Faun	*Faunis eumeus*	2	0	0	0	0	0
Lemon Emigrant	*Catopsilia prmona*	0	3	0	0	1	0
Lime Blue	*Chilades lajus*	0	1	0	0	0	0
Long-tailed Blue	*Lampides boeticus*	0	18	0	0	0	0
Painted Jezebel	*Delias hyparete*	0	1	0	0	0	0
Pale Grass Blue	*Zizeeria maha*	0	7	0	0	0	0
Plain Tiger	*Danaus chrysippus*	0	2	0	0	0	0
Plum Judy	*Abisara echerius*	6	1	0	0	0	0
Punchinello	*Zemeros flegyas*	0	3	0	0	0	0
Red Helen	*Papilio helenus*	0	1	0	0	1	0
Red-based Jezebel	*Delias pasithoe*	3	2	2	0	0	0
Rustic	*Cupha erymanthis*	0	1	0	0	0	0
Slate Flash	*Rapala manea*	0	1	0	0	0	0
South China Bush Brown	*Mycalesis zonata*	1	1	0	0	0	0
South Sullied Sailer	*Neptis clinia*	0	2	1	0	0	0
Spangle	*Papilio protenor*	0	2	0	0	0	0
Tailed Jay	*Graphium agamemnon*	0	1	0	0	0	0
White-edged Blue Baron	*Euthalia phemius*	0	2	0	0	0	0
Yellow Orange Tip	*Ixias pyrene*	0	1	0	0	0	0
	Total No. of Individuals	**32**	**82**	**4**	**0**	**3**	**0**
	Total Species	**12**	**35**	**3**	**0**	**3**	**0**

Table 8 Butterfly Species Recorded within the Study Area in Wet Season

Common Name	Species Name	Study Area					
		Secondary Woodland	Shrubland	Sandy Shore with Backshore Vegetation	Pond	Village/ Modified Area	Project Site
Angled Castor	*Ariadne ariadne*	0	1	0	0	0	0
Blue-spotted Crow	*Euploea midamus*	5	0	1	0	0	0
Brown Pansy	*Junonia iphita*	1	0	0	0	0	0
Ceylon Blue Tiger	*Ideopsis similis*	0	2	0	0	0	0
Chinese Peacock	*Papilio bianor*	6	0	0	0	0	0
Colour Sergeant	*Athyma nefte*	2	0	0	0	0	0
Common Bluebottle	*Graphium sarpedon*	1	0	2	2	1	0
Common Five-ring	*Ypthima baldus*	2	1	0	0	0	0
Common Grass Yellow	*Eurema hecabe*	8	1	0	0	1	0
Common Hedge Blue	*Acytolepis puspa*	0	1	0	0	0	0
Common Indian Crow	*Euploea core*	2	1	0	0	2	0
Common Jay	*Graphium doson*	0	1	0	0	0	0
Common Mine	*Chilasa clytia*	3	0	0	0	0	0
Common Mormon	*Papilio polytes*	3	1	1	1	2	0
Common Nawab	*Polyura athamas*	1	0	0	1	0	0
Common Sailer	*Neptis hylas*	2	1	0	0	0	0
Common Tiger	*Danaus genutia*	0	2	0	2	0	0
Dark Evening Brown	*Melanitis phedima*	0	1	0	0	0	0
Dark-band Bush Brown	*Mycalesis mineus*	9	1	0	0	0	0
Five-bar Swordtail	*Pathysa antiphates*	2	0	0	0	0	0
Forest Hopper	*Astictopterus jama*	1	0	0	0	0	0
Great Egg-fly	*Hypolimnas bolina*	5	1	0	0	0	0
Great Mormon	*Papilio memnon*	2	0	0	0	0	0
Great Orange Tip	*Hebomoia glaucippe*	1	0	0	0	0	0

Common Name	**Species Name**	**Study Area**					
		Secondary Woodland	**Shrubland**	**Sandy Shore with Backshore Vegetation**	**Pond**	**Village/ Modified Area**	**Project Site**
Great Swift	*Pelopidas assamensis*	0	1	0	0	0	0
Indian Palm Bob	*Suastus gremius*	1	0	0	0	0	0
Indian Red Admiral	*Vanessa indica*	0	1	0	0	0	0
Large Faun	*Faunis eumeus*	3	0	0	0	0	0
Lemon Emigrant	*Catopsilia prmona*	1	0	0	1	0	0
Lime Blue	*Chilades lajus*	2	0	0	0	0	0
Painted Jezebel	*Delias hyparete*	2	0	0	0	0	0
Paris Peacock	*Papilio paris*	0	0	0	0	1	0
Plum Judy	*Abisara echerius*	6	0	0	0	0	0
Purple Sapphire	*Heliophorus epicles*	0	1	1	0	0	0
Red Helen	*Papilio helenus*	4	0	0	0	0	0
Rustic	*Cupha erymanthis*	4	1	0	0	0	0
Slate Flash	*Rapala manea*	1	0	0	0	0	0
Silver Streak Blue	*Iraota timoleon*	1	0	0	0	0	0
Spangle	*Papilio protenor*	0	2	0	0	0	0
Tailed Jay	*Graphium agamemnon*	0	1	0	0	0	0
Tailed Sulphur	*Dercas verhuelli*	1	0	0	0	0	0
	Total No. of Individuals	**82**	**22**	**5**	**7**	**7**	**0**
	Total Species	**29**	**19**	**4**	**5**	**5**	**0**

Table 9 Dragonfly Species Recorded within Study Area

Common Name	Species Name	Status	Habitat Recorded in Dry Season	Habitat Recorded in Wet Season
Amber-winged Glider	*Hydrobasileus croceus*	C		W
Black-banded Gossamerwing	*Euphaea decorata*	A		W
Black Threadtail	*Prodasineura autumnalis*	A	Sh	
Common Blue Skimmmer	*Orthetrum glaccum*	A	S, Sh	Sh, W
Common Red Skimmer	*Orthetrum pruninosum*	A	Sh	S, Sh, W
Crimson Dropwing	*Trithemis aurora*	A	Sh	Sh
Indigo Dropwing	*Trithemis festiva*	A	Sh	Sh
Red-faced Skimmer	*Orthetrum chrysis*	C	S, Sh	Sh
Saddlebag Glider	*Tremea virginia*	C		Sh, W
Variegated Flutterer	*Ryhothemis variegata arria*	C		Sh
Wandering Glider	*Pantala flavescens*	A	S	D, Pd, PS, S, Sh, W
Yellow Featherlegs	*Copera marginipes*	A	D	Sh
		Total Species	**8**	**11**

VC = Very Common, C = Common, UC = Uncommon, R = Rare
W = Secondary Woodland, Sh = Shrubland, S =Sandy Shore with Backshore Vegetation, Pd = Pond, D = Village/Modified Area, PS = Project Site

Table 10 Dragonfly Species Recorded within Study Area in Dry Season

Common Name	Species Name	Status	Study Area					
			W	**Sh**	**S**	**Pd**	**D**	**PS**
Black Threadtail	*Prodasineura autumnalis*	A		1				
Common Blue Skimmer	*Orthetrum glaccum*	A		2	1			
Common Red Skimmer	*Orthetrum pruninosum*	A		1				
Crimson Dropwing	*Trithemis aurora*	A		1				
Indigo Dropwing	*Trithemis festiva*	A		3				
Red-faced Skimmer	*Orthetrum chrysis*	C		2	1			
Wandering Glider	*Pantala flavescens*	A			11			
Yellow Featherlegs	*Copera marginipes*	A		1				
	Total Species		**0**	**7**	**3**	**0**	**0**	**0**
	Total Individuals		**0**	**11**	**13**	**0**	**0**	**0**

A = Abundant, C = Common, UC = Uncommon.
W = Secondary Woodland, Sh = Shrubland, S = Sandy Shore with Backshore Vegetation, Pd = Pond, D = Village/Modified Area, PS = Project Site

Table 11 Dragonfly Species Recorded within Study Area in Wet Season

Common Name	**Species Name**	**Status**	**Study Area**					
			W	**Sh**	**S**	**Pd**	**D**	**PS**
Amber-winged Glider	*Hydrobasileus croceus*	C	2					
Black-banded Gossamerwing	*Euphaea decorata*	A	1					
Common Blue Skimmer	*Orthetrum glaccum*	A	2	5				
Common Red Skimmer	*Orthetrum pruninosum*	A	1	2	1			
Crimson Dropwing	*Trithemis aurora*	A		2				
Indigo Dropwing	*Trithemis festiva*	A		2				
Red-faced Skimmer	*Orthetrum chrysis*	C		1				
Saddlebag Glider	*Tremea virginia*	C	2	1				
Variegated Flutterer	*Ryhothemis variegata arria*	C		1				
Wandering Glider	*Pantala flavescens*	A	95	35	10	50	16	20
Yellow Featherlegs	*Copera marginipes*	A		3				
	Total Species		**6**	**9**	**2**	**1**	**1**	**1**
	Total Individuals		**103**	**52**	**11**	**50**	**16**	**20**

A = Abundant, C = Common, UC = Uncommon
W = Secondary Woodland, Sh = Shrubland, S = Sandy Shore with Backshore Vegetation, Pd = Pond, D = Village/Modified Area, PS = Project Site

Table 12 Amphibian and Reptile Species Recorded within Study Area

Common Name	**Species Name**	**Status**	**Habitat Recorded in Dry Season**	**Habitat Recorded in Wet Season**
Amphibians				
Asian Common Toad	*Bufo melanosticus*	A	W	
Gunther's Frog	*Rana guentheri*	A	Sh	S
Reptiles				
Changeable Lizard	*Calotes versicolor*	A	Sh	
Common Rat Snake	*Ptyas mucosus*	P	PS	S
Long-tailed Skink	*Mabuya longicaudata*	A	Sh	
Reeves' Smooth Skink	*Scincella reevesii*	A	Sh	
	Total Species		**6**	**2**

W = Secondary Woodland, Sh = Shrubland, S = Sandy Shore with Backshore Vegetation, Pd = Pond, D = Village/Modified Area, PS = Project Site
A = Abundant, UC = Uncommon, P = Protected

Table 13 Fish Species and Individuals Recorded from the Stream/ Channels at Lung Mei Study Area

Scientific Name	Status	Origin	Relative Abundance							
			S1	S2	S3	S4	Lo Tsz River (S5)		Shan Liu River (S6)	
							Lower	Upper	Lower	Upper
Guppy *Poecilia reticulata*	Common	Exotic to China	No fish was recorded in S1 and S2.		+			++	++	++
Mosquito Fish *Gambusia affinis*	Common	Exotic to China			+	+++	++	+++	++	+++
Swordtail *Xiphophorus hellerii*	Common	Exotic to China							++	
Tilapia *Oreochromis niloticus*	Common	Exotic to China				++		+	+	
Variable Platyfish *Xiphophorus variatus*	Common	Exotic to China			+		++	+++		+++
Common Mudskipper *Periophthalmus modestus*	Common	Western Pacific region					+		+	
Common Silver-biddy *Gerres oyena*	Common	Indo-Pacific region					++		++	

+ = less than 20 individuals; ++ = 20-50 individuals; +++ = more than 50 individuals

For Lo Tsz River and Shan Liu River, Lower = Section of the stream located below Ting Kok Road. Upper = Section of the stream above Ting Kok Road.

Table 14 Mean Number of Individuals (m-2) (± S.D.) of Intertidal Organisms Recorded from the Artificial / Disturbed Shoreline During the Intertidal Survey

	High Intertidal Zone		Middle Intertidal Zone		Low Intertidal Zone	
Snail						
Nodilittorina radiata	0.8	± 1.8	0		0	
Planaxis sulcatus	2.4	± 5.4	0		96	± 203.7
Monodonta labio	2.4	± 5.4	18.4	± 15.7	4.8	± 6.6
Bivalves (% cover)						
Saccostrea cucullata	1.8%	± 2.5%	7.0%	± 4.8%	38.0%	± 36.8%
Isognomon isognomum	5.4%	± 8.4%	5.2%	± 6.1%	0.4%	± 0.9%
Barnacles (% cover)						
Balanus amphitrite	0.4%	± 0.9%	0.6%	± 0.9%	0.0%	

Table 15 Benthic Organisms Recorded within the Soft Bottom Habitat of the Project Site

Depth	Sample	Number of individuals	Biomass (g)	Scientific	Family	Order	Class	Phylumn
0 m CD	1	9	0.4218	*Clithon oulaniensis*	Neritidae	Archaeogastropoda	Gastropoda	Mollusca
	1	1	0.557	*Cerithidea sp.*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	1	1	0.0118	*Diogenes edwardsii*	Diogenidae	Anomura	Crustacea	Arthropoda
	1	25	0.6334	*Batillaria multiformis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	1	1	0.0073	*Timoclea imbricata*	Veneridae	Veneroida	Bivalvia	Mollusca
	1	1	0.0306	*Nassarius papillosus*	Nassariidae	Stenoglossa	Gastropoda	Mollusca
0 m CD	2	5	0.1886	*Clithon oulaniensis*	Neritidae	Archaeogastropoda	Gastropoda	Mollusca
	2	6	1.5772	*Balanus albicostatus*	Balanudae	Thoracica	Crustacea	Arthropoda
	2	4	0.638	*Nassarius papillosus*	Nassariidae	Stenoglossa	Gastropoda	Mollusca
	2	28	0.7338	*Batillaria multiformis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	2	1	0.0005	*Prionospio sp.*	Spionidae	Spionida	Polychaeta	Annelida
	2	1	0.0004	*Corophium sp.*	Corophiidae	Amphipoda	Crustacea	Arthropoda
	2	1	0.0019	*Cirratulus sp.*	Cirratulidae	Spionida	Polychaeta	Annelida
	2	1	0.0183	*Ruditapes philippinarum*	Veneridae	Veneroida	Bivalvia	Mollusca
0 m CD	3	7	0.3075	*Clithon oulaniensis*	Neritidae	Archaeogastropoda	Gastropoda	Mollusca
	3	30	0.6624	*Batillaria multiformis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	3	1	0.1849	*Nassarius papillosus*	Nassariidae	Stenoglossa	Gastropoda	Mollusca
	3	1	0.0105	*Timoclea imbricata*	Veneridae	Veneroida	Bivalvia	Mollusca
	3	1	0.0008	*Prionospio sp.*	Spionidae	Spionida	Polychaeta	Annelida
-1 m CD	4	6	0.4666	*Cerithidea cingulata*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	4	7	0.3664	*Batillaria multiformis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	4	7	0.051	*Cerithidea sp.*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
-1 m CD	5	2	0.3196	*Nassarius dealbatus*	Nassariidae	Stenoglossa	Gastropoda	Mollusca
	5	16	0.6292	*Batillaria multiformis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	5	6	0.5466	*Cerithidea cingulata*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	5	2	0.0142	*Iravadia quadrasi*	Rissoidae	Mesogastropoda	Gastropoda	Mollusca
-1 m CD	6	2	0.3642	*Nassarius dealbatus*	Nassariidae	Stenoglossa	Gastropoda	Mollusca
	6	1	0.1924	*Saccostrea cucullata*	Ostreidae	Pterioida	Bivalvia	Mollusca
	6	16	0.5912	*Batillaria multiformis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	6	4	0.3419	*Cerithidea cingulata*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca

Depth	Sample	Number of individuals	Biomass (g)	Scientific	Family	Order	Class	Phylumn
	6	2	0.0151	*Iravadia quadrasi*	Rissoidae	Mesogastropoda	Gastropoda	Mollusca
	6	1	0.0008	*Syllis sp.*	Syllidae	Phyllodocida	Polychaeta	Annelida
	6	2	0.0013	*Prionospio ehlersi*	Spionidae	Spionida	Polychaeta	Annelida
	6	1	0.0035	*Ruditapes philippinarum*	Veneridae	Veneroida	Bivalvia	Mollusca
	6	1	0.0007	*Aonides oxycephala*	Spionidae	Spionida	Polychaeta	Annelida
	6	1	0.0069	*Modiolus sp.*	Mytilidae	Mytiloida	Bivalvia	Mollusca
	6	3	0.1478	*Timoclea imbricata*	Veneridae	Veneroida	Bivalvia	Mollusca
	6	4	0.0441	*Cerithidea sp.*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
-2 m CD	7	1	0.1674	*Nassarius dealbatus*	Nassariidae	Stenoglossa	Gastropoda	Mollusca
	7	1	0.062	*Cerithidea cingulata*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	7	7	0.1553	*Batillaria multiformis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	7	1	0.2308	*Cerithidea sp.*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	7	14	0.1009	*Batillaria zonalis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	7	1	0.0057	*Mitrella bella*	Pyrenidae	Stenoglossa	Gastropoda	Mollusca
	7	1	0.0161	*Assiminea sp.*	Assimineidae	Mesogastropoda	Gastropoda	Mollusca
-2 m CD	8	2	0.2347	*Nassarius dealbatus*	Nassariidae	Stenoglossa	Gastropoda	Mollusca
	8	1	0.651	*Barbatia decussata*	Arcidae	Arcoida	Bivalvia	Mollusca
	8	2	0.146	*Cerithidea cingulata*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	8	14	0.5686	*Batillaria multiformis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	8	1	0.0027	*Aonides oxycephala*	Spionidae	Spionida	Polychaeta	Annelida
	8	2	0.0104	*Ruditapes philippinarum*	Veneridae	Veneroida	Bivalvia	Mollusca
	8	3	0.0091	*Mitrella bella*	Pyrenidae	Stenoglossa	Gastropoda	Mollusca
	8	7	0.0532	*Batillaria zonalis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
-2 m CD	9	1	0.0992	*Saccostrea cucullata*	Ostreidae	Pterioida	Bivalvia	Mollusca
	9	19	0.528	*Batillaria multiformis*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca
	9	1	0.0931	*Timoclea imbricata*	Veneridae	Veneroida	Bivalvia	Mollusca
	9	12	0.1179	*Batillaria sp.*	Potamodidae	Mesogastropoda	Gastropoda	Mollusca

Table 16 General Descriptions of the Seabed and Qualitative Survey Recorded along each Zone

Zone	**Description**
Artificial / disturbed shoreline at Tai Mei Tuk	The seabed was mainly composed of boulders and bedrocks with sand and rubbles in between. Low cover of mud was also observed on the substratum. Low abundance (< 10 individuals) and cover of coral (< 5 %) were recorded, which were common and widespread species in Hong Kong (*Oulastrea crispata* and *Cyphastrea serailia*). Visibility was poor (~1m).
Natural rocky shore at east of Ma Shi Chau	The seabed was mainly composed of boulders and bedrocks with sand and rubbles in between. Low cover of mud was also observed on the substratum. Extremely low abundance (< 3 individuals) and cover of coral (< 5 %) were recorded, which was common and widespread species in Hong Kong (*Psammocora superficialis*). Visibility was poor (~1m).
Natural shore at east of Yeung Chau	The seabed was mainly composed of rocks, boulders and sands with rubbles in between. Low abundance (< 10 individuals) and cover of coral (< 5 %) were recorded, which was common and widespread species in Hong Kong (*Oulastrea crispata*). Visibility was poor (~1m).
Soft bottom habitat within the Project Site	The seabed was mainly composed of sandy and small bubbles. No coral was found at this zone. Visibility was around 1.5m.
Soft bottom habitat adjacent to the Project Site	The seabed was composed of sand and mud. No coral was found at this zone. Visibility was poor (~1m).

Table 17 Detail Descriptions of the Seabed and Qualitative Survey Recorded along each Rapid Ecological Assessment (REA) Transect

Location	Transect	Depth	Description
Artificial / disturbed shoreline at Tai Mei Tuk	1	-3 to –5 mPD	The seabed was mainly composed of boulders/bedrocks with rubbles in between. Visibility was fair (~1.0m) along the transect. One colony of hard coral *Oulastrea crispata* was recorded. One seahorse *Hippocampus* sp. was recorded. The transect started from east to west direction.
	2	-3 to - 4 mPD	The seabed was mainly composed of boulders/bedrocks with sand and rubbles in between. Visibility was fair (~1.0m) along the transect. No coral was recorded. The transect started from east to west direction.
	3	-3 to –5 mPD	The seabed was composed of boulders/bedrocks and in some parts with sand. Visibility was fair (~1.0m) along the transect. No coral was recorded The transect started from south to north direction.
	`4	-3 to –5 mPD	The seabed was mainly composed of bedrocks/ boulders with sand and rubbles in between. Visibility was fair (~1m – 1.5m) along the transect. No coral was recorded. The transect started from south-west to north-east direction.
	5	-2.5 to –6 mPD	The seabed was composed of boulder and bedrocks with sand in between. Visibility was fair (~1m). Two seahorses *Hippocampus* sp. was recorded. No coral was recorded. The transect started from south-west to north-east direction.
	6	-3 to –6 mPD	The seabed was composed of sand and muddy with some rocks in between. Visibility was fair (~1m). Two hard coral colonies were recorded along the transect which are *Oulastrea crispata* and *Cyphastrea serailia*. The transect started from south-east to north-west direction.
	7	-3 to –5 mPD	The seabed was mainly composed with rocks and sandy. Visibility was fair (~1m). One seahorse *Hippocampus* sp. was recorded. No coral was recorded. The transect started from south to north direction.
	8	-2.5 to –4 mPD	The seabed was mainly composed with bedrocks/boulder with some sand in between. Visibility was fair (~1m). No coral was recorded. The transect started from south to north direction.
	9	-3 to –6 mPD	The seabed was mainly with mud with rocks in between. Visibility was fair (~1m). Four hard colonies were recorded along the transect which are all *Oulastrea crispata*. The transect started from south to north direction.
	10	-2.5 to –5 mPD	The seabed was mainly composed with bedrocks/boulders with mud and sand in between. Visibility was fair (~1m). No coral was recorded. The transect started from south to north direction.
Natural rocky shore at east of Ma Shi Chau	11	-3 to –5 mPD	The seabed was mainly composed of boulders/bedrocks with sandy in between. Visibility was fair (~1.0m) along the transect. No coral was found at this area. The transect started from south-west to north-east direction.
	12	-3 to – 5 mPD	The seabed was mainly composed of boulders/bedrocks with sand and rubbles in between. Visibility was fair (~1.0m) along the transect. No coral was recorded. The transect started from south-west to north-east direction.
	13	-2.5 to –5 mPD	The seabed was composed of boulders/bedrocks with sand and rubbles in between. Visibility was fair (~1.0m) along the transect. No coral was recorded. The transect started from west to east direction.
	14	-2.5 to –4 mPD	The seabed was mainly composed of bedrocks/ boulders with sand and rubbles in between. Visibility was fair (~1m – 1.5m) along the transect. Two hard corals were recorded along the transect which are all *Psammocora superficialis* . The transect started from north-west to south-east direction.

Location	Transect	Depth	Description
	15	-2.5 to –4 mPD	The seabed was mainly composed with bedrocks/boulders with mud and sand in between. Visibility was fair (~1m). One hard coral colony was recorded along the transect which is *Oulastrea crispata*. The transect started from north-west to south-east direction.
Natural rocky shore at east of Yeung Chau	16	-2.5 to –5 mPD	The seabed was mainly composed of rocks and sand with rubbles in between. Visibility was fair (~1.0m) along the transect. Two hard coral colonies were recorded along the transect which are all *Oulastrea crispata*. One seahorse *Hippocampus* sp. was recorded. The transect started from north-west to south-east direction.
	17	-2.5 to – 4 mPD	The seabed was mainly composed of rocks and sand with rubbles in between. Visibility was fair (~1.0m) along the transect. Three hard coral colonies were recorded along the transect which are all *Oulastrea crispata*. The transect started from south-west to north-east direction.
	18	-3 to –5 mPD	The seabed was composed of boulders/rocks with sand and rubbles in between. Visibility was fair (~1.0m) along the transect. Three hard coral colonies were recorded along the transect which are all *Oulastrea crispata*. Two seahorse *Hippocampus* sp. was recorded. The transect started from north-west to south-east direction.
	19	-2.5 to –4 mPD	The seabed was mainly composed of rocks/ boulders with sand in between. Visibility was fair (~1m) along the transect. No coral was recorded. The transect started from north to south direction.
	20	-2.5 to –4 mPD	The seabed was mainly composed with rocks and sand with rubbles in between. Visibility was fair (~1m). No coral was recorded The transect started from north to south direction.

Table 18 Seabed Attributes Along the Rapid Ecological Assessment (REA) Transects

Location	**Artificial / disturbed shoreline at Tai Mei Tuk**										**Natural rocky shore at east of Ma Shi Chau**					**Natural rocky shore at east of Yeung Chau**				
Transect	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Seabed attributes [a]																				
Hard substrate																				
Continuous pavement																				
Bedrock	3	3	3	3	3			3		3	3	3	2	3	3					
Rubble	1	1		1		2	2		1		1	1	1			1	1	1	1	1
Sand	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	2	2	1	1	2
Silt						3			3	1					1					
Boulders – large	2	2	2	2	2		3	2			2	2	2	2	2	2	2	3	2	2
Boulders – small					1			1	1	2			1	1	1	3	2	1	2	2
Ecological attributes [a]																				
Hard coral	1					1			1					1	1	1	1	1		
Dead standing coral																				
Soft coral																				
Antipatharia																				
Macroalgae																				

a Note: 1 = 1-10% Cover, 2 = 11-30% Cover, 3 = 31-50% Cover, 4 = 51-75% Cover, 5 = 76-100% Cover.

Table 19 Coral Species and Their Relative Sizes Recorded Along the Rapid Ecological Assessment (REA) Transects

Transect	Position (m)	Species	Approx. Size (cm)
1	3.5	*Oulastrea crispata*	3
	6.7	*Oulastrea crispata*	5
6	4.8	*Oulastrea crispata*	5
	9.5	*Cyphastrea serialia*	20
9	5.6	*Oulastrea crispata*	6
	5.6	*Oulastrea crispata*	5
	8.5	*Oulastrea crispata*	9
	8.6	*Oulastrea crispata*	7
14	5.6	*Psammocora superficialis*	12
	7.8	*Psammocora superficialis*	14
15	5.6	*Oulastrea crispata*	5
16	5.3	*Oulastrea crispata*	4
	7.9	*Oulastrea crispata*	6
17	2.5	*Oulastrea crispata*	5
	4.7	*Oulastrea crispata*	7
	8.8	*Oulastrea crispata*	3
18	2.0	*Oulastrea crispata*	8
	4.4	*Oulastrea crispata*	4
	4.7	*Oulastrea crispata*	5

Note: The three coral species *Oulastrea crispate, Cyphastrea serailia* and *Psammocora superficialis* are regarded as common, dominant and abundant species in Hong Kong

Table 20 Hard Coral Species Recorded During the Rapid Ecological Assessment (REA)

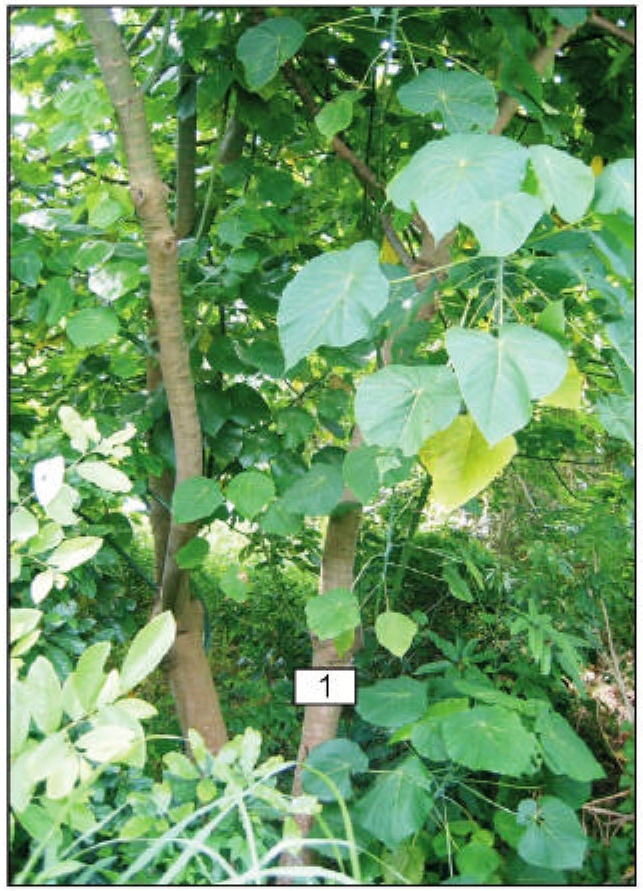
	Abundance																			
Location	**Artificial shoreline at Tai Mei Tuk**							**Natural rocky shore at east of Ma Shi Chau**						**Natural rocky shore at east of Yeung Chau**						
Transect	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Hard Coral Species																				
Cyphastrea serailia	-	-	-	-	-	1	-	-	-	-										
Oulastrea crispata	2	-	-	-	-	1	-	-	4	-	-	-	-	-	1	2	3	3	-	-
Psammocora superficialis											-	-	-	2	-					
Total Number of Species	1	0	0	0	0	2	0	0	1	0	0	0	0	1	1	1	1	1	0	0

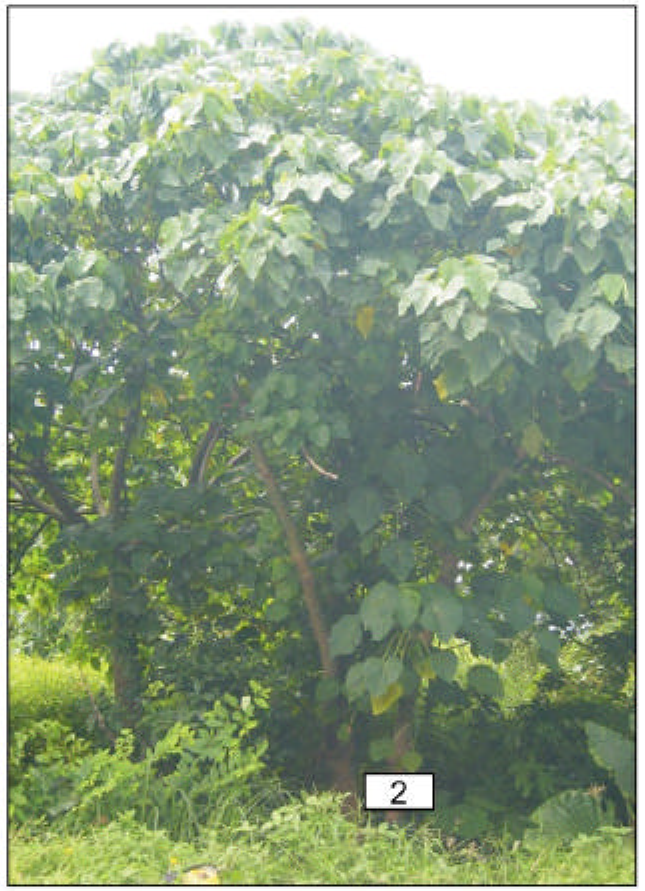
Appendix H

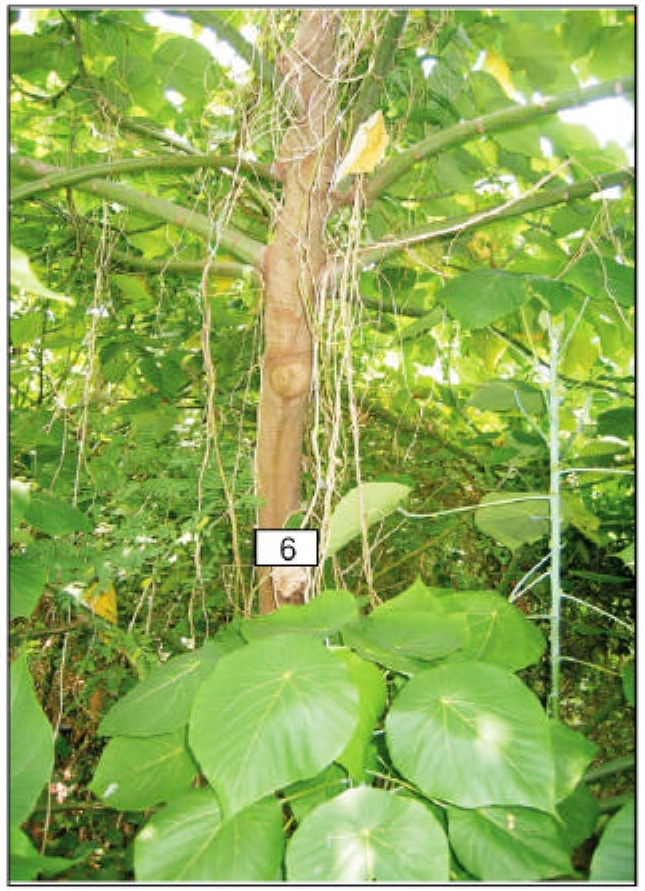
Tree Survey Data

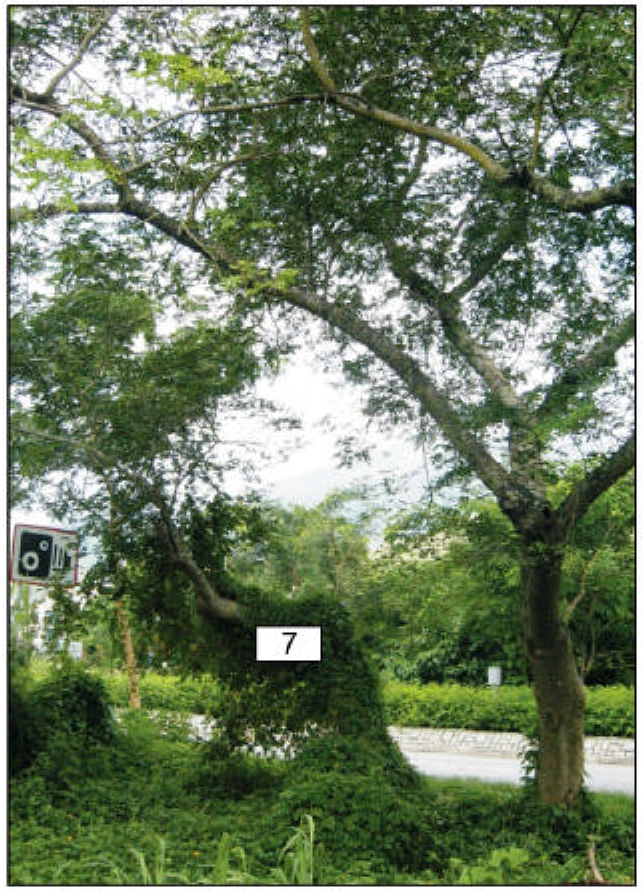
Appendix H1

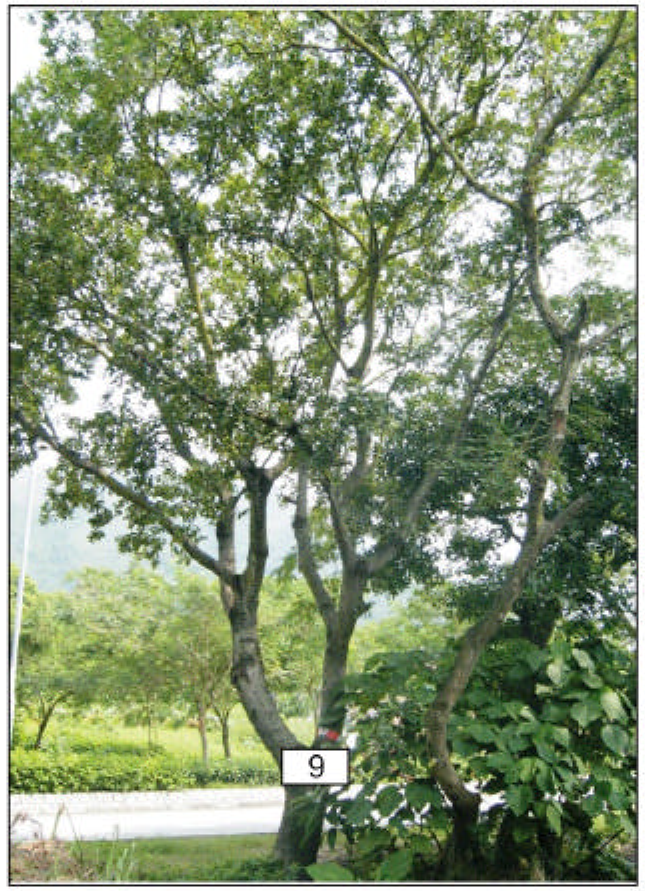
Photographic Records











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Project Title:

DEVELOPMENT OF A BATHING
BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

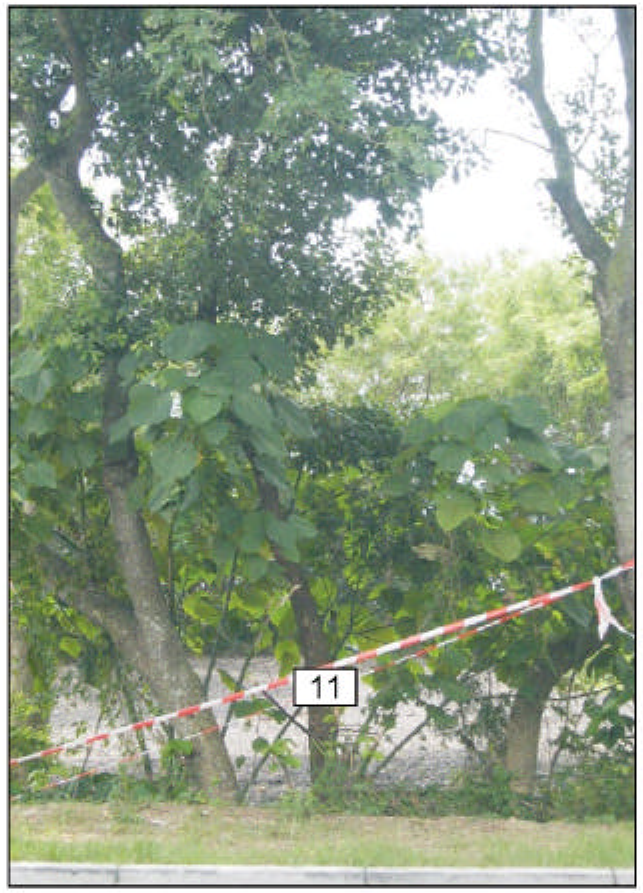
Figure Title:

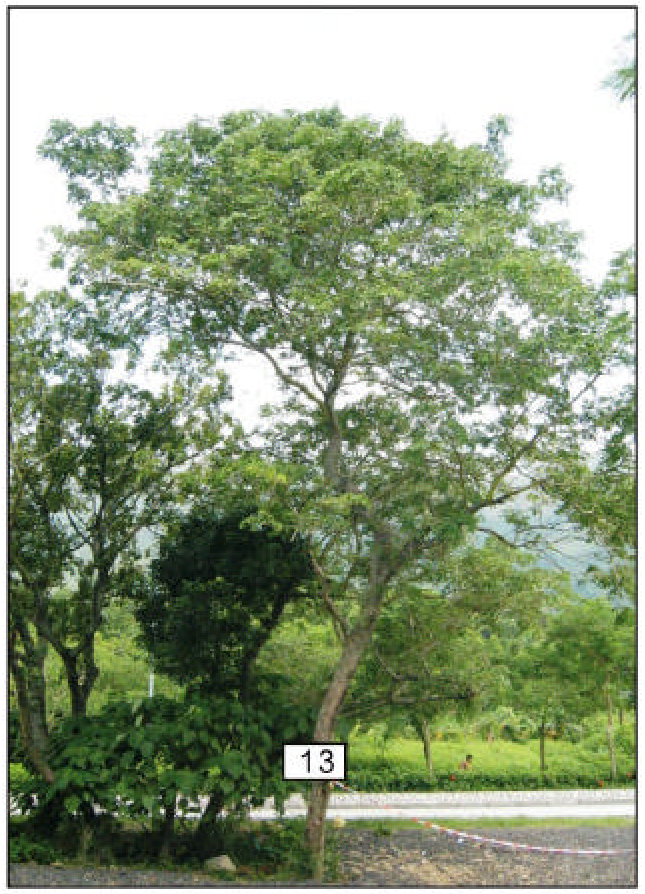
PHOTOGRAPHIC RECORDS OF
TREE NOS. 1-3 & 6-10

APPENDIX H1 - FIGURE 1

Checked	Scale	Rev.
SL	NTS	0

Designed	Drawn	Date
-	MT	13/03/2007





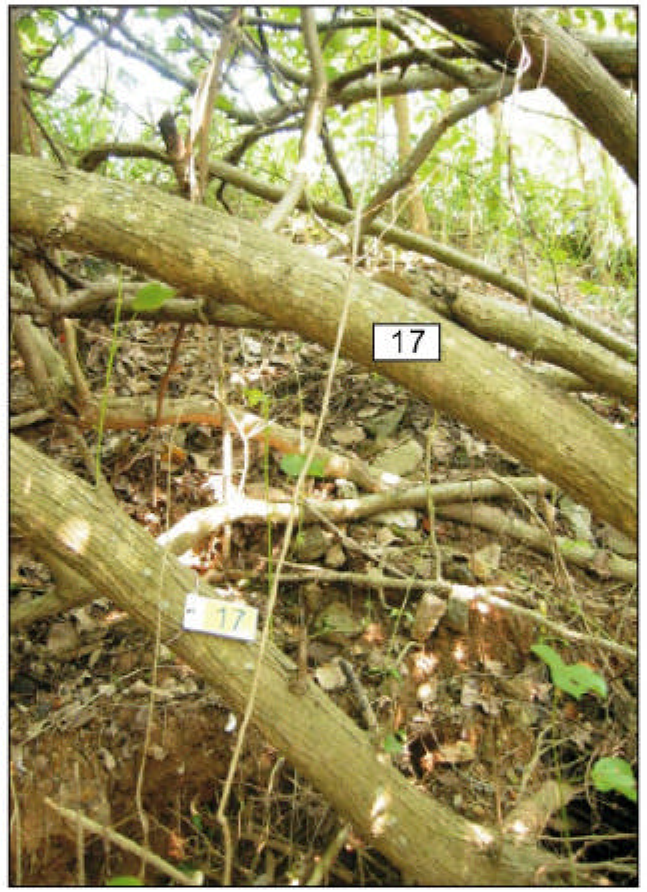


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Figure Title:

PHOTOGRAPHIC RECORDS OF
TREE NOS. 11- 18

APPENDIX H1 - FIGURE 2

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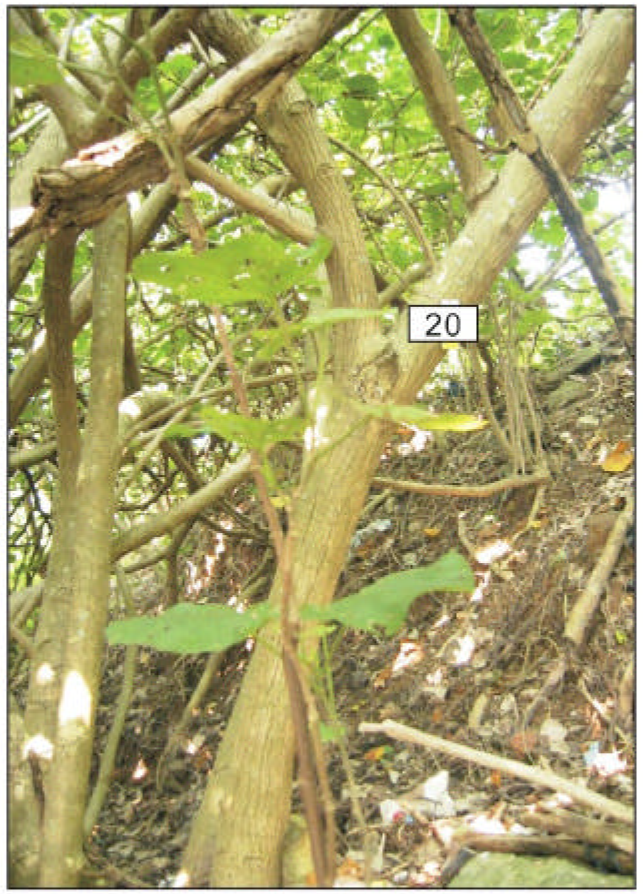
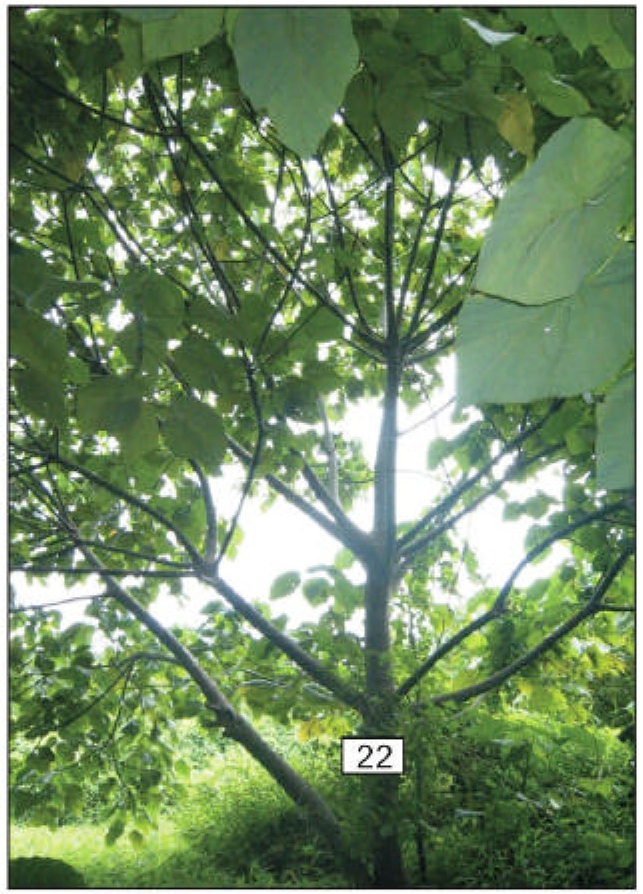
Designed	Drawn	Date
-	MT	13/03/2007





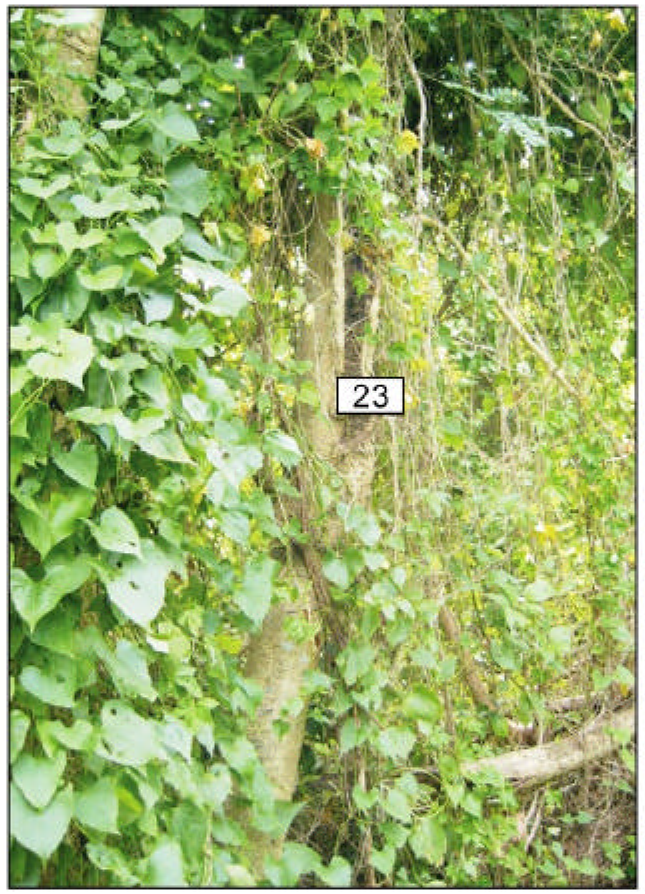


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Figure Title:
PHOTOGRAPHIC RECORDS OF
TREE NOS. 19 – 20 & 22 - 26

APPENDIX H1 – FIGURE 3

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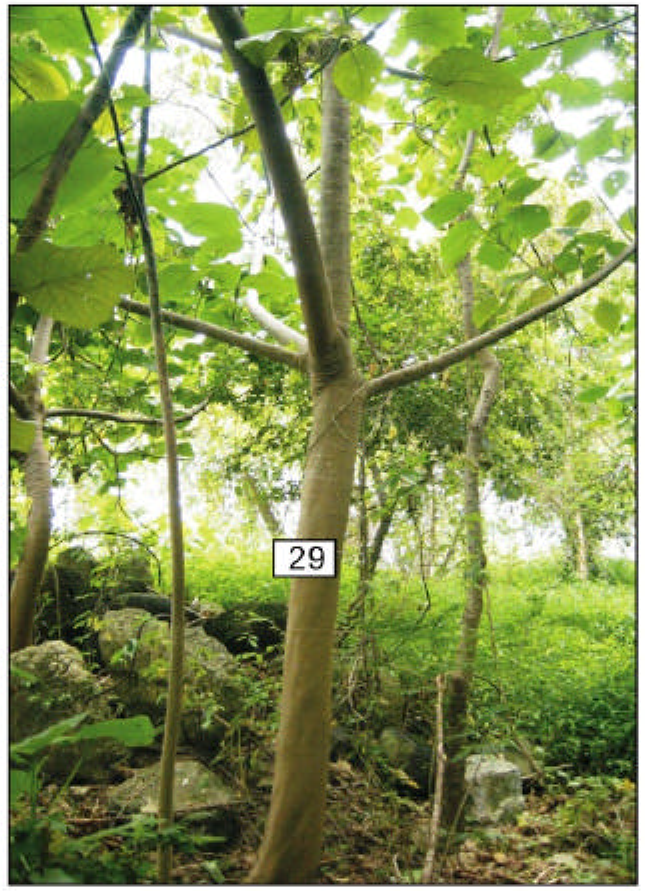
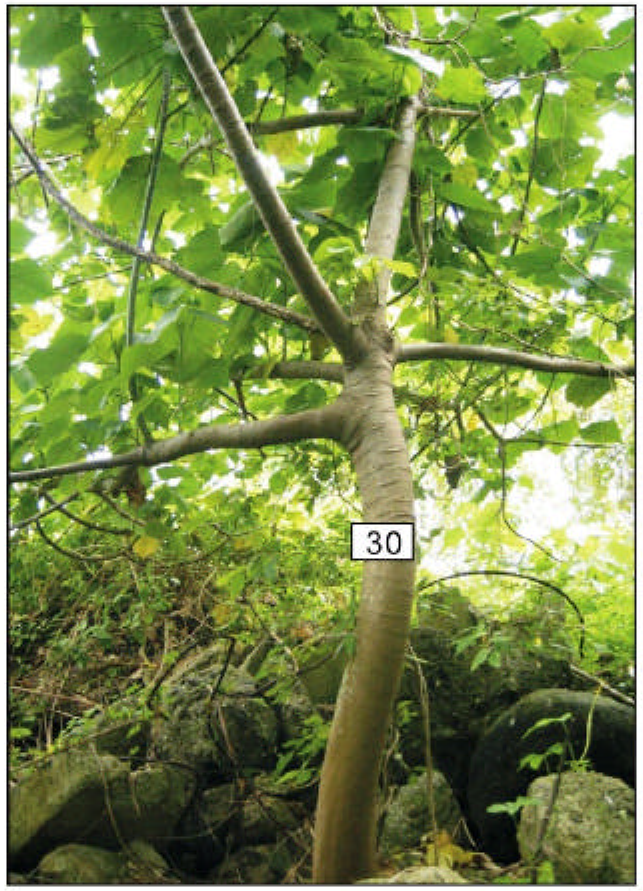
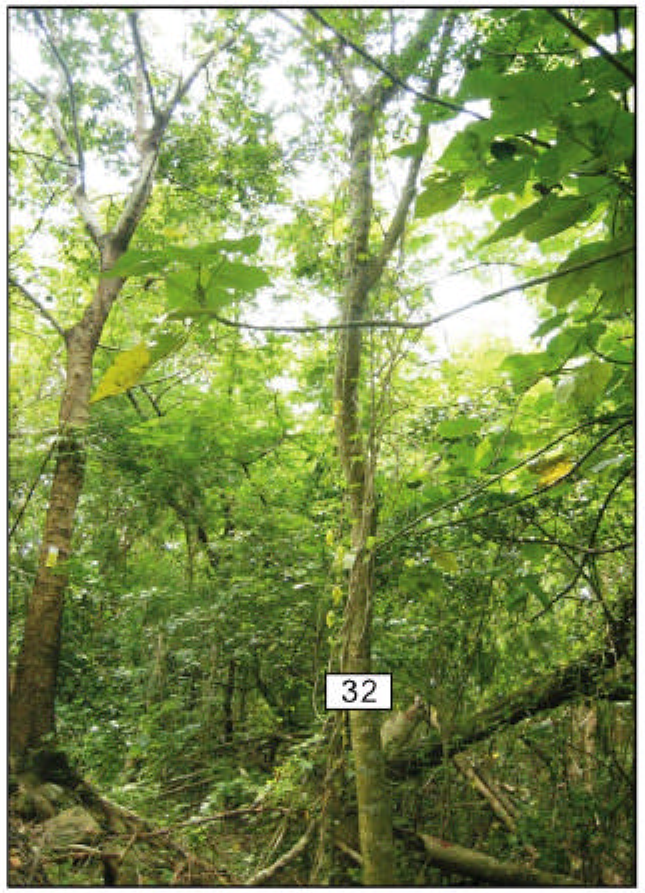
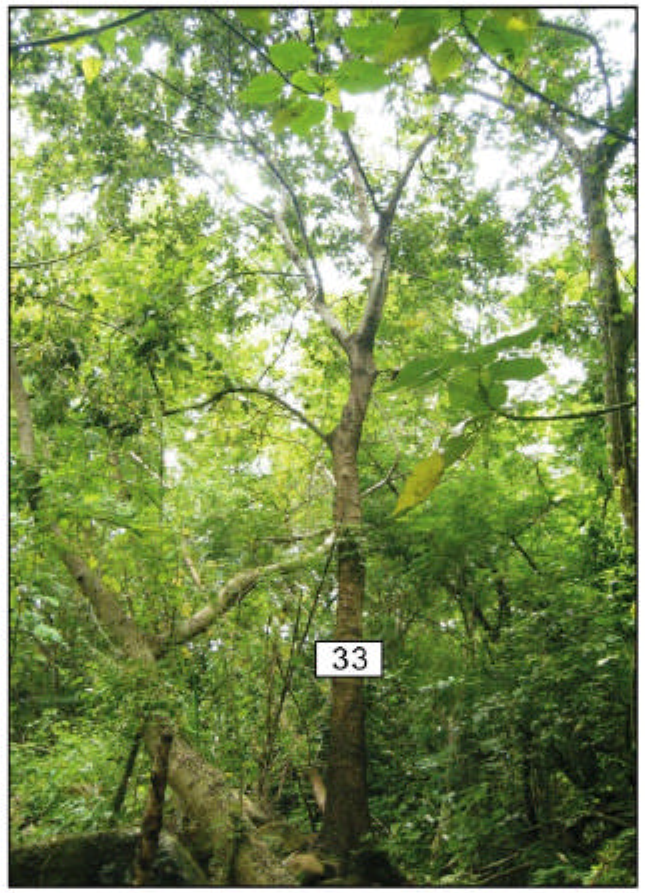
SL	NTS	0
Designed	Drawn	Date
-	MT	13/03/2007









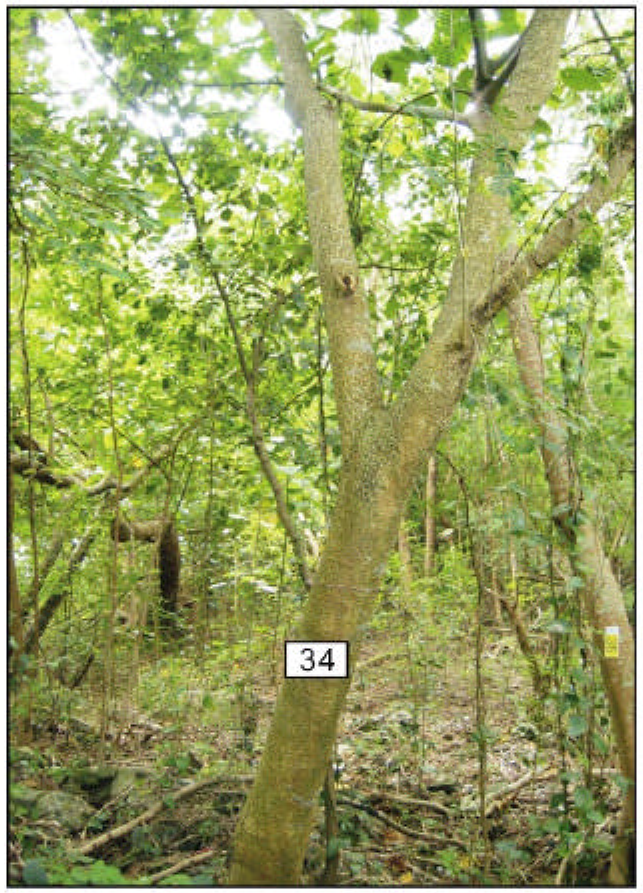


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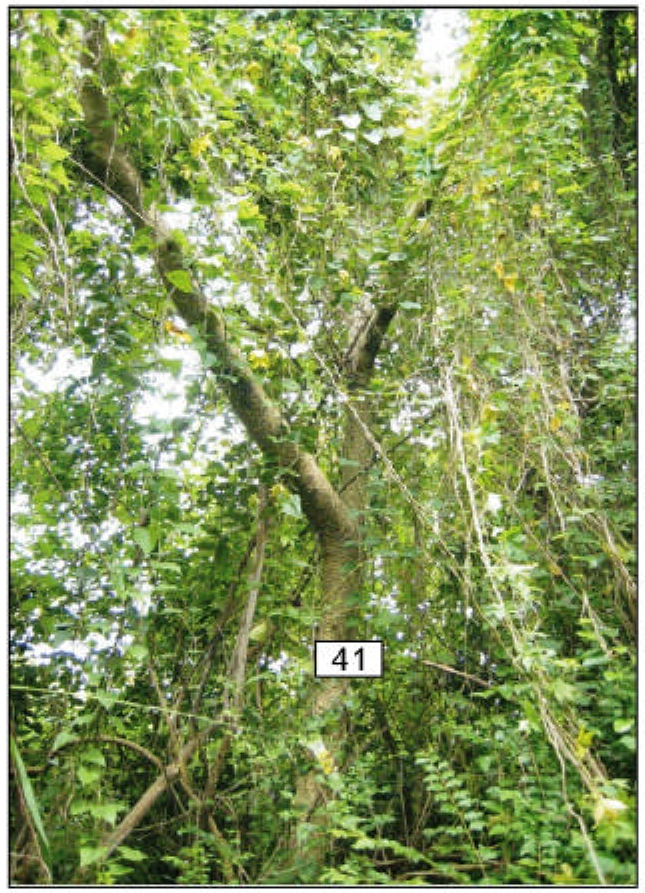
Figure Title:
PHOTOGRAPHIC RECORDS OF
TREE NOS. 27 - 34

APPENDIX H1 – FIGURE 4

Checked SL	Scale NTS	Rev. 0
Designed -	Drawn MT	Date 13/03/2007



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Project Title:
DEVELOPMENT OF A BATHING
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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Figure Title:
PHOTOGRAPHIC RECORDS OF
TREE NOS. 35 - 42

APPENDIX H1 – FIGURE 5

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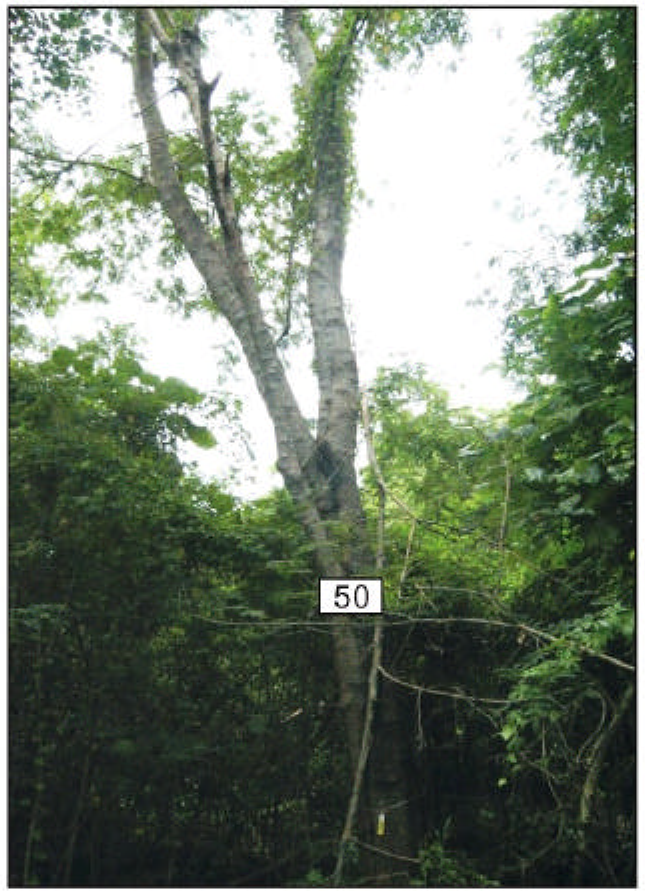

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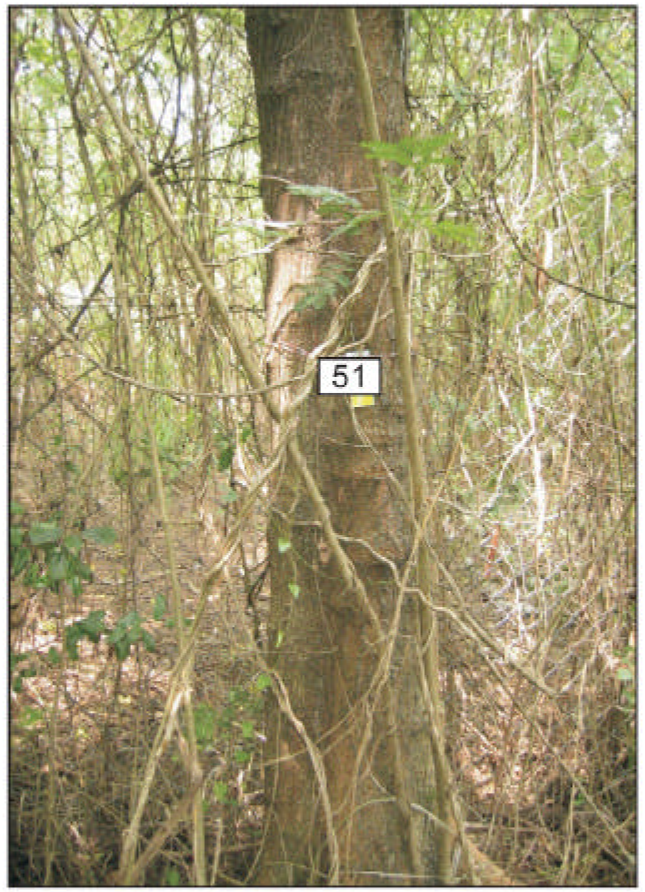
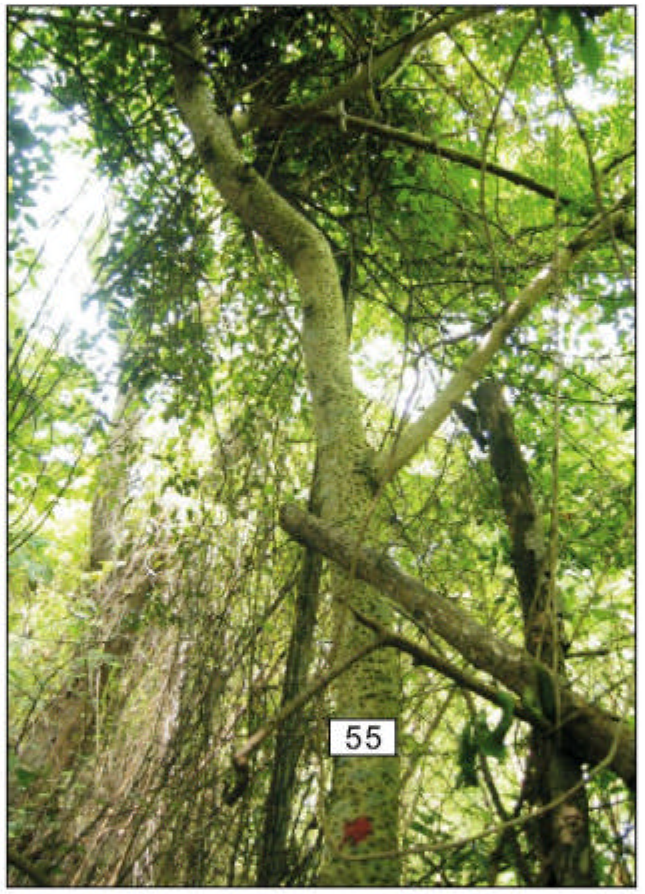
		Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO	Figure Title: PHOTOGRAPHIC RECORDS OF TREE NOS. 43 - 50	Checked: SL Scale: NTS Rev.: 0 Designed: - Drawn: MT Date: 13/03/2007





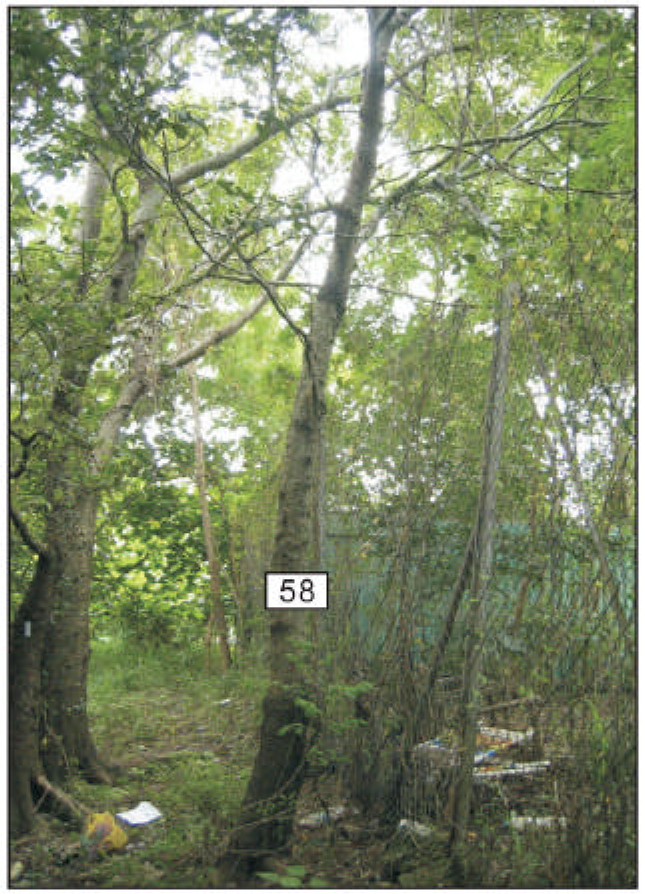


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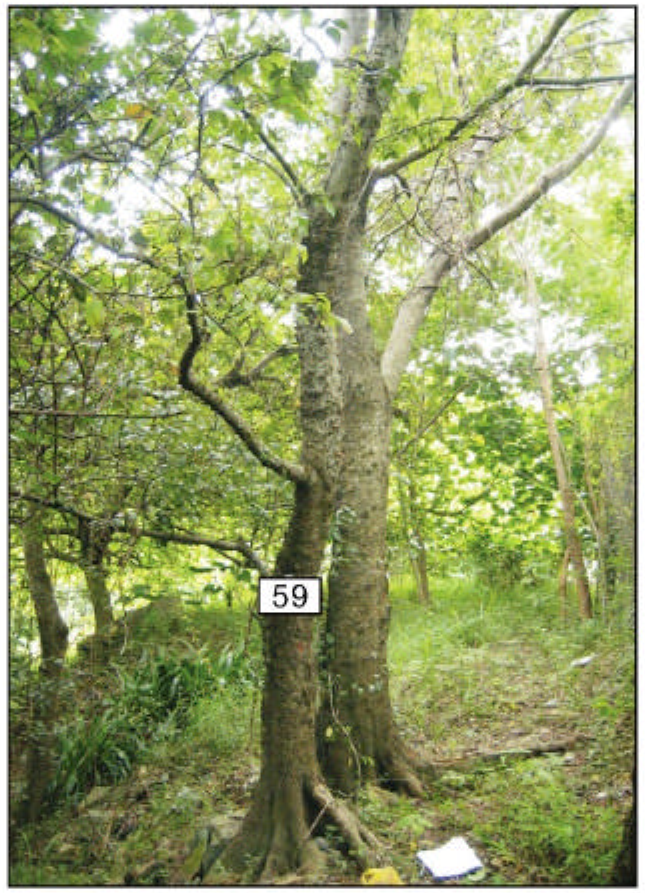
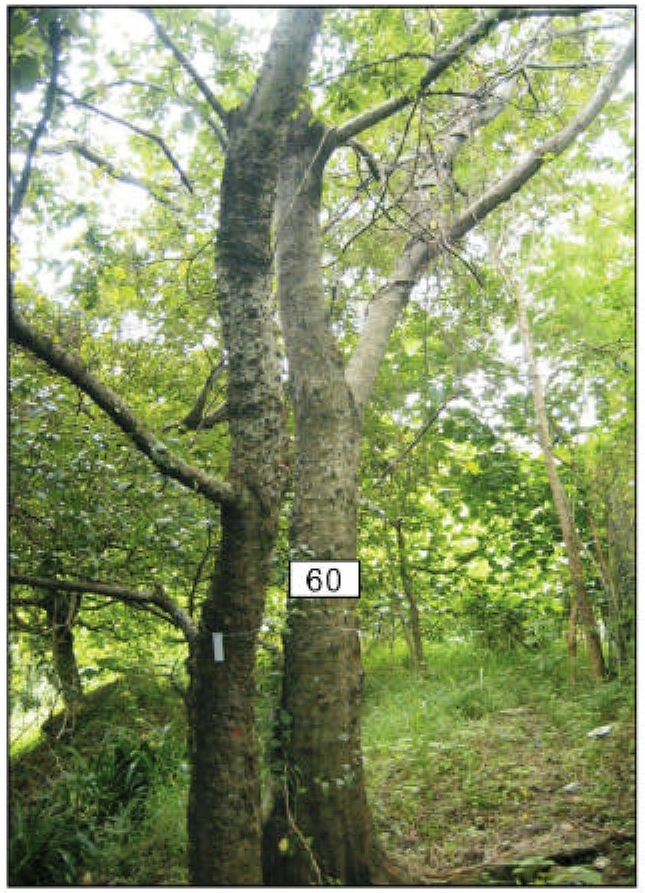
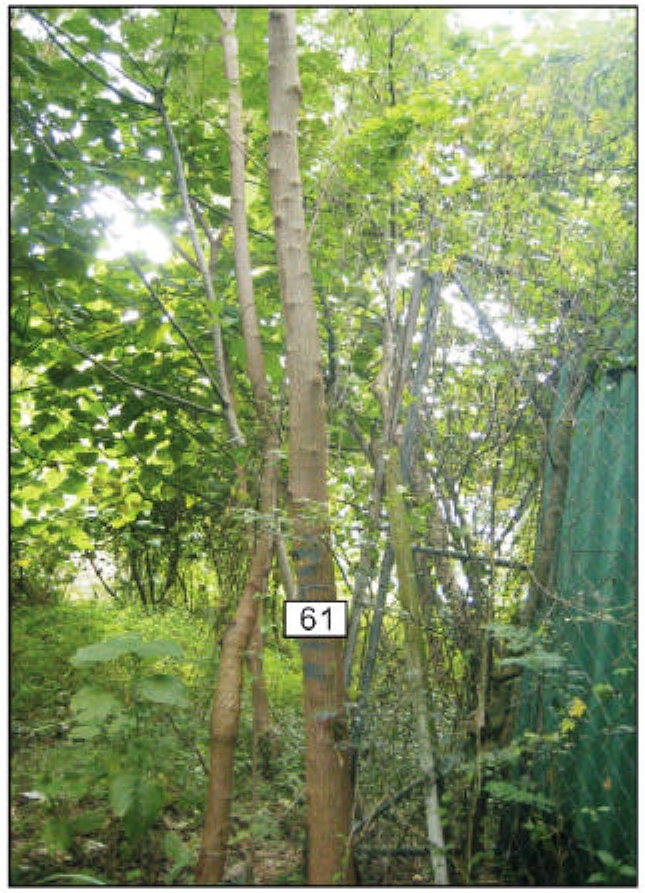
Figure Title:
PHOTOGRAPHIC RECORDS OF
TREE NOS. 51 - 58

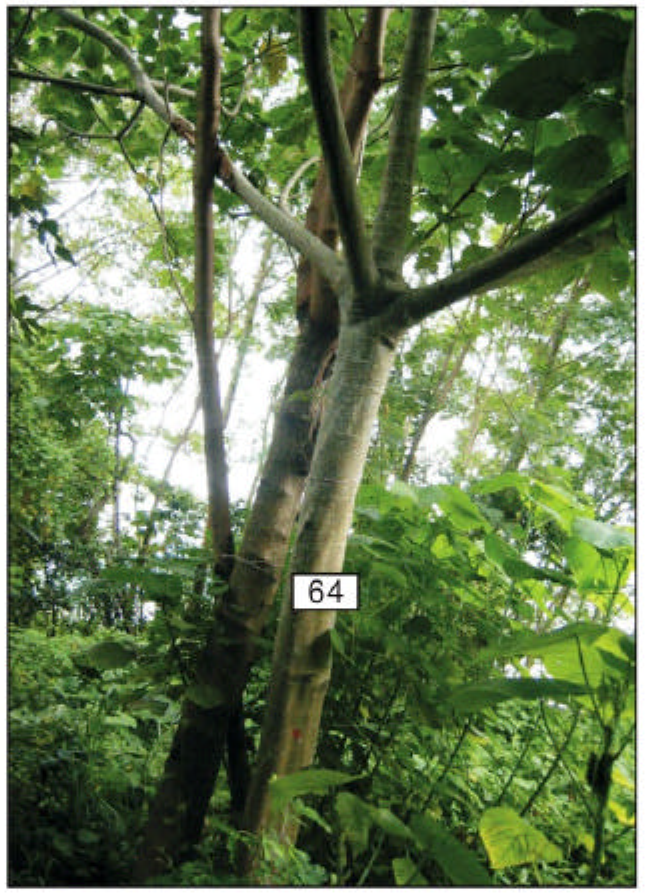
APPENDIX H1 – FIGURE 7

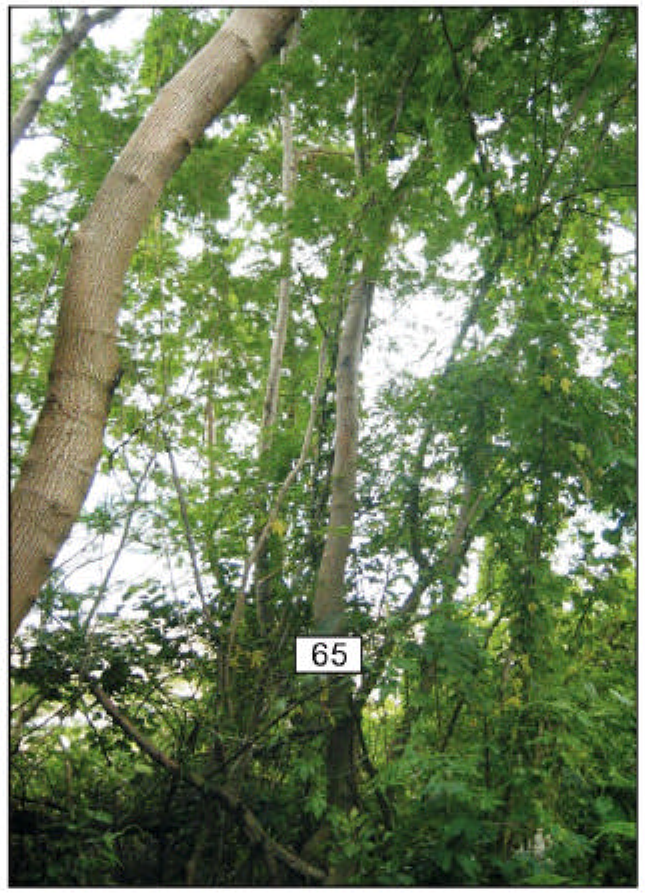
Checked SL	Scale NTS	Rev. 0
Designed -	Drawn MT	Date 13/03/2007











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DEVELOPMENT OF A BATHING
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Figure Title:

PHOTOGRAPHIC RECORDS OF
TREE NOS. 59 - 66

APPENDIX H1 – FIGURE 8

Checked	Scale	Rev.
SL	NTS	0
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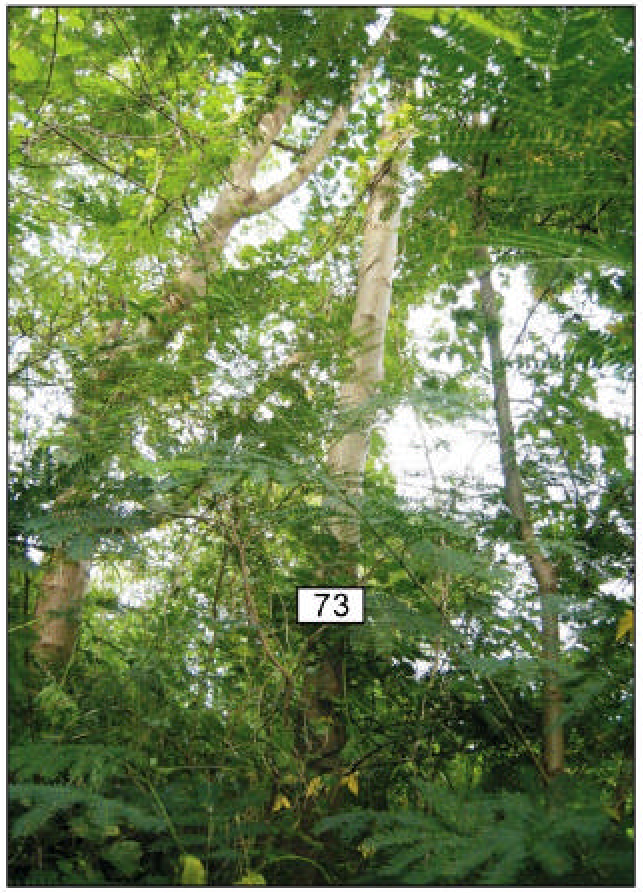

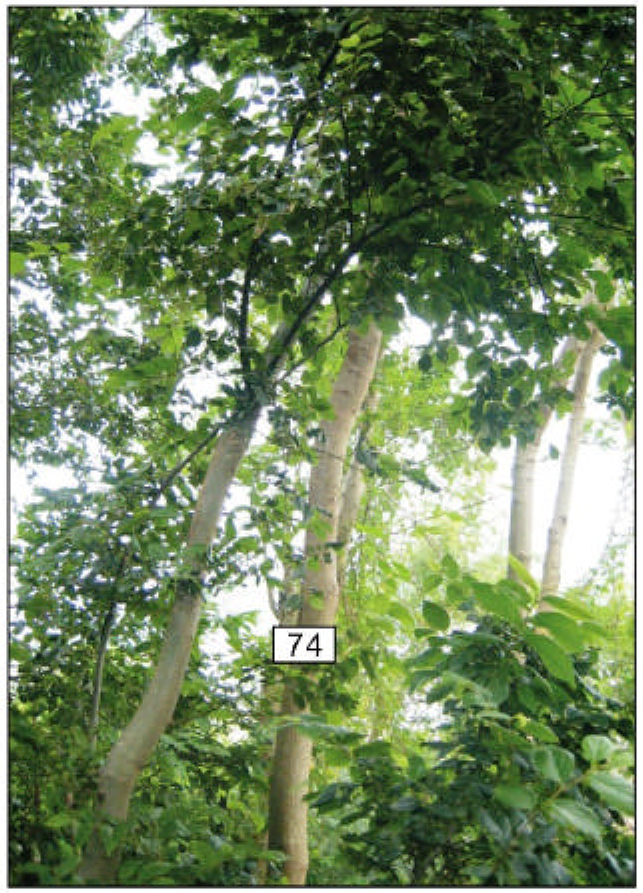

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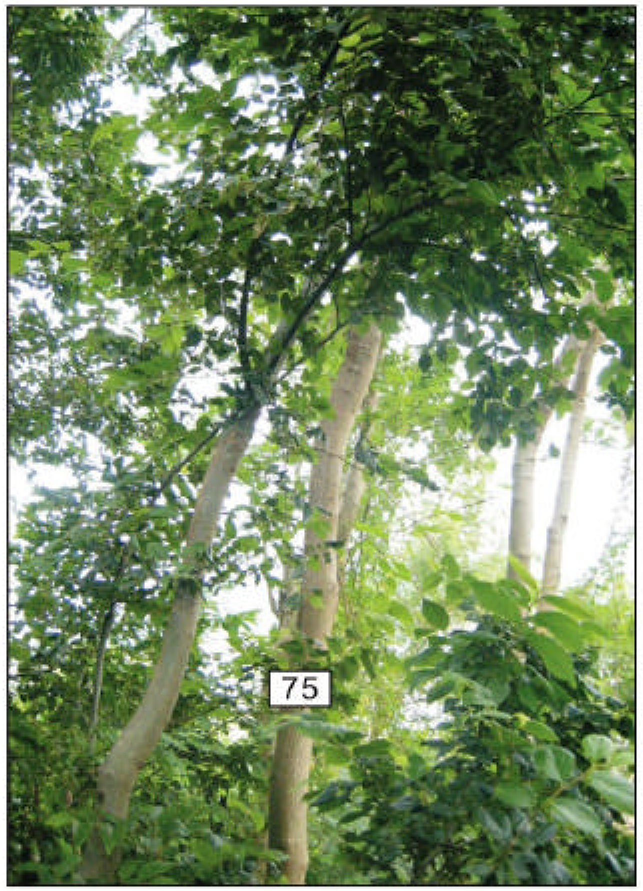
Figure Title:

PHOTOGRAPHIC RECORDS OF
TREE NOS. 67 - 74

APPENDIX H1 – FIGURE 9

Checked	Scale	Rev.
SL	NTS	0
Designed	**Drawn**	**Date**
-	MT	13/03/2007



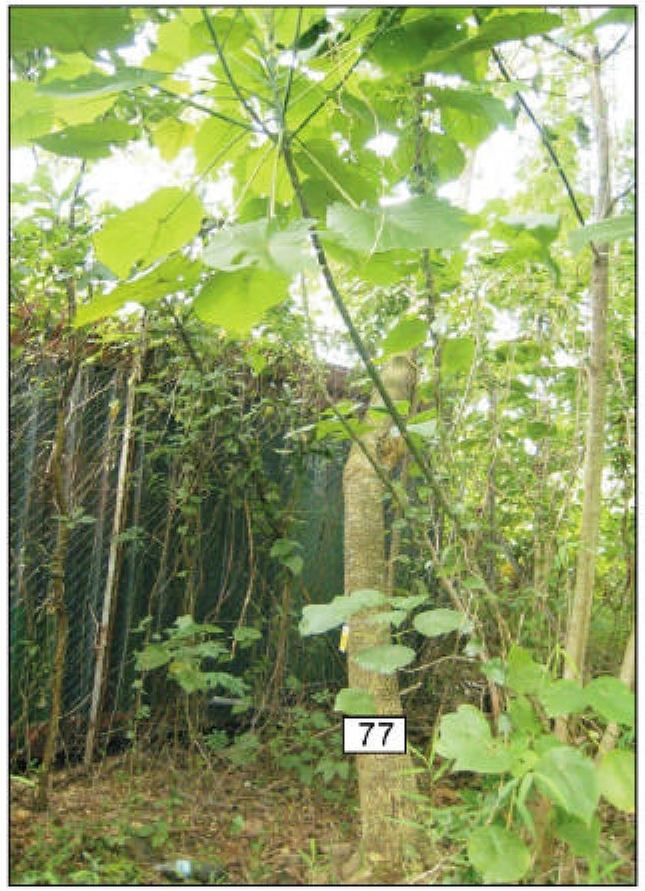


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Figure Title:

PHOTOGRAPHIC RECORDS OF
TREE NOS. 75 - 82

APPENDIX H1 – FIGURE 10

Checked SL	Scale NTS	Rev. 0
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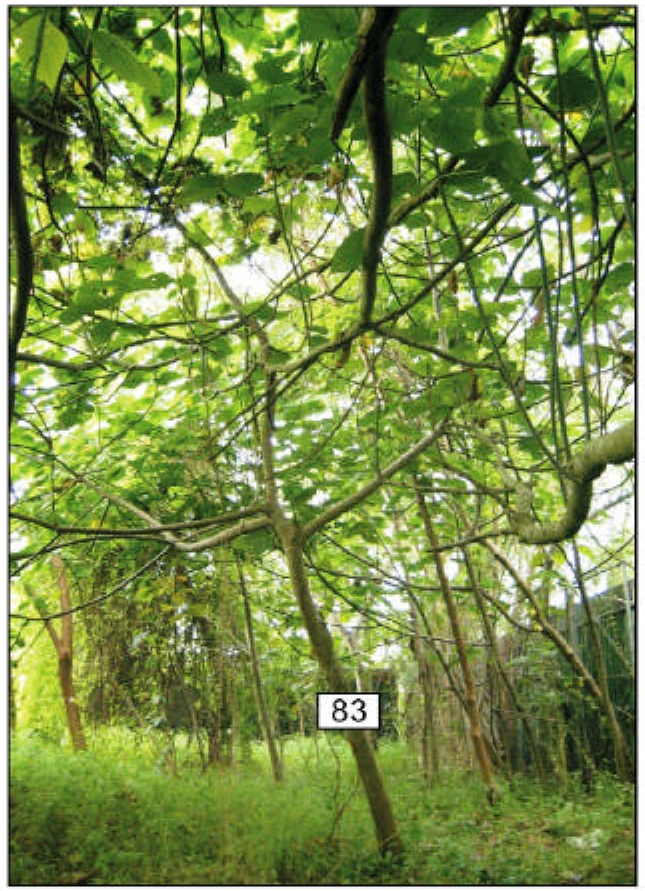

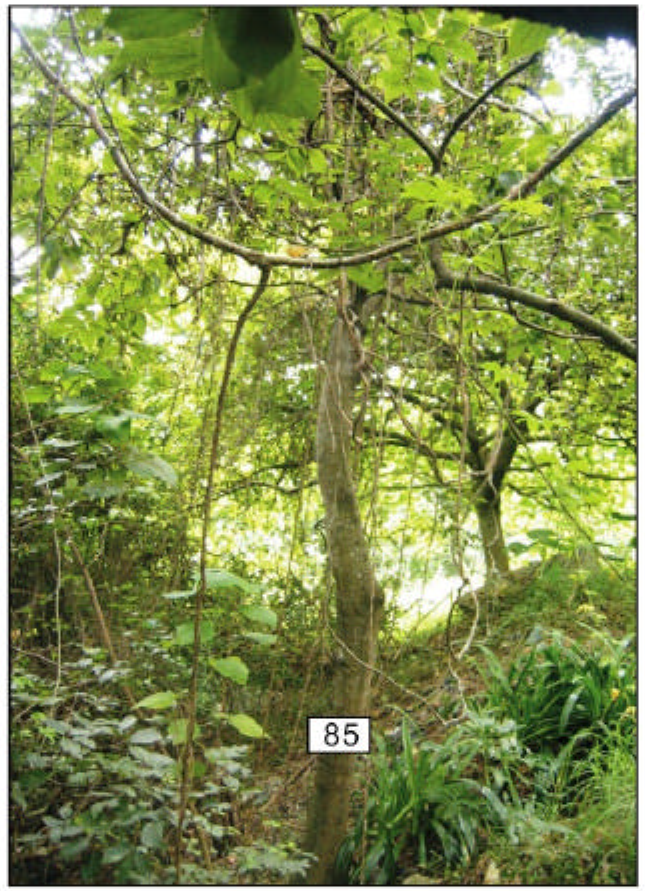

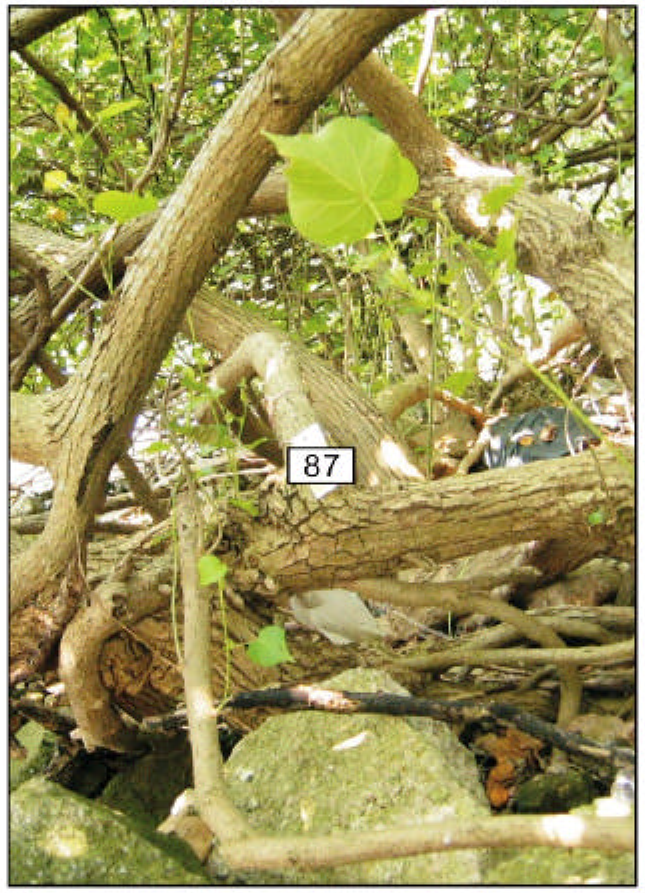

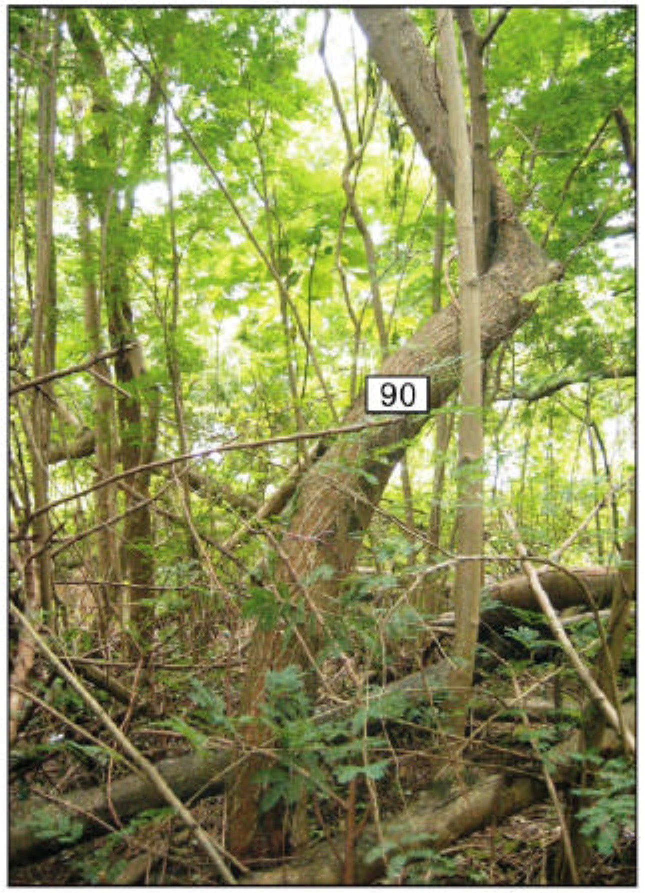

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DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

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Figure Title:

PHOTOGRAPHIC RECORDS OF TREE NOS. 83 - 90

APPENDIX H1 – FIGURE 11

Checked	Scale	Rev.
SL	NTS	0
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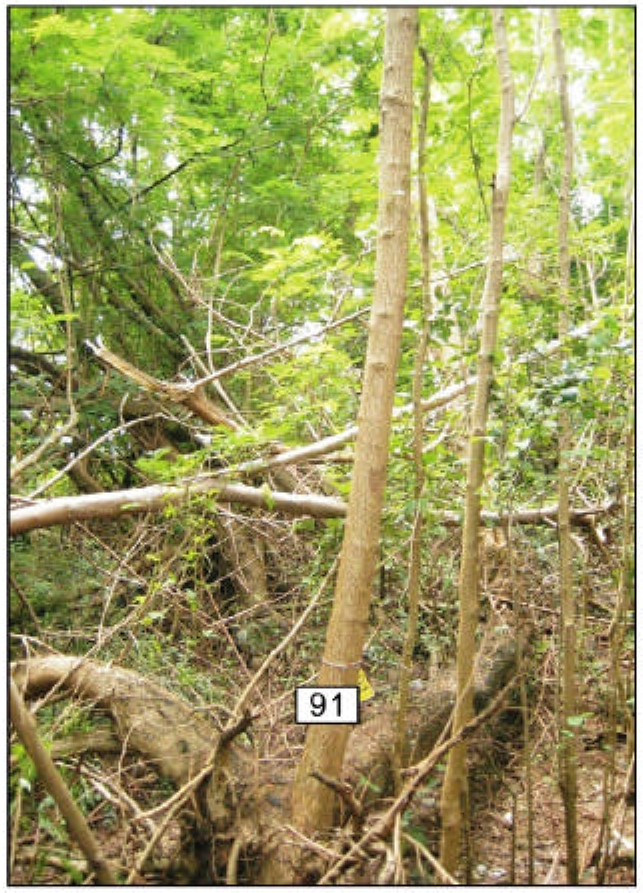
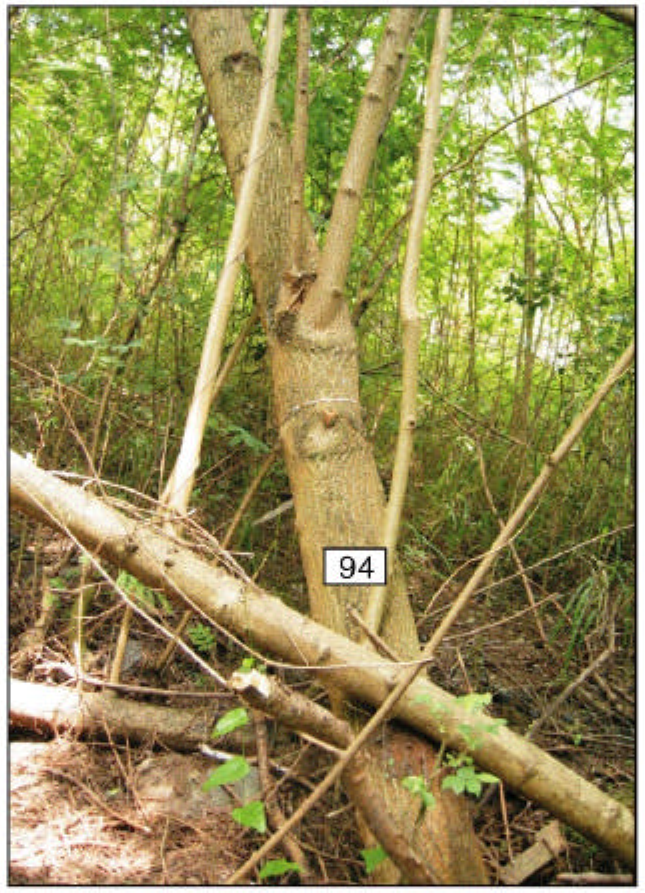
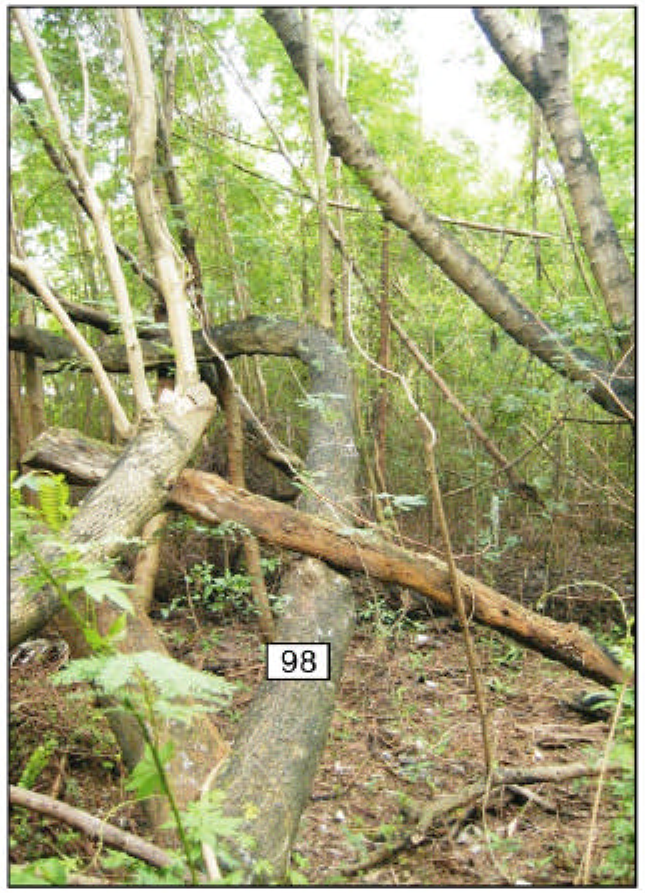
-	MT	13/03/2007







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BEACH AT LUNG MEI, TAI PO

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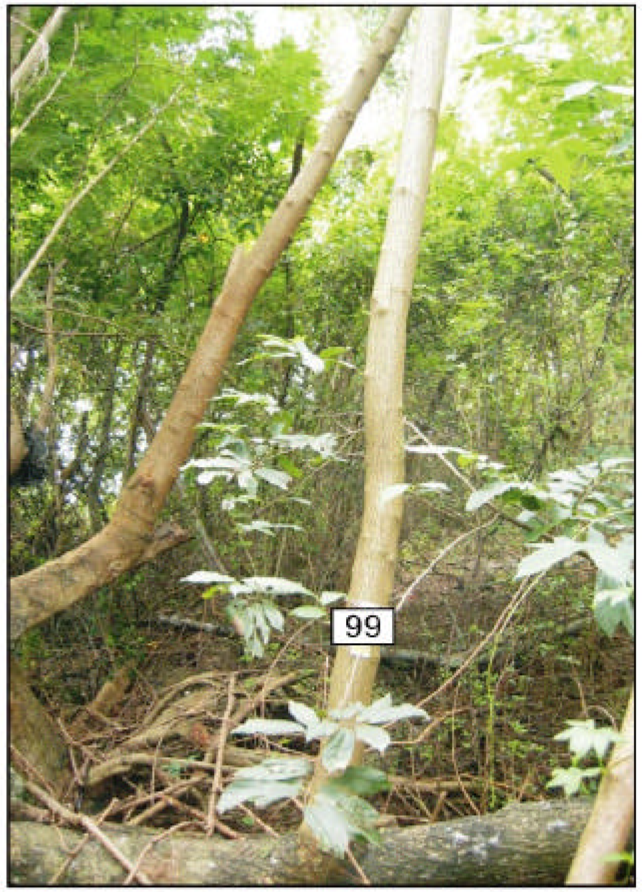
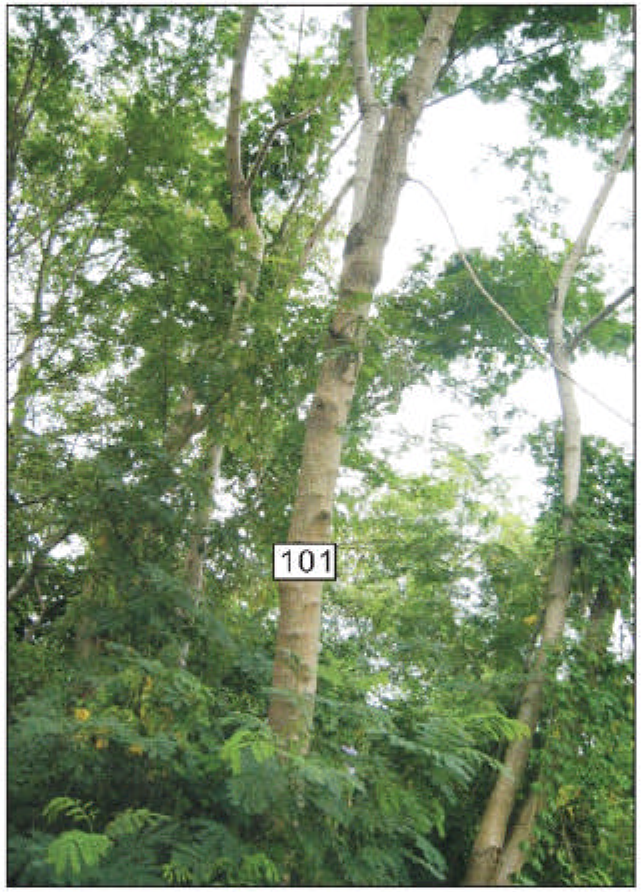
Figure Title:

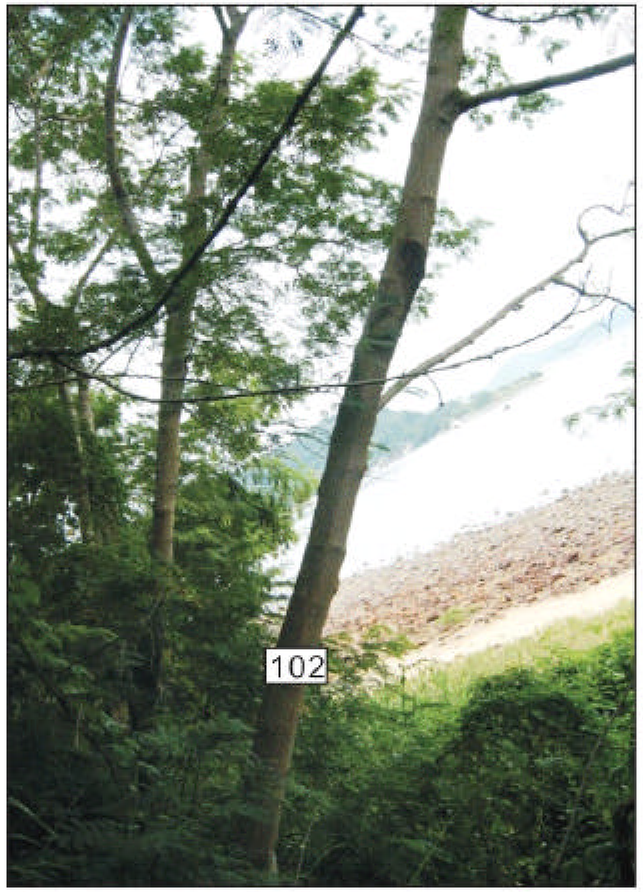
PHOTOGRAPHIC RECORDS OF
TREE NOS. 91 - 98

APPENDIX H1 – FIGURE 12

Checked SL	Scale NTS	Rev. 0
Designed -	Drawn MT	Date 13/03/2007







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DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

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Figure Title:
PHOTOGRAPHIC RECORDS OF TREE NOS. 99 - 106

APPENDIX H1 – FIGURE 13

Checked SL	Scale NTS	Rev. 0
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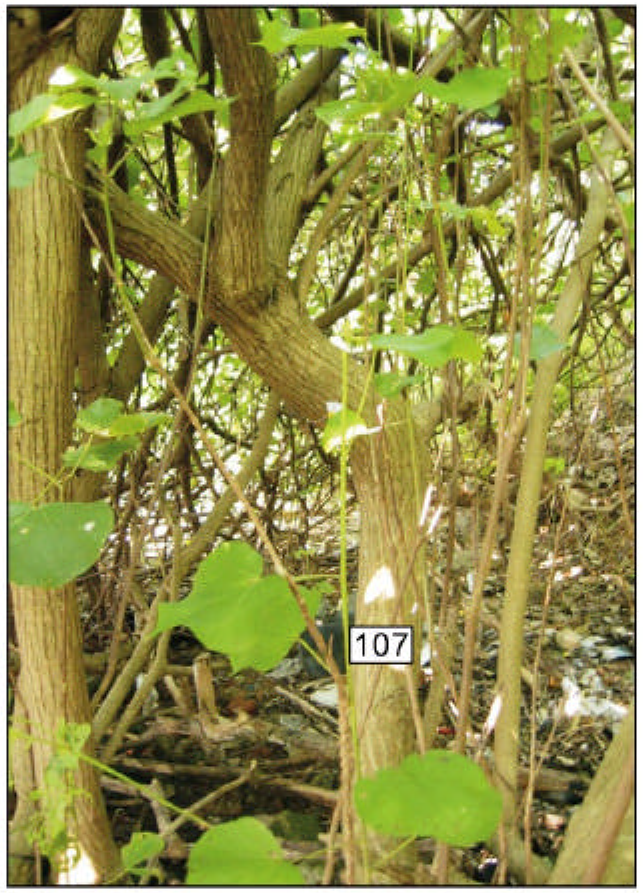

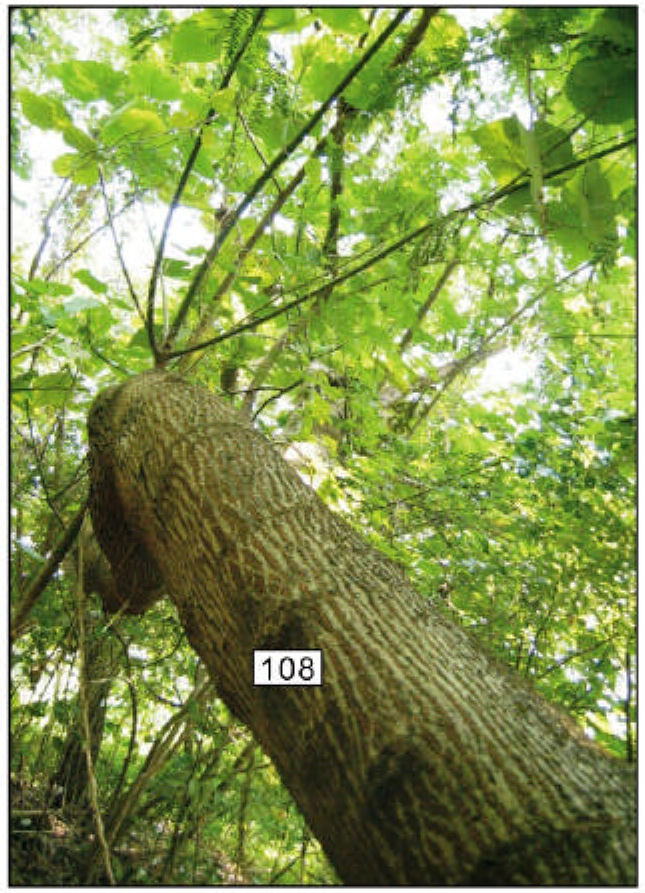

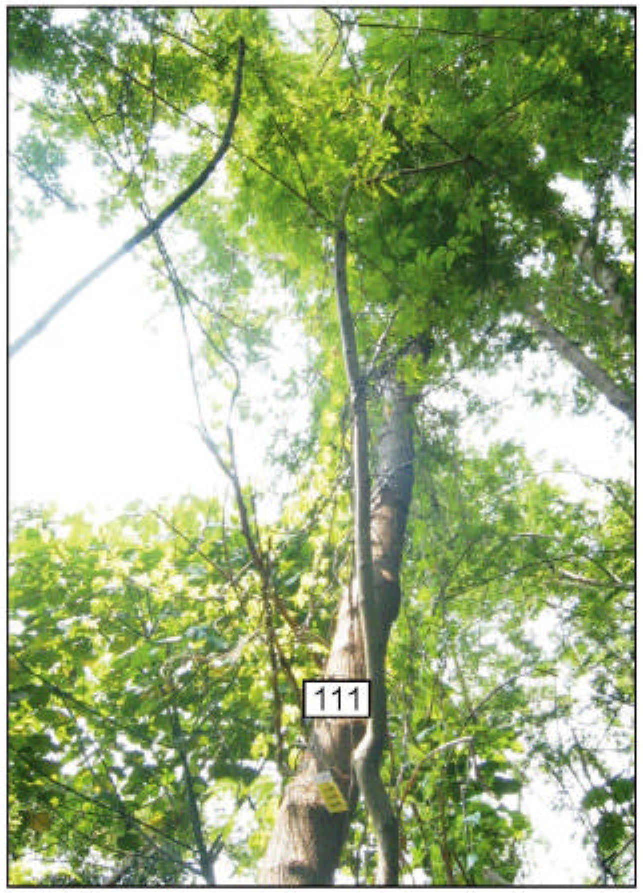

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Figure Title:
PHOTOGRAPHIC RECORDS OF
TREE NOS. 107 - 114

APPENDIX H1 – FIGURE 14

Checked	Scale	Rev.
SL	NTS	0
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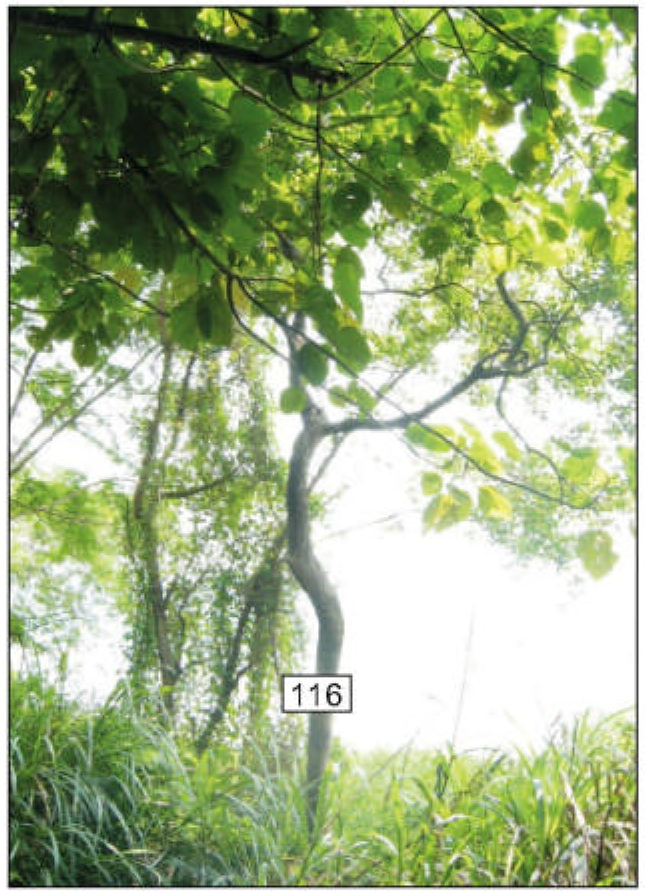

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Figure Title:
PHOTOGRAPHIC RECORDS OF
TREE NOS. 115 – 117 & 119 - 121

APPENDIX H1 – FIGURE 15

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Figure Title:

PHOTOGRAPHIC RECORDS OF
TREE NOS. 122 - 129

APPENDIX H1 – FIGURE 16

Checked	Scale	Rev.
SL	NTS	0
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-	MT	13/03/2007


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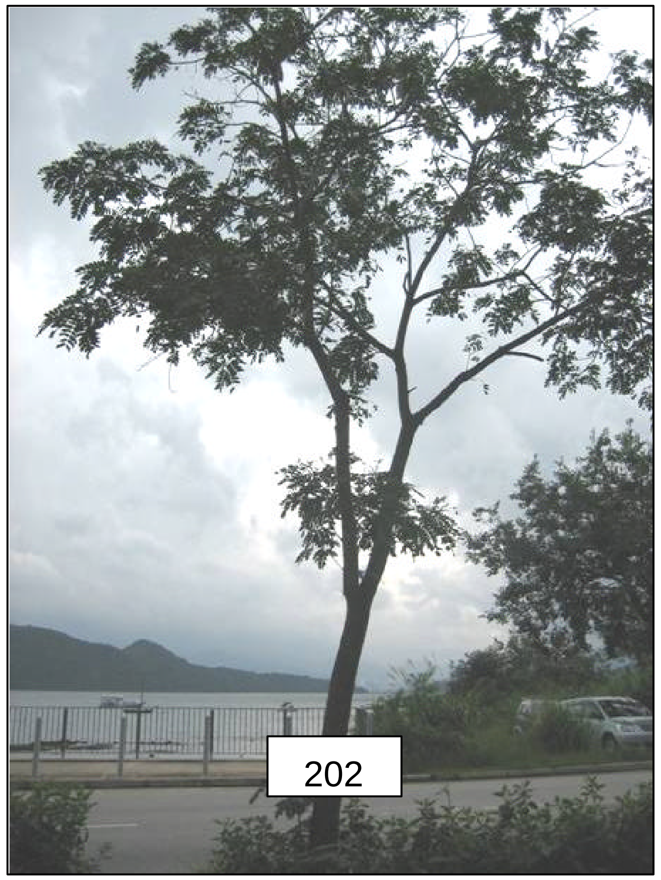
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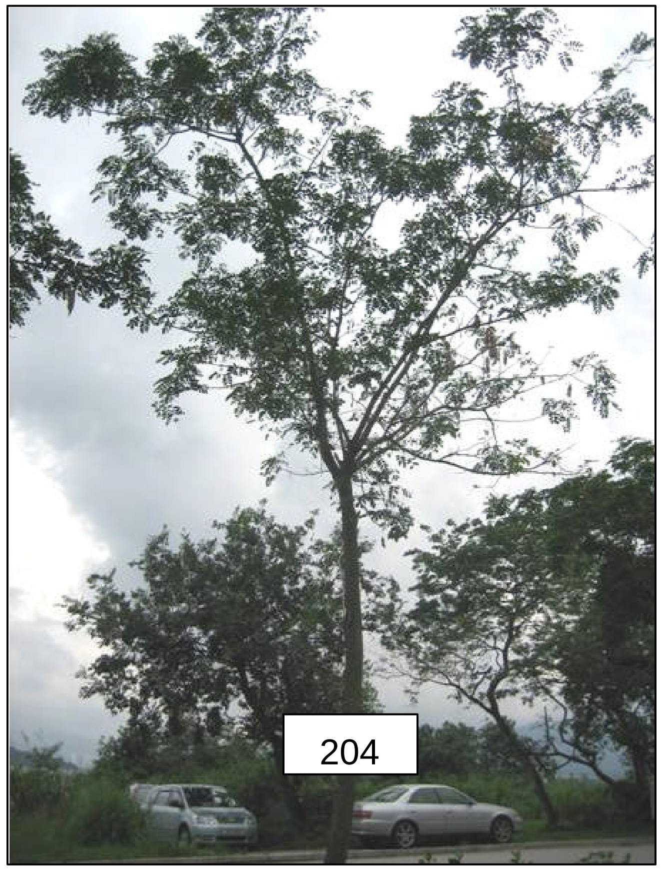
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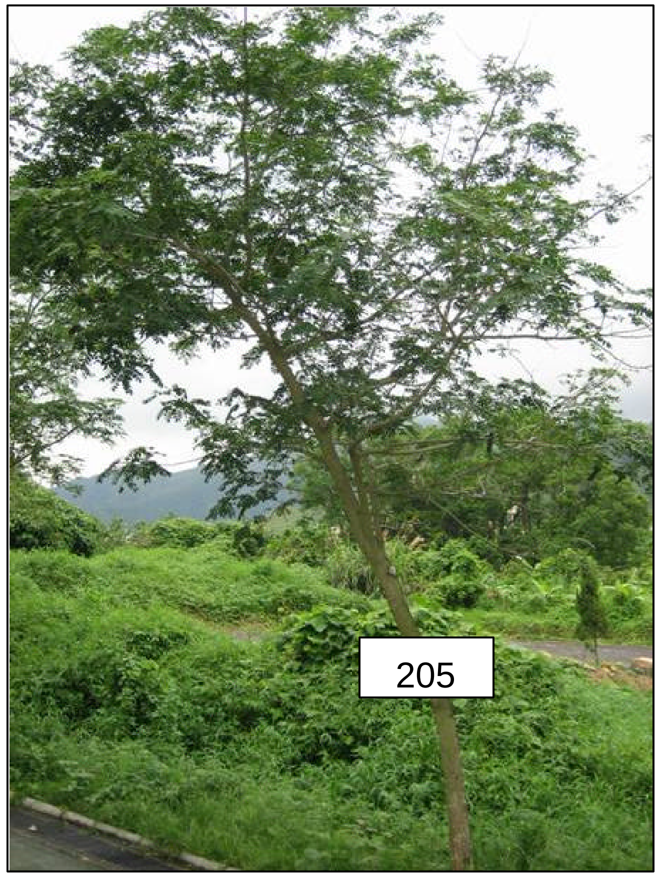
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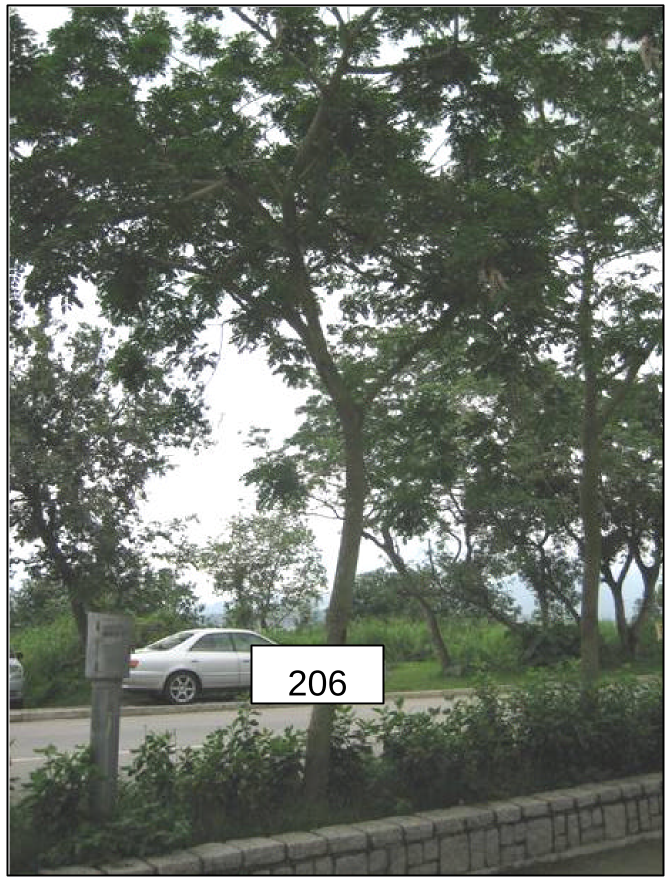
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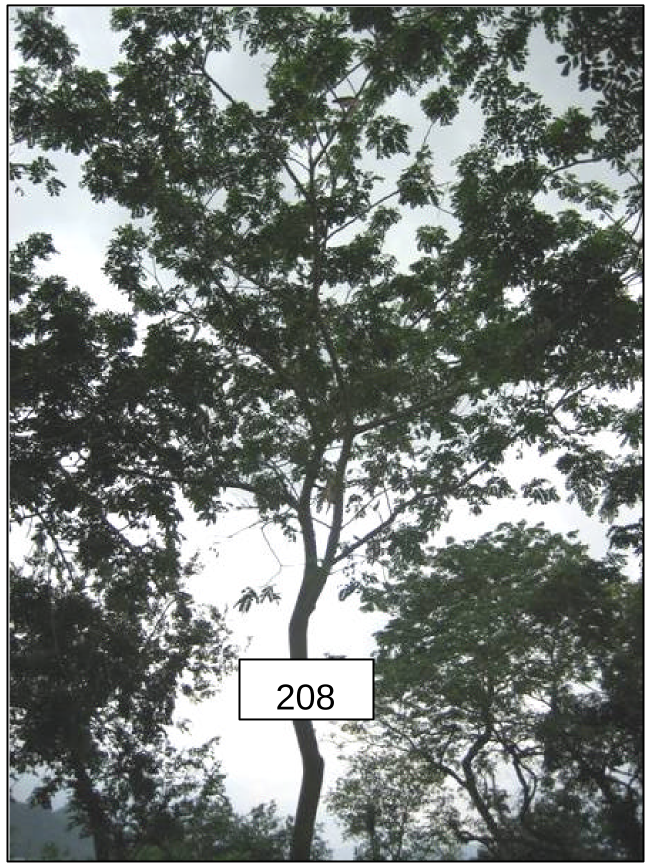
208

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DEVELOPMENT OF A BATHING
BEACH AT LUNG MEI, TAI PO

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Figure Title:

PHOTOGRAPHIC RECORDS OF
TREE NOS. 201 - 208

APPENDIX H1 – FIGURE 17

Checked	Scale	Rev.
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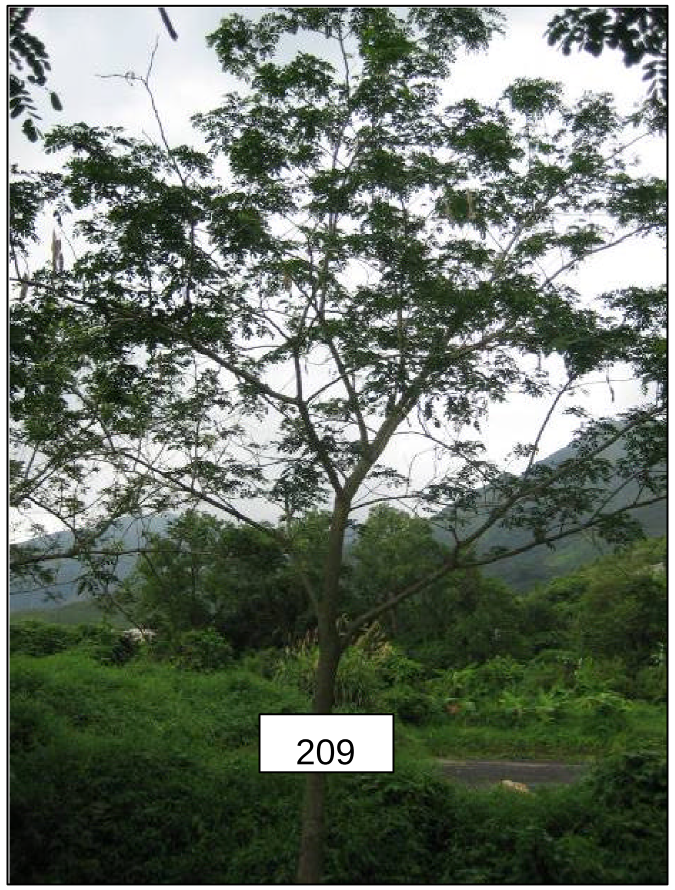
Designed	Drawn	Date
-	MT	13/03/2007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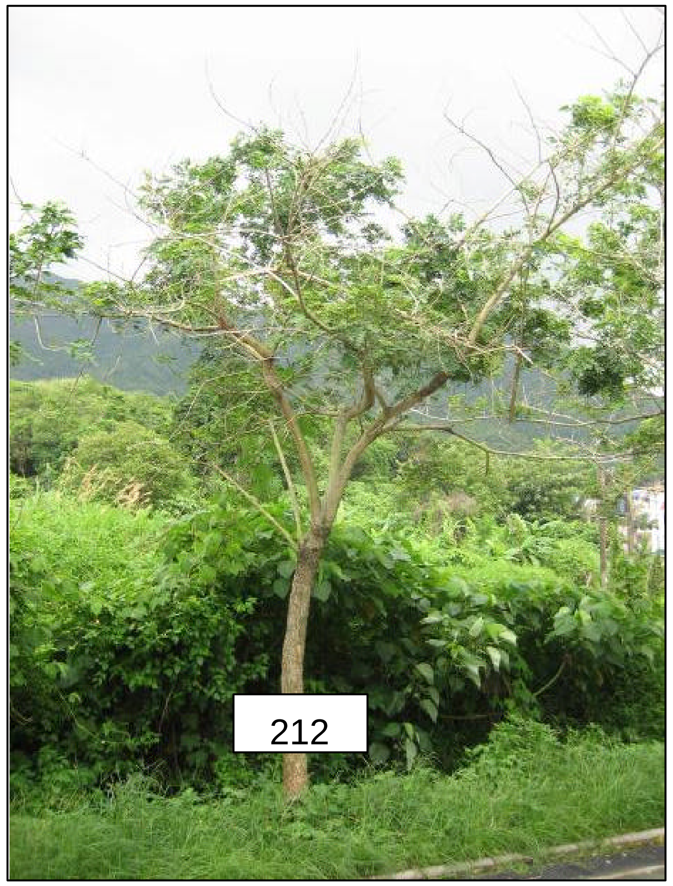
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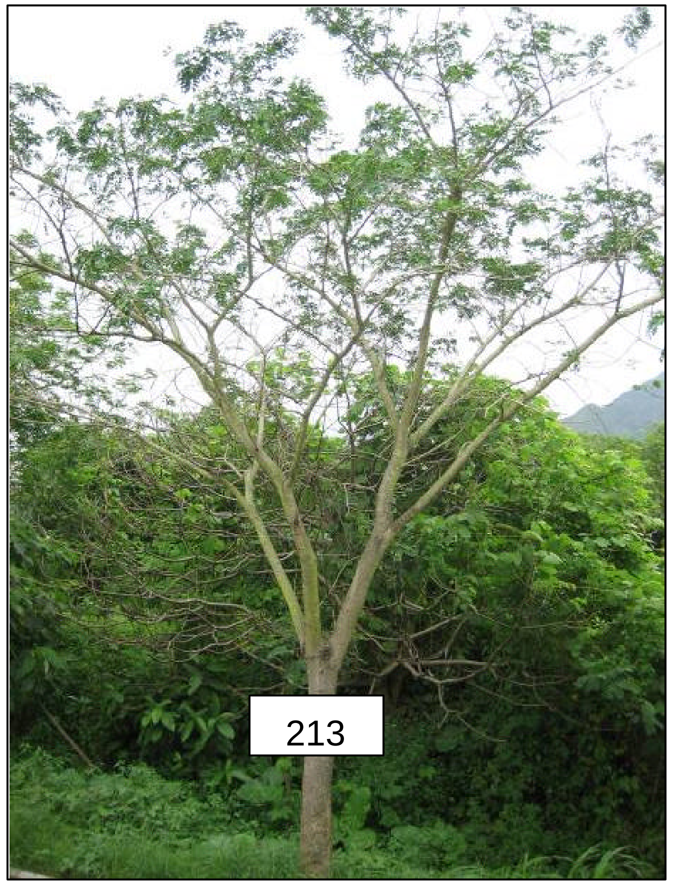
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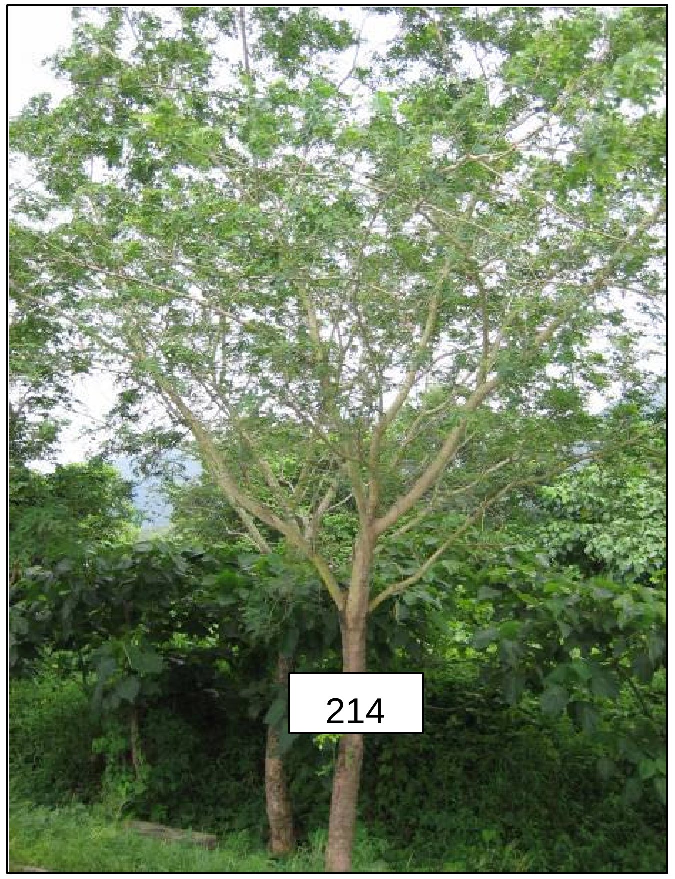
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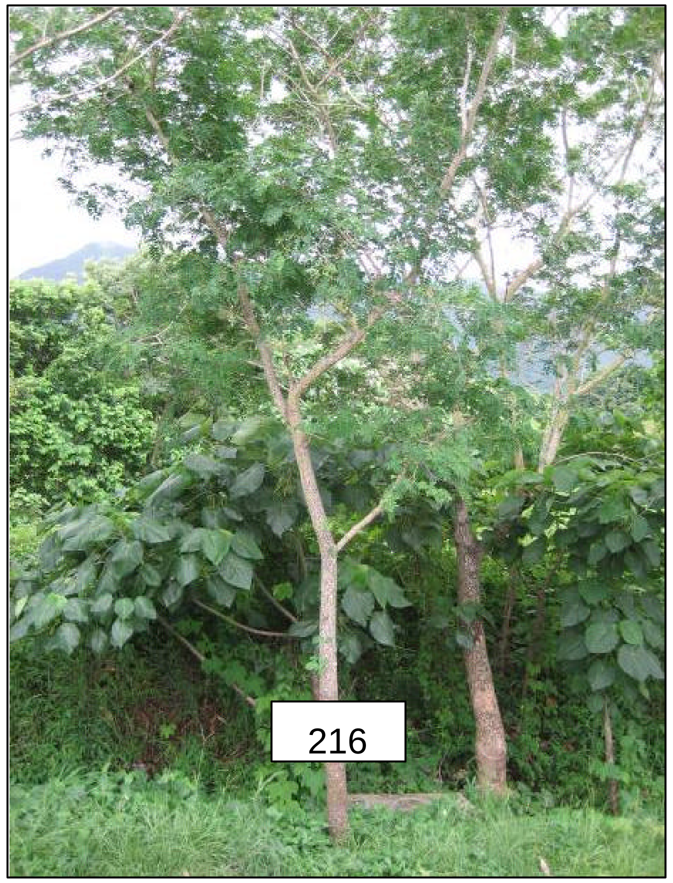
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Figure Title:

PHOTOGRAPHIC RECORDS OF
TREE NOS. 209 - 216

APPENDIX H1 – FIGURE 18

Checked SL	Scale NTS	Rev. 0
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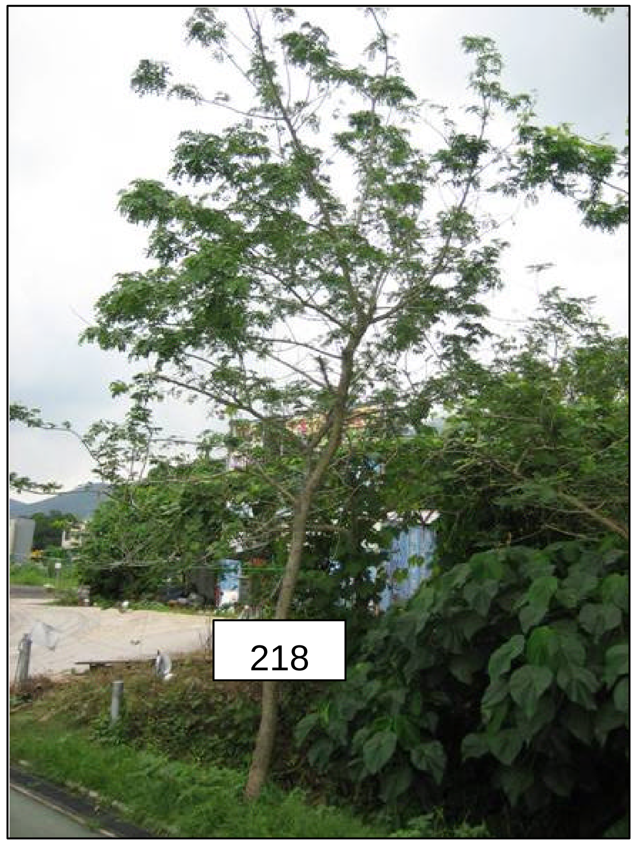
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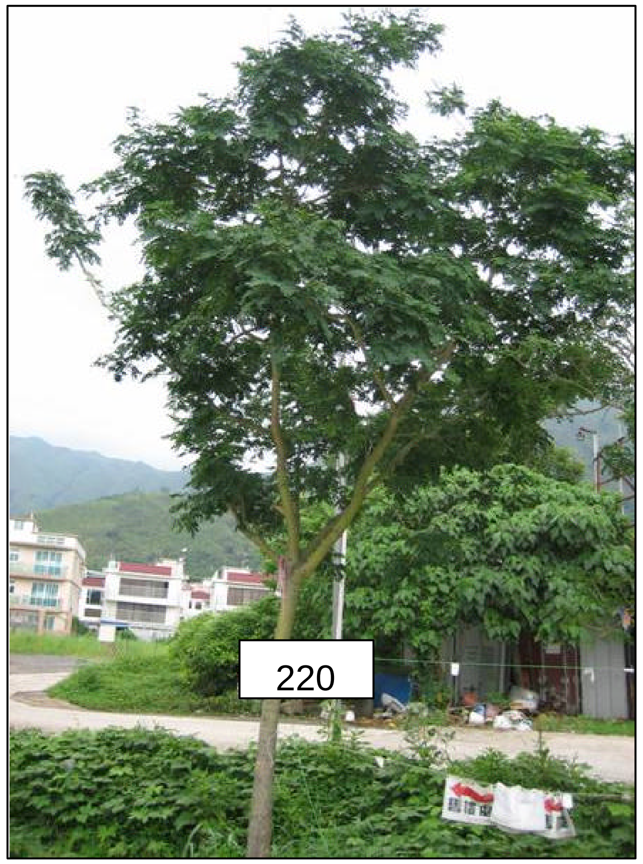
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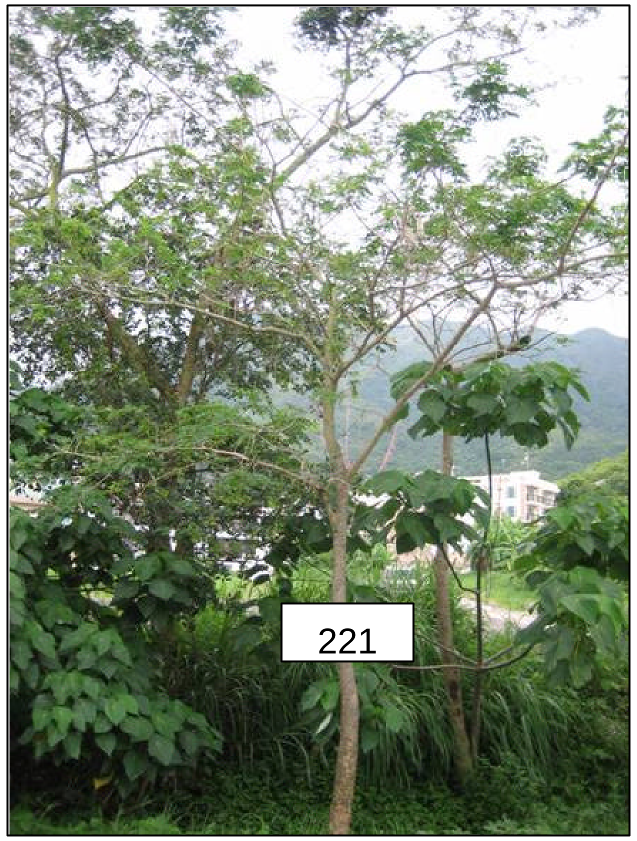
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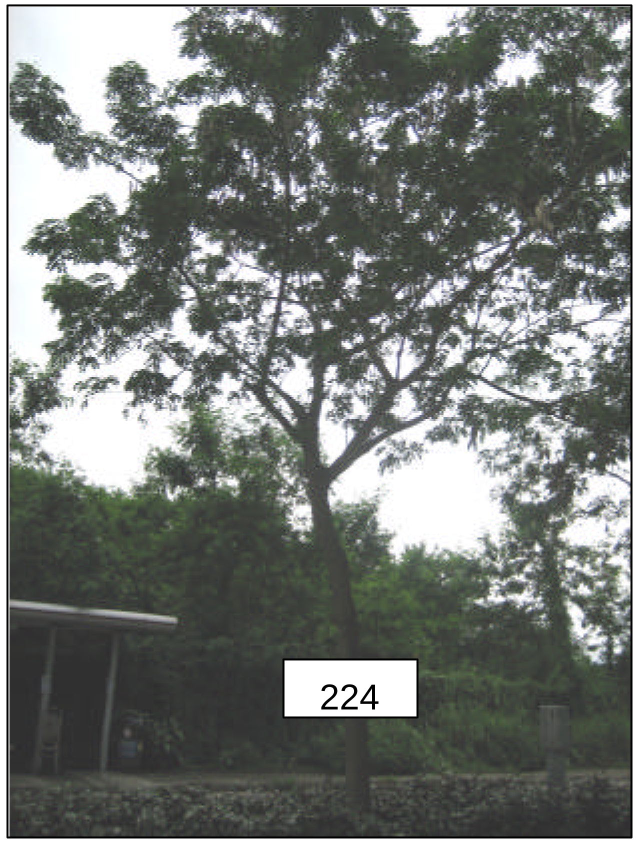
224

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DEVELOPMENT OF A BATHING
BEACH AT LUNG MEI, TAI PO

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Figure Title:

PHOTOGRAPHIC RECORDS OF
TREE NOS. 217 - 224

APPENDIX H1 – FIGURE 19

Checked	Scale	Rev.
SL	NTS	0
Designed	Drawn	Date
-	MT	13/03/2007


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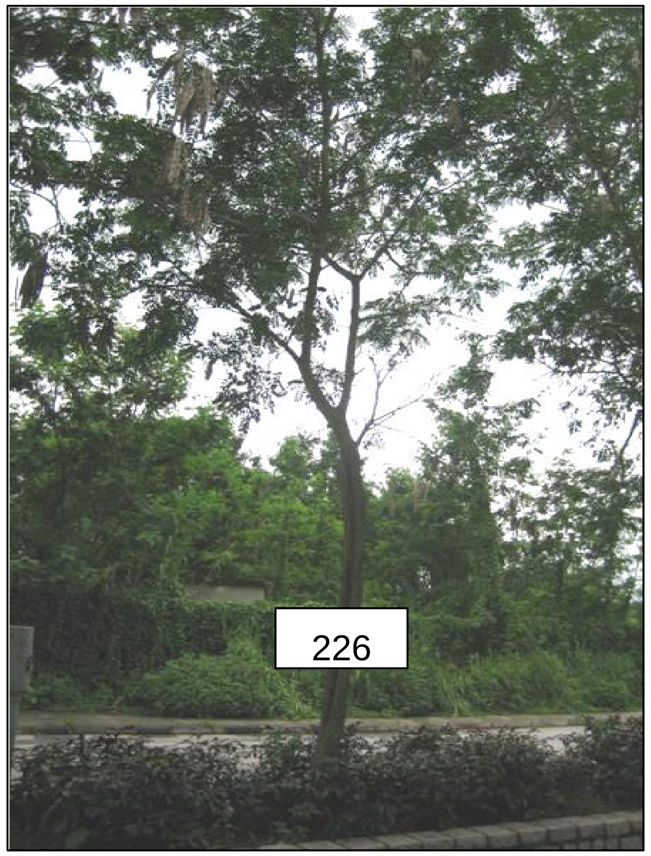
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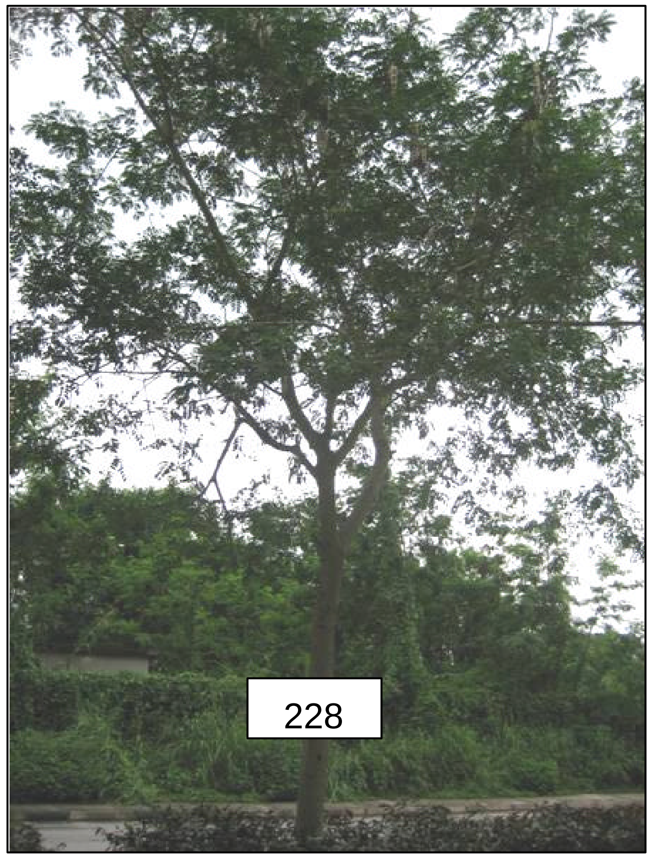
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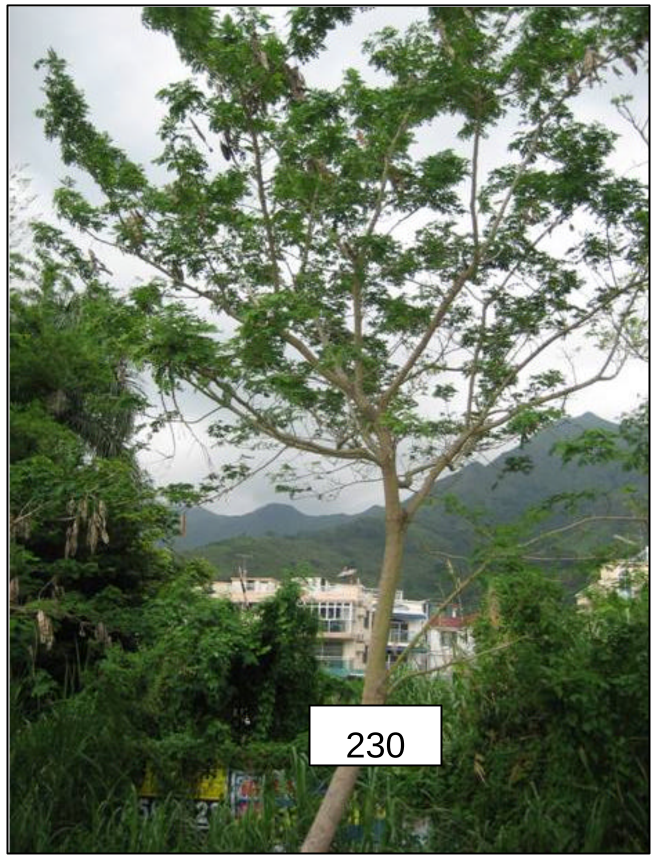
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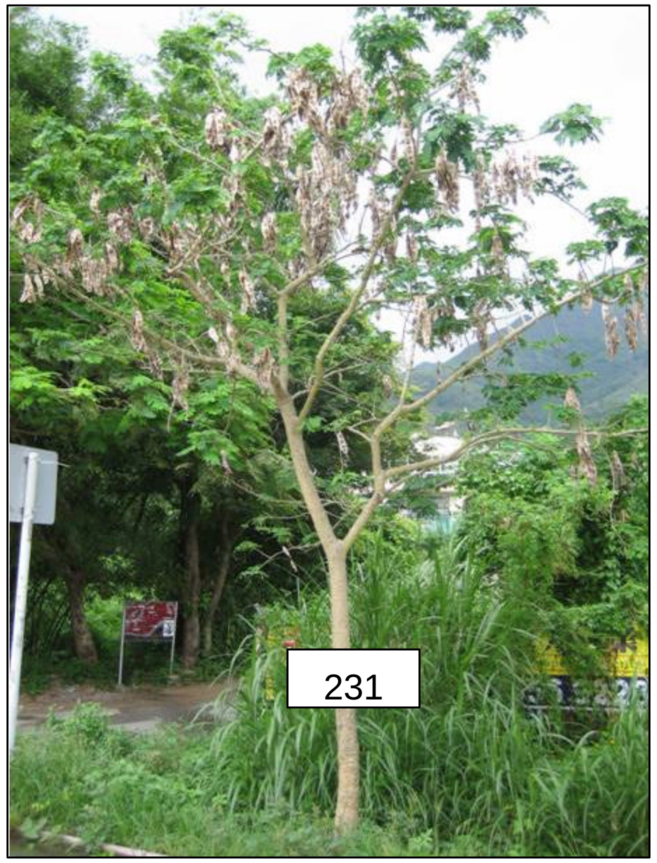
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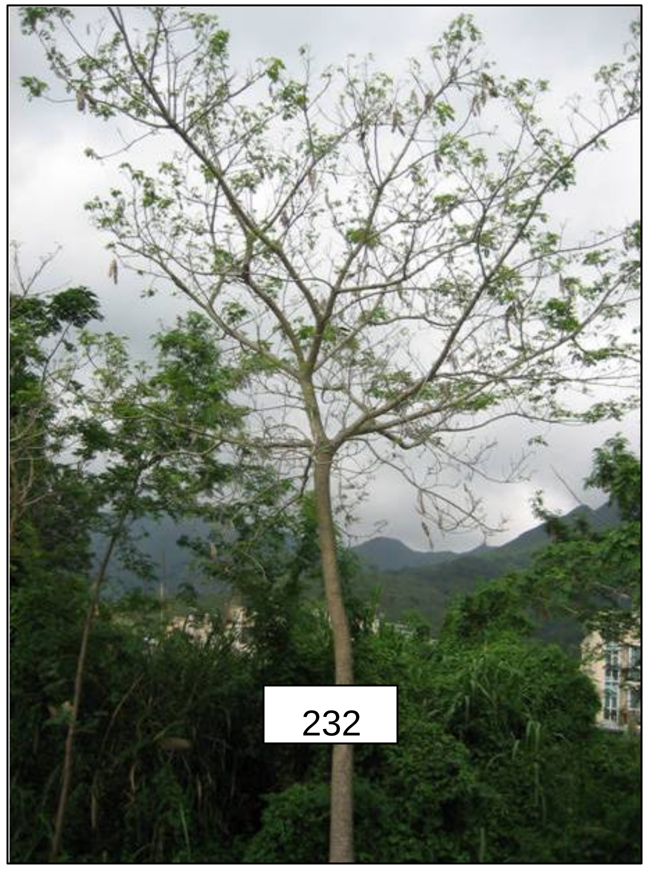
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APPENDIX H1 – FIGURE 20

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-	MT	13/03/2007

Appendix H2

Tree Survey Schedule

Annex H2 Tree Survey Schedule for Tai Po Lung Mei

A	B	C	D	F	G	H	I	J			K			L			P
Tree No.	**Species**	**Northing (m)**	**Easting (m)**	**Trunk Diameter (m)**	**Trunk Circumference (m)**	**Height (m)**	**Crown Spread (m)**	**Tree Form**			**Health Condition**			**Amenity Value**			**Brief Description/ Comment**
								G	**F**	**P**	**G**	**F**	**P**	**H**	**M**	**L**	
1	*Macaranga tanarius*	841457	836912	0.14	0.43	4. 0	3. 0			1		1				1	Young in age and leaning trunk
2	*Macaranga tanarius*	841458	836910	0.20	0.63	5. 0	6. 0			1		1				1	Crowded by other trees
3	*Macaranga tanarius*	841459	836911	0.25	0.77	5. 0	5. 0		1			1			1		Leaning trunk and crowded by other trees
6	*Macaranga tanarius*	841480	836915	0.13	0.42	3. 0	1. 5										Young in age and crowded by other trees
7	*Albizia lebbeck*	841501	836920	0.26	0.83	3. 0	2. 0			1			1			1	Broken branches and twisted by climbers
8	*Albizia lebbeck*	841502	836920	0.34	1.07	6. 0	5. 0		1			1			1		Broken branches
9	*Celtis sinensis*	841510	836920	0.48	1.50	6. 0	4. 0		1			1			1		Good tree form
10	*Albizia lebbeck*	841512	836919	0.19	0.60	4. 0	3. 0			1			1			1	Broken and leaning trunk
11	*Cinnamomum camphora*	841513	836919	0.15	0.48	4. 0	2. 0			1		1				1	Young in age and crowded by other trees
12	*Albizia lebbeck*	841514	836921	0.25	0.80	6. 0	6. 0		1			1				1	Leaning and broken trunk and crowded by other trees
13	*Albizia lebbeck*	841515	836918	0.29	0.90	7. 0	5. 0		1			1				1	Damaged trunk with broken branches
14	*Celtis sinensis*	841526	836920	0.29	0.90	4. 0	3. 0		1			1			1		Damaged trunk and rubbish on top of soil
15	*Hibiscus tiliaceus*	841521	836908	0.29	0.90	6. 0	4. 0			1		1				1	Trunk bending down and not possible to transplant
16	*Hibiscus tiliaceus*	841522	836904	0.25	0.80	6. 0	3. 0			1		1				1	Trunk bending down
17	*Hibiscus tiliaceus*	841519	836897	0.19	0.60	5. 0	4. 0			1		1				1	Trunk bending down
18	*Celtis sinensis*	841512	836896	0.22	0.70	5. 0	3. 0		1			1			1		Good condition
19	*Albizia lebbeck*	841508	836893	0.25	0.80	6. 0	6. 0			1		1				1	Leaning and bending trunk
20	*Hibiscus tiliaceus*	841501	836893	0.21	0.67	5. 0	4. 0			1		1				1	Twisted with other trees
*22	*Macaranga tanarius*	841462	836895	0.22	0.69	4. 0	3. 0		1			1		1			Good tree form and mature in age
23	*Albizia lebbeck*	841465	836889	0.27	0.85	4. 0	3. 0			1		1				1	Deformed trunk and crowded by other trees
24	*Albizia lebbeck*	841459	836899	0.11	0.33	3. 0	1. 5			1		1				1	Elongated leaning trunk
25	*Albizia lebbeck*	841454	836901	0.30	0.95	6. 0	4. 0			1		1				1	Crowded by other trees and twisted by climbers
*26	*Albizia lebbeck*	841451	836896	0.37	1.15	5. 0	5. 0		1			1		1			Mature in age and twisted by climbers
27	*Macaranga tanarius*	841453	836894	0.19	0.60	4. 0	3. 0			1		1				1	Lean and deformed trunk
28	*Albizia lebbeck*	841452	836887	0.16	0.49	4. 0	3. 0			1			1			1	Broken branches and twisted by climbers
29	*Macaranga tanarius*	841450	836887	0.15	0.46	4. 0	3. 0		1			1			1		Young in age and twisted by climbers
30	*Macaranga tanarius*	841451	836885	0.13	0.40	4. 0	3. 0			1		1				1	Deformed trunk
31	*Albizia lebbeck*	841446	836889	0.12	0.38	5. 0	3. 0			1		1				1	Leaning and deformed trunk
32	*Albizia lebbeck*	841445	836890	0.17	0.52	3. 0	1. 5			1		1				1	Elongated trunk and crowded by other trees
33	*Celtis sinensis*	841445	836888	0.16	0.49	4. 0	2. 0		1			1				1	Elongated trunk with broken branches
34	*Albizia lebbeck*	841448	836899	0.18	0.57	6. 0	3. 0			1		1				1	Elongated trunk
35	*Macaranga tanarius*	841448	836900	0.10	0.32	4. 0	2. 0		1			1				1	Multiple trunks
36	*Leucaena leucocephala*	841444	836902	0.23	0.73	7. 0	4. 0			1		1				1	Uplifting roots with broken trunk
37	*Leucaena leucocephala*	841446	836905	0.15	0.46	6. 0	3. 0			1			1			1	Lean and deheaded trunk
38	*Leucaena leucocephala*	841446	836907	0.12	0.39	6. 0	3. 0			1			1			1	Lean and deheaded trunk
39	*Leucaena leucocephala*	841447	836907	0.12	0.37	5. 0	2. 0			1			1			1	Lean and deheaded trunk
40	*Albizia lebbeck*	841451	836907	0.17	0.52	4. 0	2. 0			1		1				1	Twisted by climbers and crowded by other trees
41	*Albizia lebbeck*	841452	836904	0.19	0.61	4. 0	2. 0			1			1			1	Deheaded trunk twisted by climbers and no leaves
42	*Albizia lebbeck*	841440	836902	0.13	0.42	4. 0	3. 0			1			1			1	Leaning trunk and crowded by other trees
43	*Leucaena leucocephala*	841439	836902	0.12	0.38	5. 0	3. 0			1			1			1	Leaning trunk and crowded by other trees
44	*Leucaena leucocephala*	841437	836900	0.19	0.61	6. 0	3. 0			1			1			1	Young in age and crowded by other trees
*45	*Gossampinus malabarica*	841428	836872	0.57	1.78	8. 0	4. 0		1			1		1			Mature in age and in good condition
46	*Macaranga tanarius*	841430	836875	0.13	0.40	4. 0	3. 0			1		1				1	Two elongated trunks
47	*Macaranga tanarius*	841429	836876	0.11	0.33	4. 0	2. 0			1		1				1	Young in age
48	*Celtis sinensis*	841427	836878	0.11	0.33	4. 0	2. 0			1		1				1	Young in age
49	*Leucaena leucocephala*	841426	836879	0.10	0.31	5. 0	2. 0			1		1				1	Young in age with leaning trunk
50	*Leucaena leucocephala*	841423	836875	0.34	1.06	8. 0	4. 0			1		1				1	Broken trunk and branches
51	*Leucaena leucocephala*	841421	836880	0.32	0.99	7. 0	3. 0		1			1				1	Elongated trunk and crowded by other trees
52	*Leucaena leucocephala*	841432	836879	0.12	0.37	6. 0	2. 0			1		1				1	Leaning and elongated trunk
53	*Macaranga tanarius*	841433	836881	0.16	0.50	6. 0	3. 0			1		1				1	Leaning and elongated trunk
54	*Albizia lebbeck*	841429	836881	0.14	0.44	3. 5	3. 0			1			1			1	Young in age with leaning trunk
55	*Albizia lebbeck*	841426	836883	0.11	0.33	4. 0	2. 0			1			1			1	Young in age with leaning trunk
56	*Leucaena leucocephala*	841428	836887	0.21	0.67	8. 0	3. 0			1		1				1	Multiple broken and leaning trunks
57	*Leucaena leucocephala*	841399	836868	0.16	0.50	7. 0	3. 0			1			1			1	Elongated and leaning trunk

Annex H2 Tree Survey Schedule for Tai Po Lung Mei

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Tree No.	**Species**	**Northing (m)**	**Easting (m)**	**Trunk Diameter (m)**	**Trunk Circumference (m)**	**Height (m)**	**Crown Spread (m)**	**Tree Form**			**Health Condition**			**Amenity Value**			**Brief Description/ Comment**
								G	**F**	**P**	**G**	**F**	**P**	**H**	**M**	**L**	
58	*Celtis sinensis*	841393	836866	0.20	0.62	6. 0	3. 0			1			1			1	Elongated and leaning trunk
*59	*Celtis sinensis*	841391	836865	0.27	0.86	5. 0	4. 0		1			1		1			Mature in age with good tree form
*60	*Celtis sinensis*	841390	836865	0.32	1.00	6. 0	3. 0		1			1		1			Mature in age with good tree form
61	*Leucaena leucocephala*	841383	836865	0.11	0.36	6. 0	2. 0			1		1				1	Leaning and elongated trunk
62	*Leucaena leucocephala*	841410	836868	0.17	0.52	3. 5	4. 0			1		1				1	Twisted by climbers
63	*Macaranga tanarius*	841414	836869	0.18	0.58	5. 0	3. 0			1		1				1	Leaning trunk and crowded by other trees
64	*Macaranga tanarius*	841412	836868	0.19	0.60	5. 0	3. 0		1			1			1		Broken trunk and crowded by other trees
65	*Leucaena leucocephala*	841419	836866	0.11	0.35	6. 0	3. 0			1		1				1	Leaning trunk twisted by climbers
66	*Leucaena leucocephala*	841420	836867	0.18	0.56	8, 0	4. 0			1		1				1	Leaning and elongated trunk
67	*Leucaena leucocephala*	841421	836868	0.14	0.43	7. 0	3. 0			1		1				1	Leaning and elongated trunk
68	*Leucaena leucocephala*	841424	836870	0.10	0.32	5. 0	3. 0			1		1				1	Elongated trunk and crowded by other trees
69	*Cinnamomum camphora*	841423	836868	0.10	0.31	4. 0	2. 0			1		1				1	Leaning trunk and crowded by other trees
70	*Macaranga tanarius*	841425	836869	0.11	0.35	7. 0	3. 0			1		1				1	Crowded by other trees
71	*Leucaena leucocephala*	841426	836867	0.11	0.34	6. 0	3. 0			1		1				1	Leaning trunk and crowded by other trees
72	*Leucaena leucocephala*	841427	836864	0.18	0.58	7. 0	3. 0			1		1				1	Leaning trunk twisted by climbers
73	*Leucaena leucocephala*	841427	836863	0.11	0.35	7. 0	3. 0			1		1				1	Leaning trunk twisted by climbers
74	*Leucaena leucocephala*	841423	836864	0.17	0.52	7. 0	3. 0			1		1				1	Leaning trunk
75	*Leucaena leucocephala*	841425	836865	0.11	0.33	7. 0	3. 0			1		1				1	Leaning trunk and crowded by other trees
76	*Albizia lebbeck*	841380	836877	0.21	0.66	6. 0	5. 0			1		1				1	Leaning and elongated trunk
77	*Albizia lebbeck*	841377	836879	0.20	0.63	5. 0	4. 0			1		1				1	Leaning and elongated trunk
78	*Acacia confusa*	841377	836872	0.18	0.56	5. 0	3. 0			1			1			1	Twisted by climbers
79	*Albizia lebbeck*	841382	836870	0.12	0.37	4. 0	3. 0			1		1				1	Leaning and elongated trunk
80	*Macaranga tanarius*	841380	836869	0.10	0.30	4. 0	2. 0			1		1				1	Leaning and elongated trunk
81	*Macaranga tanarius*	841382	836867	0.11	0.33	5.. 0	3. 0			1		1				1	Leaning and elongated trunk
82	*Leucaena leucocephala*	841376	836869	0.13	0.42	6. 0	3. 0			1		1				1	Leaning and elongated trunk
83	*Macaranga tanarius*	841379	836863	0.11	0.33	3. 0	3. 5			1		1				1	Young in age and leaning trunk
*84	*Macaranga tanarius*	841379	836856	0.33	1.04	4. 0	10. 0		1			1			1		Mature in age and grew on rocky base
*85	*Celtis sinensis*	841387	836861	0.24	0.75	6. 0	6. 0		1			1			1		Mature in age and twisted by climbers
*86	*Cinnamomum camphora*	841392	836861	0.37	1.15	8. 0	5. 0		1			1			1		Mature in age and twisted by climbers
87	*Hibiscus tiliaceus*	841524	836898	0.16	0.50	5. 0	3. 0			1		1				1	Trunk bending down and not possible to be transplanted
88	*Leucaena leucocephala*	841435	836899	0.16	0.50	6. 0	4. 0			1		1				1	Leaning trunk and crowded by other trees
89	*Leucaena leucocephala*	841437	836898	0.12	0.37	7. 0	4. 0			1		1				1	Leaning and broken trunk
90	*Leucaena leucocephala*	841436	836897	0.16	0.50	6. 0	4. 0			1			1			1	Broken trunk
91	*Leucaena leucocephala*	841435	836896	0.19	0.60	6. 0	4. 0			1		1				1	Leaning trunk
92	*Leucaena leucocephala*	841436	836898	0.16	0.50	6. 0	4. 0			1		1				1	Uplifting roots and crowded by other trees
93	*Leucaena leucocephala*	841434	836899	0.13	0.40	7. 0	2.0			1		1				1	Young in age
94	*Leucaena leucocephala*	841434	836898	0.32	1.00	8. 0	6. 0			1		1				1	Uplifting roots and crowded by other trees
95	*Leucaena leucocephala*	841430	836898	0.10	0.30	5. 0	3. 0			1		1				1	Multiple trunks and crowded by other trees
96	*Leucaena leucocephala*	841428	836896	0.32	1.00	5. 0	3. 0			1		1				1	Deformed trunk
97	*Leucaena leucocephala*	841431	836894	0.10	0.30	7. 0	3. 0			1			1			1	Deheaded and leaning trunk
98	*Leucaena leucocephala*	841425	836893	0.13	0.40	7. 0	3. 0			1			1			1	Deformed, broken and leaning trunk
99	*Leucaena leucocephala*	841426	836891	0.32	1.00	8. 0	4. 0			1			1			1	Deformed, broken and leaning trunk
100	*Leucaena leucocephala*	841428	836862	0.16	0.50	7. 0	4. 0			1		1				1	Leaning and elongated trunk
101	*Leucaena leucocephala*	841427	836861	0.13	0.40	7. 0	3. 0			1		1				1	Leaning and elongated trunk
102	*Leucaena leucocephala*	841426	836860	0.13	0.40	6. 0	3. 0			1		1				1	Leaning and elongated trunk
103	*Leucaena leucocephala*	841426	836862	0.10	0.30	4. 0	2. 0			1		1				1	Multiple leaning trunks
104	*Leucaena leucocephala*	841420	836861	0.10	0.30	6. 0	3. 0			1		1				1	Leaning and elongated trunk
105#	*Hibiscus tiliaceus*	841501	836893	0.04	0.11	4.0	2.0			1		1				1	The tree was poor in condition
106#	*Hibiscus tiliaceus*	841501	836893	0.04	0.13	4.0	3.0			1		1				1	The tree was poor in condition
107#	*Hibiscus tiliaceus*	841501	836893	0.05	0.15	4.0	3.0			1		1				1	Bend together and not possible to transplant
108#	*Leucaena leucocephala*	841452	836904	0.11	0.35	10.0	2.0			1			1			1	uplifting roots and fall down
109#	*Leucaena leucocephala*	841450	836902	0.04	0.11	8.0	2.0			1		1				1	Elongated trunk
110#	*Leucaena leucocephala*	841449	836903	0.04	0.11	8.0	2.0			1		1				1	Two elongated trunks
111#	*Leucaena leucocephala*	841443	836895	0.04	0.12	8.0	2.0			1		1				1	Uplifting roots with leaning trunk and crowded by other trees

Annex H2 Tree Survey Schedule for Tai Po Lung Mei

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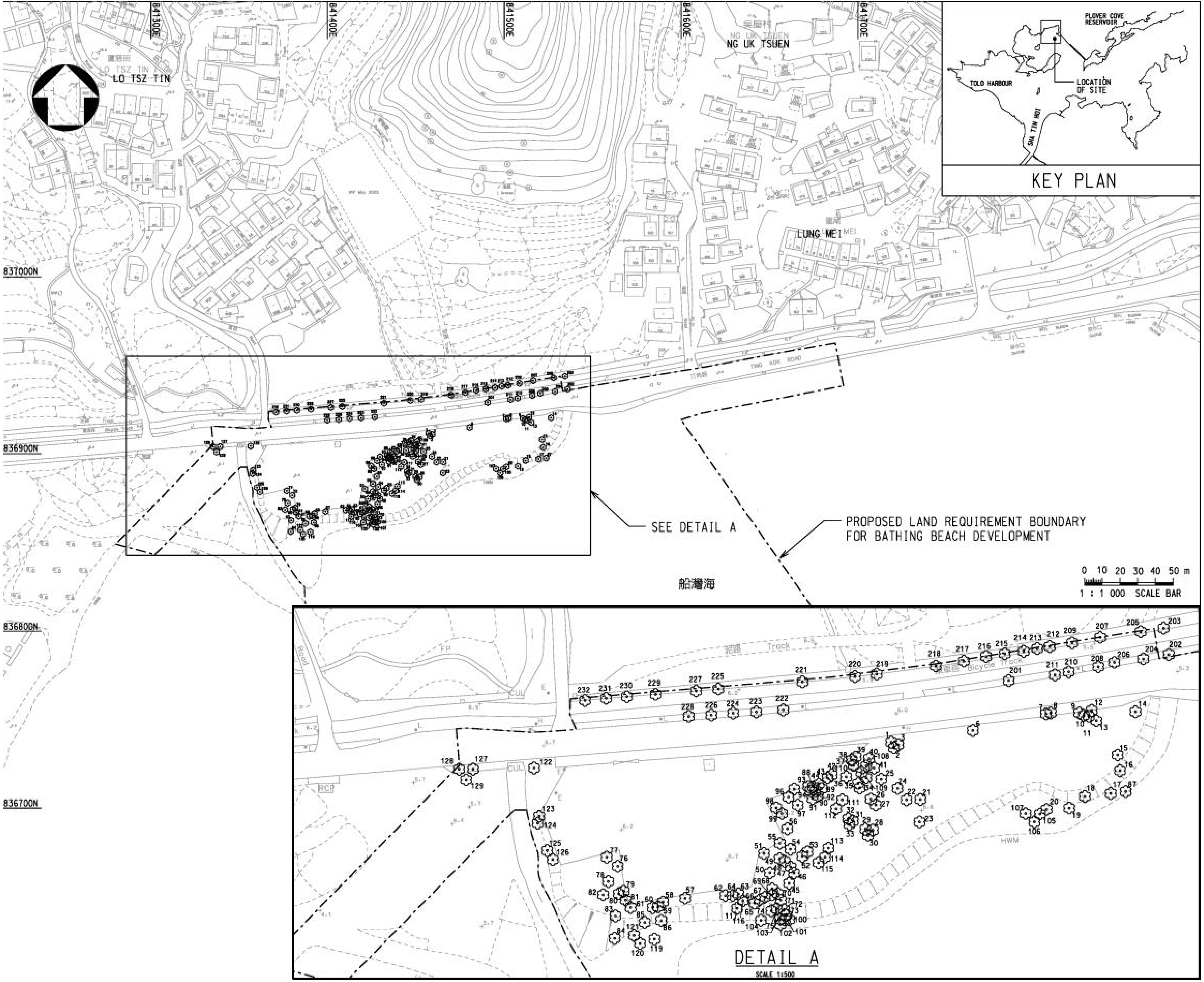
Tree No.	**Species**	**Northing (m)**	**Easting (m)**	**Trunk Diameter (m)**	**Trunk Circumference (m)**	**Height (m)**	**Crown Spread (m)**	**Tree Form**			**Health Condition**			**Amenity Value**			**Brief Description/ Comment**
								G	**F**	**P**	**G**	**F**	**P**	**H**	**M**	**L**	
112#	*Leucaena leucocephala*	841442	836893	0.04	0.14	8.0	2.0			1		1				1	Uplifting roots
113#	*Albizia lebbeck*	841439	836882	0.06	0.20	6.0	5.0		1			1				1	Broken branches and twisted by climbers
114#	*Leucaena leucocephala*	841438	836879	0.04	0.11	6.0	2.0			1		1				1	Leaning and elongated trunk
115#	*Leucaena leucocephala*	841437	836878	0.03	0.10	6.0	2.0			1		1				1	Twisted by climbers
116#	*Sapium discolor*	841415	836867	0.04	0.12	5.0	4.0		1			1			1		Broken branches and twisted by climbers
117#	*Sapium discolor*	841414	836865	0.06	0.18	5.0	2.0			1			1			1	Bending trunk with broken branches
119#	*Excoecaria agallocha*	841390	836856	0.08	0.25	4.0	5.0			1		1				1	Multiple trunks and twisted and shaded by climbers
120#	*Hibiscus tiliaceus*	841386	836855	0.08	0.25	2.0	2.0			1		1				1	Multiple trunks
121#	*Excoecaria agallocha*	841385	836857	0.10	0.30	3.0	3.0			1		1				1	Multiple trunks
122#	*Albizia lebbeck*	841356	836904	0.30	0.94	7.0	3.0			1			1			1	The tree was deheaded and was dead
123#	*Macaranga tanarius*	841357	836890	0.28	0.88	7.0	10.0		1			1			1		The tree located at steep slope with multiple trunks
124#	*Macaranga tanarius*	841357	836888	0.25	0.79	5.0	3.0			1		1				1	Leaning trunk and located at steep slope
125#	*Leucaena leucocephala*	841360	836880	0.15	0.47	9.0	2.0			1		1				1	Leaning trunk and located at steep slope
126#	*Leucaena leucocephala*	841361	836878	0.15	0.47	9.0	2.0			1		1				1	Leaning trunk and located at steep slope
127	*Melaleuca quinquenervia*	841339	836904	0.15	0.46	5.0	1.5			1		1				1	Young in age
128	*Melaleuca quinquenervia*	841335	836904	0.15	0.44	5.0	2.0			1		1				1	Young in age
129	*Macaranga tanarius*	841337	836901	0.11	0.32	4.0	5.0			1		1				1	Multiple trunks
201#	*Albizia lebbeck*	841491	836929	0.14	0.44	3.5	3.0		1			1			1		Good tree form
202#	*Albizia lebbeck*	841536	836936	0.15	0.47	3.0	2.0		1			1			1		Good tree form
203#	*Albizia lebbeck*	841534	836944	0.16	0.50	4.0	3.5		1			1			1		Good tree form
204#	*Albizia lebbeck*	841529	836935	0.15	0.47	4.5	3.0		1			1			1		Good tree form
205#	*Albizia lebbeck*	841528	836943	0.15	0.47	4.0	3.5		1			1			1		Slanted trunk
206#	*Albizia lebbeck*	841520	836934	0.15	0.47	3.5	3.0		1			1			1		Good tree form
207#	*Albizia lebbeck*	841516	836941	0.18	0.57	4.5	3.0		1			1			1		Good tree form
208#	*Albizia lebbeck*	841516	836933	0.15	0.47	5.0	3.5		1			1			1		Good tree form
209#	*Albizia lebbeck*	841508	836940	0.20	0.63	4.5	4.0		1			1			1		Good tree form
210#	*Albizia lebbeck*	841508	836931	0.18	0.57	4	3.5		1			1			1		Good tree form
211#	*Albizia lebbeck*	841504	836931	0.18	0.57	3.5	3.0		1			1			1		Good tree form
212#	*Albizia lebbeck*	841502	836939	0.16	0.50	3.5	3.0		1			1			1		Good tree form
213#	*Albizia lebbeck*	841499	836938	0.23	0.72	4.0	4.0		1			1			1		Broken Bark
214#	*Albizia lebbeck*	841495	836937	0.22	0.69	4.5	4.5		1			1			1		Good tree form
215#	*Albizia lebbeck*	841489	836937	0.10	0.31	4.0	1.5		1			1			1		Good tree form
216#	*Albizia lebbeck*	841484	836936	0.21	0.66	4.0	3.3		1			1			1		Good tree form
217#	*Albizia lebbeck*	841478	836935	0.20	0.63	5.0	4.0		1			1			1		Good tree form
218#	*Albizia lebbeck*	841470	836933	0.13	0.41	4.0	3.0		1			1			1		Slanted trunk
219#	*Albizia lebbeck*	841453	836931	0.14	0.44	3.5	2.5		1			1			1		Good tree form
220#	*Albizia lebbeck*	841447	836930	0.15	0.47	4.0	3.0		1			1			1		Good tree form
221#	*Albizia lebbeck*	841432	836929	0.11	0.35	4.0	3.5		1			1			1		Good tree form
222#	*Albizia lebbeck*	841427	836921	0.18	0.57	5.0	4.5		1			1			1		Good tree form
223#	*Albizia lebbeck*	841419	836920	0.20	0.63	4.0	3.5		1			1			1		Good tree form
224#	*Albizia lebbeck*	841412	836920	0.21	0.66	4.0	3.5		1			1			1		Good tree form
225#	*Albizia lebbeck*	841408	836927	0.11	0.35	4.0	3.0		1			1			1		Slanting Bark
226#	*Albizia lebbeck*	841406	836919	0.18	0.57	5.0	3.5		1				1			1	Target cankers is founded along the tree trunk
227#	*Albizia lebbeck*	841402	836926	0.13	0.41	4.0	3.0			1		1			1		Slanting Bark
228#	*Albizia lebbeck*	841400	836919	0.20	0.63	5.0	4.5		1			1			1		Good tree form
229#	*Albizia lebbeck*	841391	836925	0.16	0.50	5.0	5.0		1			1			1		Good tree form
230#	*Albizia lebbeck*	841382	836924	0.20	0.63	5.5	3.5		1			1			1		Good tree form
231#	*Albizia lebbeck*	841377	836924	0.22	0.69	5.5	4.0		1			1			1		Good tree form
232#	*Albizia lebbeck*	841371	836923	0.12	0.38	3.5	2.5		1			1			1		Good tree form

Tree number with "" indicates tree with high landscape value or in good tree form or in maturity. Tree number with "#" indicates trees supplemented on site with coordinates recorded by rough estimation. Tree number with "^" indicates trees of same specie were formed very densely and was difficult to identify individually, tree group was given instead of individual trees.*

Appendix H3

Tree Survey Plan



NOTES:

1. ALL LEVELS ARE IN METERS AND SHALL REFER TO PRINCIPAL DATUM (mPD)
2. THIS DRAWING SHALL READ IN CONJUNCTION WITH DRAWING NO. CALBDS/EN/011

LEGEND :

—·— PROPOSED LAND REQUIREMENT BOUNDARY

✿ TREE LOCATION AND NUMBER

✿ GROUP TREE LOCATION AND NUMBER

CIVIL ENGINEERING AND
DEVELOPMENT DEPARTMENT

Consulting Engineer

Halcrow

Halcrow China Ltd.

Environmental Resources
Management
as sub-consultant

Agreement No.:
CE 59/2005(EP)

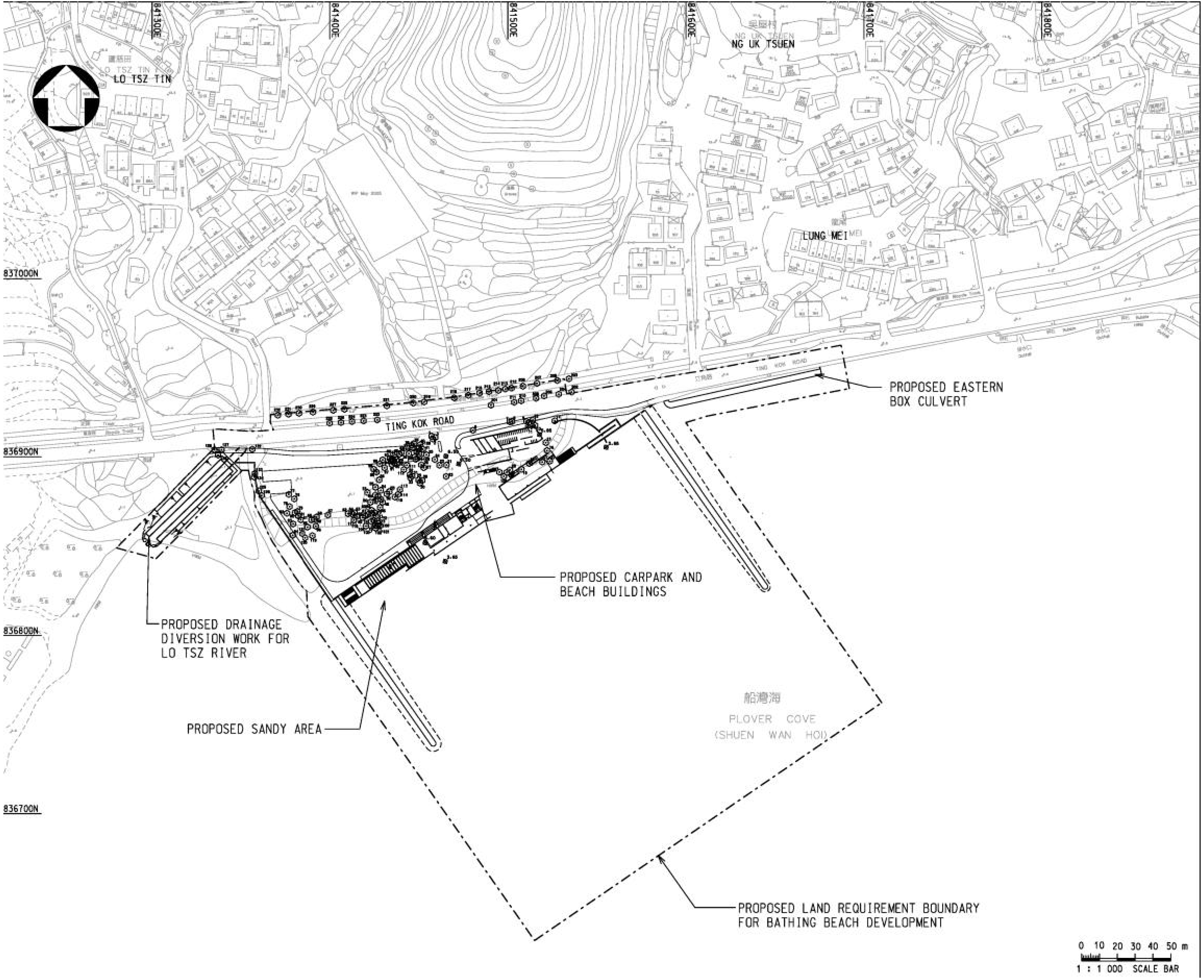
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPENDIX H3 – FIGURE 1

Project Title:
DEVELOPMENT OF A BATHING BEACH
AT LUNG MEI, TAI PO

Figure Title:
TREE SURVEY PLAN (SHEET 1 OF 2)

Checked -	Scale AS SHOWN	Rev. 2
Designed -	Drawn KK	Date 17/05/2007



NOTE:

1. THIS DRAWING SHALL READ IN CONJUNCTION WITH DRAWING NO. CALBDS/EN/010

LEGEND :

— - — PROPOSED LAND REQUIREMENT BOUNDARY

✿ TREE LOCATION AND NUMBER

✿ GROUP TREE LOCATION AND NUMBER

⊕ 3.65 PROPOSED FINISHED GROUND LEVEL

CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

Consulting Engineer

Halcrow China Ltd.

Environmental Resources Management as sub-consultant

Agreement No.: CE 59/2005(EP)

Project Title: DEVELOPMENT OF A BATHING BEACH AT LUNG MEI, TAI PO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

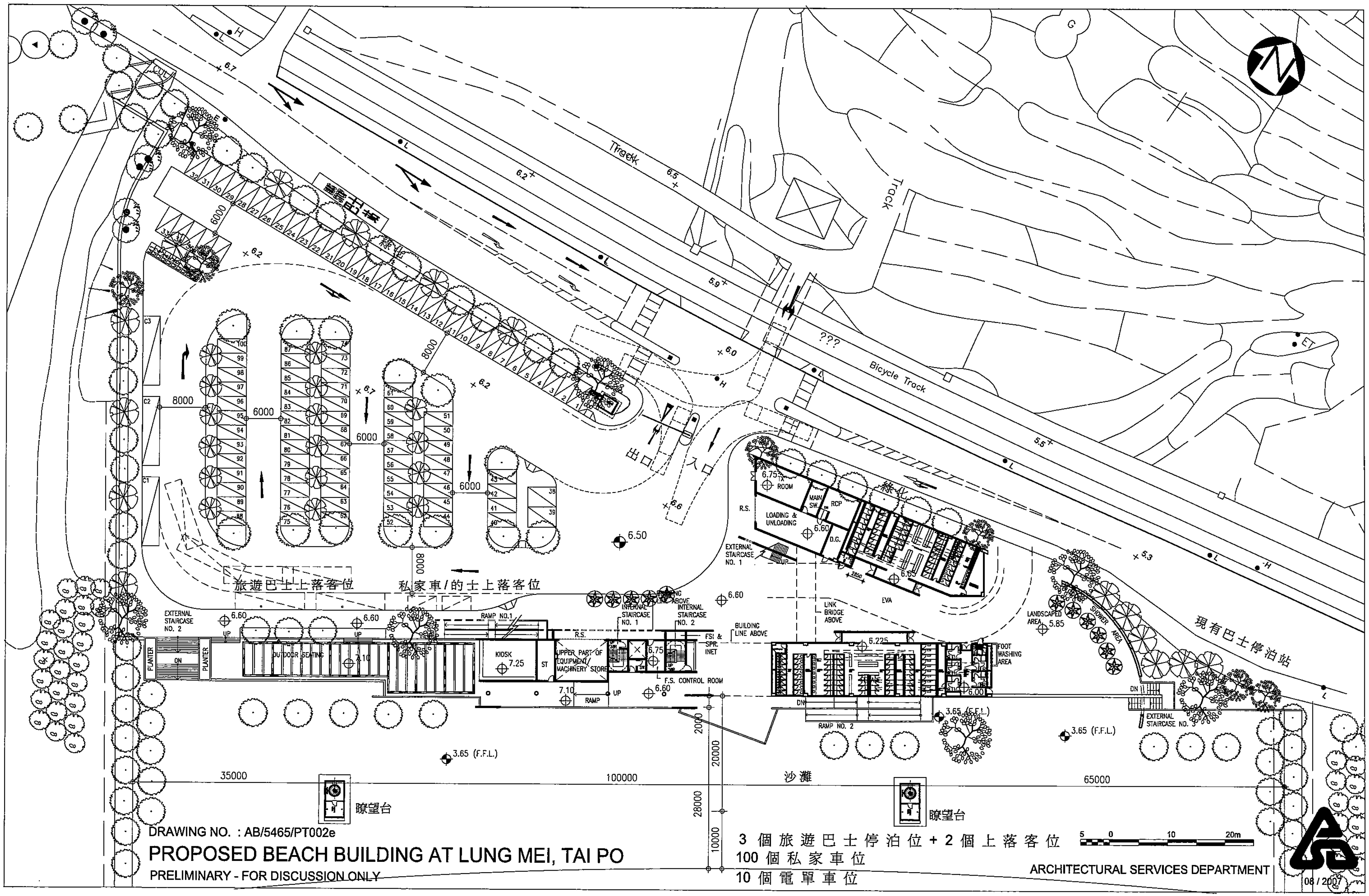
Figure Title: TREE SURVEY PLAN (SHEET 2 OF 2)

APPENDIX H3 – FIGURE 2

Checked -	Scale AS SHOWN	Rev. 2
Designed -	Drawn KK	Date 17/05/2007

Appendix I

Preliminary Design Drawings of Proposed Beach Buildings



DRAWING NO. : AB/5465/PT002e

PROPOSED BEACH BUILDING AT LUNG MEI, TAI PO

PRELIMINARY - FOR DISCUSSION ONLY

3 個旅遊巴士停泊位 + 2 個上落客位
100 個私家車位
10 個電單車位

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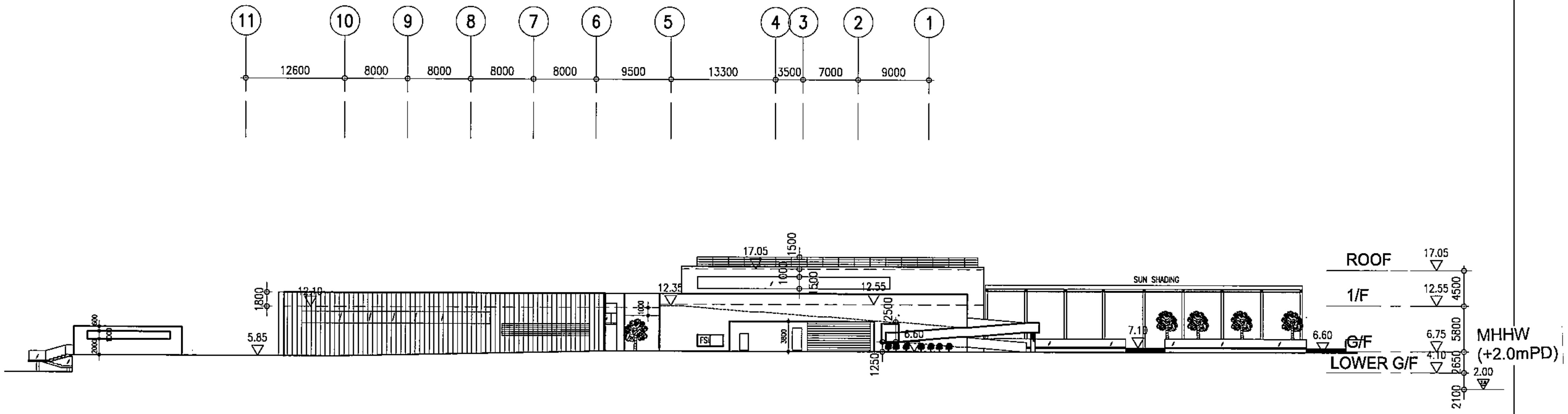
08 / 2007



NORTH ELEVATION

DRAWING NO. : AB/5465/PT013d

SCALE 1:600

PROPOSED BEACH BUILDING AT LUNG MEI, TAI PO

PRELIMINARY - FOR DISCUSSION ONLY

5 0 10 20m

ARCHITECTURAL SERVICES DEPARTMENT

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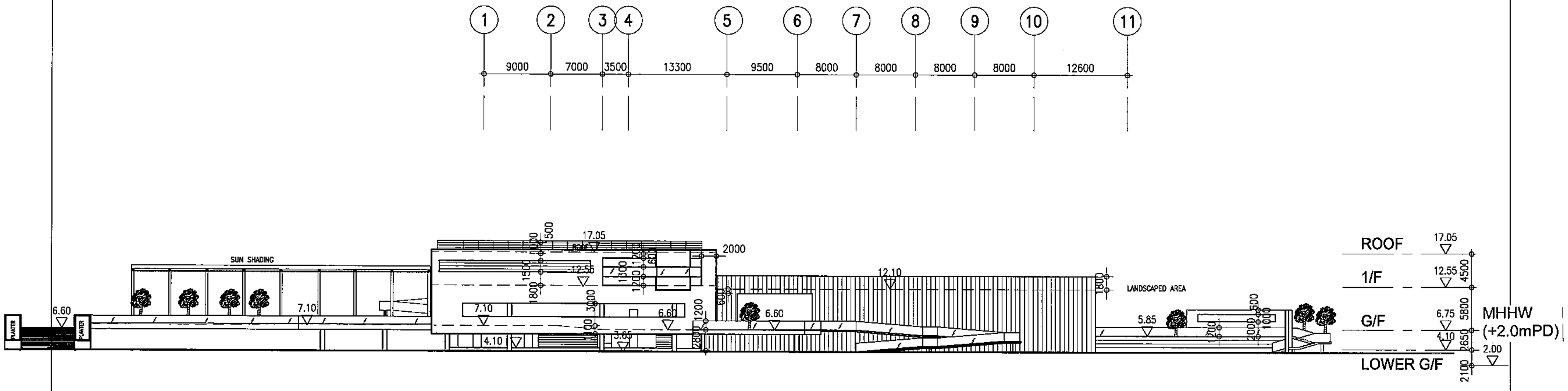


SOUTH ELEVATION

DRAWING NO. : AB/5465/PT011d

SCALE 1:600

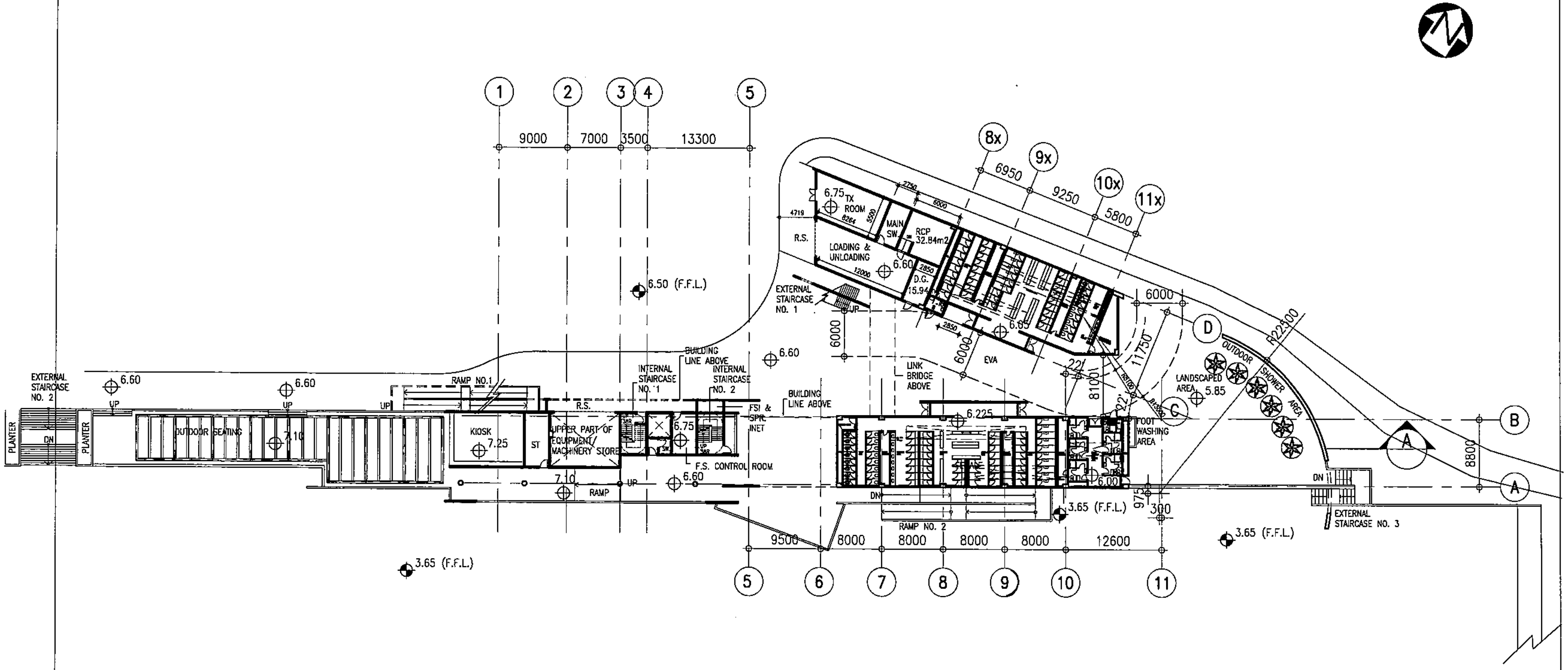
PROPOSED BEACH BUILDING AT LUNG MEI, TAI PO

PRELIMINARY - FOR DISCUSSION ONLY

5 0 10 20m

ARCHITECTURAL SERVICES DEPARTMENT

08 / 2007



GROUND FLOOR PLAN

DRAWING NO. : AB/5465/PT002d

SCALE 1:600

5 0 10 20m

PROPOSED BEACH BUILDING AT LUNG MEI, TAI PO

PRELIMINARY - FOR DISCUSSION ONLY

ARCHITECTURAL SERVICES DEPARTMENT

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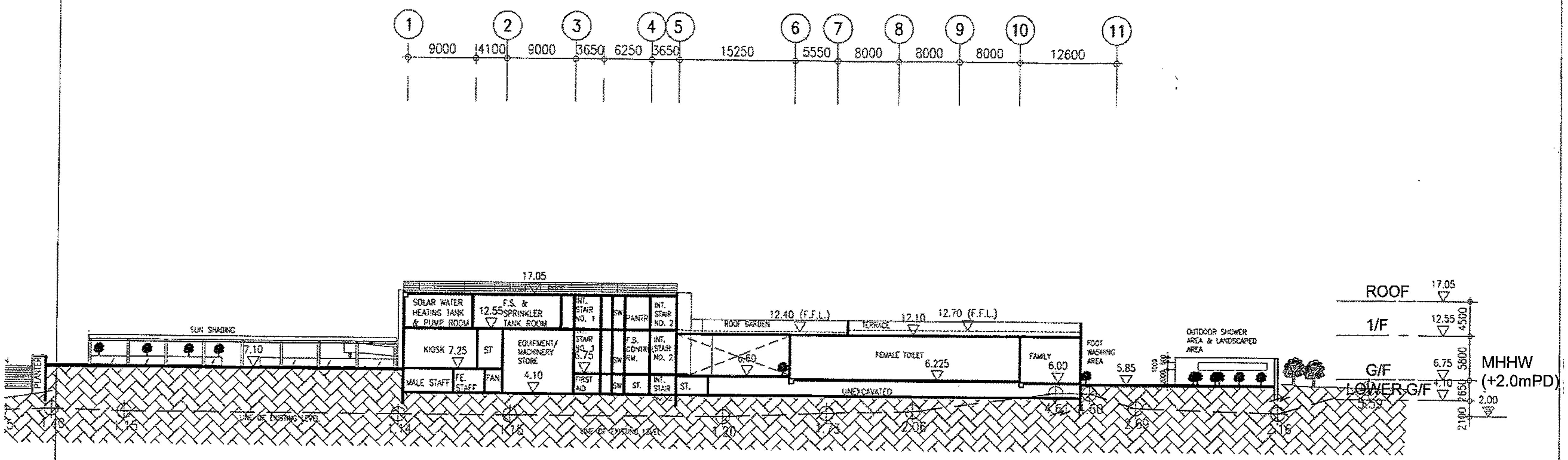
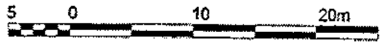


SECTION A-A

DRAWING NO. : AB/5465/LCS201

SCALE 1:600



PROPOSED BEACH BUILDING AT LUNG MEI, TAI PO

ARCHITECTURAL SERVICES DEPARTMENT