

7 STRATEGIC ENVIRONMENTAL ASSESSMENT

To examine the future use of areas to be released from the existing Closed Area and put them under planning control, Strategic Environmental Assessment Study (the SEA Study) is conducted to provide strategic and regional environmental information and suggestions to address any potential environmental conditions, so as to achieve sustainable development in the Study Area. The SEA study is not intended to be a project-based study.

The purpose of this Strategic Environmental Assessment (SEA) Report is to evaluate at strategic level the potential landuse environmental impacts, the cumulative environmental impacts and environmental sustainability implications of the planning framework of the Recommended Development Plan (RDP) formulated under the Main Study. Major environmental issues in relation to air quality, noise, water quality, hazard, landfill, waste, ecology and cultural heritage have been evaluated. Environmental mitigation measures to address the impacts and follow-up investigations requirements are recommended together with the policy and institutional framework arrangements, where applicable. Innovative ideas and new technologies that provide an alternative to resolve the existing and potential future environmental problems are also examined.

It should also be noted that this Study is a broad brush assessment only and when individual project is implemented, detailed studies and/or assessments shall be carried out by the respective project proponent(s) to evaluate and confirm adequacy and technical feasibility of the recommended environmental mitigation measures and infrastructure facilities. Some of these environmental mitigation measures and infrastructure facilities should also be implemented as recommended prior to population intake of the proposed developments.

7.1 Air Quality Impact

7.1.1 Introduction

This section presents the assessment of potential air quality impacts to all existing, committed, planned and proposed air sensitive uses in areas from which developments are proposed under the landuse planning. It evaluates the potential air quality implications of the proposed landuse framework, including the identification and assessment of the pollution emission sources of the proposed developments on the existing, committed, planned and proposed sensitive receivers, as well as identification and assessment of potential air quality impacts arising from existing and planned polluting sources on future sensitive uses of the proposed development areas. Potential air quality impacts on the representative Air Sensitive Receivers (ASRs) have been assessed in accordance with the requirements of Hong Kong Planning Standards and Guidelines (HKPSG), Annex 4 and Annex 12 of the TM-EIAO as well as the requirements set out under Clause 4.13 of the Study Brief. Proposals of mitigation measures required to reduce the cumulative air pollution impacts have been recommended.

7.1.2 Overview of Potential Air Quality Implications of the Landuse Framework

The RDP is illustrated in **Figures 4.11, 4.27, 4.43, 4.59, 4.75 and 4.91**. Different landuse proposals and proposed developments of the RDP will have the potential to affect the existing and planned sensitive uses in the Study Area. There are also various existing and planned polluting uses in and near the Study Area which will potentially pose environmental impacts on the future sensitive use of the proposed development areas such as Kong Nga Po Comprehensive Development Area, Eco-lodge at Ma Tso Lung, village expansion, adaptive reuse of the existing schools for holiday camps, etc. The potential air quality implications of the landuse proposals are discussed in the following sections.

7.1.2.1 Potential air pollution sources of the landuse proposals

(1) Road improvement works

Figure 6.2.1 shows the road improvement network for the Closed Area. Before the opening up of the FCA and its village roads to the general public, road improvement / upgrading is required. It is assumed that road improvement works as well as all other proposed developments are expected to be completed by Year 2020. With more traffic flow induced upon opening up of the FCA, a corresponding increase in vehicular emissions generated from the induced traffic are to be expected, and thus the potential air quality impacts on the existing, planned and proposed sensitive uses.

(2) Proposed Crematorium at Sandy Ridge

The location of the proposed crematorium is indicated in **Figure 4.111**. There will be three proposed cremators. The design and operation of the proposed crematorium is assumed similar to that of Diamond Hill Crematorium. It is noted that FEHD is intended to use cleaner and more environmental-friendly fuel (e.g. town gas) in new government crematoria. Nevertheless, use of light diesel fuel similar to Diamond Hill Crematorium has been assumed for conservative assessment purpose in this study.

Major air pollutant emissions of concern from the cremation process are odour, particulates, hydrogen chloride, carbon monoxide, sulphur dioxide, nitrogen oxides, total organic carbon, mercury and dioxins. Exhaust emissions from cremators design should need to comply with the BPM 12/2 (06) – “A Guidance Note on the Best Practicable Means for Incinerators (Crematoria)” and other environmental requirements. The potential air quality impacts arising from the proposed crematorium on the existing, planned and proposed sensitive uses is to be addressed.

(3) Man Kam To Development Corridor

The southern side of Man Kam To Road has been identified as having the potential to accommodate commercial and logistic type uses. It is assumed that the area would provide for high quality logistics, warehousing and distribution as well as gateway commercial facilities. There are no industrial emission sources associated with these facilities and air quality implications are not expected.

7.1.2.2 Potential odour emission of the landuse proposals

As a worst-case planning scenario for environmental assessment, a horse-riding school will be sited in the planned recreational area near Pak Fu Shan. Potential odour impacts on the nearby sensitive receivers are to be assessed.

7.1.2.3 Potential air quality implication of the existing and planned polluting sources

All future sensitive uses of the proposed development areas including the village zone, adaptive uses of the existing public schools for holiday camp, proposed Eco-lodge, Kong Nga Po Comprehensive Development Area, Man Kam To Development Corridor, Hung Lung Hang Residential Area, and planned recreational area near Fung Wong Wu, Pak Fu Shan and Tong To Ping Tsuen will be exposed to vehicular emission impact from open road. Some of them will also be impacted by air pollution sources including the existing and planned BCPs and cumulative impacts from other concurrent projects.

(1) Existing Open Road

Potential vehicular emission impact arising from open roads on the planned sensitive uses is anticipated. Major roads encroaching and in the vicinity of the Study Area include San Tin Highway, Fanling Highway, Castle Peak Road, Lok Ma Chau Road, Man Kam To Road, Sha Tau Kok Road and Kwu Tung Road. Local roads with light traffic volume include Ma Tso Lung Road, Lin Ma Hang Road, Lo Wu Station Road, Ping Che Road and Wo Keng Shan Road, etc. Small access roads connecting villages are also common in the Study

Area. Road improvement / upgrading work is also required before opening up of the FCA to the general public. Change in traffic flow pattern upon opening of the closed area would cause potential vehicular emission impact on the existing, planned and proposed sensitive uses.

(2) Existing Boundary Control Points

Figures 7.1.1, 7.1.3 and 7.1.6 illustrate the locations of the Lok Ma Chau boundary control point (BCP), Man Kam To BCP and Sha Tau Kok BCP respectively. Potential vehicular emission impact arising from idling vehicles at the kiosks and loading/unloading bay within the BCPs on existing, planned and proposed sensitive receivers is anticipated. Since the Vehicle Holding Area (VHA) is only designed for emergency purposes such as computer system breakdown, it will not be included in the assessment.

(3) Planned NENT New Development Areas (NDAs)

Figure 1.1 illustrates the locations of the planned NENT NDAs. In order to meet long-term housing demand and to accommodate additional population and create associated jobs, three NDAs were identified, including Kwu Tung North NDA, Fanling North NDA, and Ping Che/Ta Kwu Ling NDA, as having potential development opportunities. According to Project Profile (PP-337/2007), Kwu Tung North and Fanling North NDAs comprise residential development with associated employment and community facilities. Ping Che/Ta Kwu Ling NDA provides a 'reception area' for open storage and rural industries that are affected by the development clearance for the other two NDAs. The first population intake year for NDAs is expected to be around 2019.

Since the EIA is currently being undertaken by other consultant team, development plan for the study is not available during preparation of this report. However, potential cumulative air quality impact from their induced traffic will also be included in the assessment.

According to the latest tentative plan, high-end industries with low emission will be sited in the Ping Che/Ta Kwu Ling NDA. In accordance with the HKPSG, a buffer zone of at least 100m from the industrial zone should be complied. Cumulative air quality impact due to industrial emission on the planned sensitive uses is not expected, but still cannot be ruled out if the industrial emission activities are planned in the development layout scheme. Nonetheless, the EIA for NENT NDA is currently being undertaken and the potential environmental implications on the future proposed developments will be assessed and reconfirmed.

(4) Planned Liantang/ Heung Yuen Wai BCP

Figure 7.1.4 illustrates the locations of the BCPs on Hong Kong side and study area within 500m from the boundary. The Liantang / Heung Yuen Wai BCP is proposed to connect with the Eastern Corridor and provide efficient access to Guangdong, Fujian, and Jiangxi for enhancing ties between Hong Kong and the Mainland. It will also help extend the economic hinterland of Hong Kong and Shenzhen and promote regional development. In addition, the proposed new BCP will satisfy the long-term transport needs and help re-distribute the cross-boundary traffic from Man Kam To BCP and Sha Tau Kok BCP to alleviate the frequent traffic congestions.

The proposed Tsung Yuen Ha Village Zone, and Recreational Areas near Pak Fu Shan and Fong Wong Wu is located close to the Heung Yuen Wai BCP; and are subject to potential air quality impact. The Liantang/ Heung Yuen Wai BCP is a Designated Project under EIAO, and a statutory EIA is required to assess and determine its potential environmental impact and mitigation measures. For the purpose of cumulative air quality assessment in this study, the latest layout of the BCP is assumed and the associated traffic flow has been taken into account, in which vehicular emissions from the highway, kiosks, loading/unloading bay are included in the assessment.

Based on the information collected from Liantang/ Heung Yuen Wai BCP Feasibility Study, it is understood that ventilation system will be provided to the tunnel sections of the alignment to ensure the in-tunnel air quality. Pollutants generated within the tunnel sections will be extracted and discharged via ventilation buildings. The locations and elevations of the ventilation buildings are yet to be determined, however, they will be located at sufficient distance away from nearby proposed development areas. According to the latest alignment option, the ventilation shafts (and tunnel portals) were outside the Closed Area Boundary and more than 500m away from the planned receivers. Hence the associated air quality impact is considered not significant. However, since the latest layout and design are yet to be finalised, the potential air quality implication on the proposed landuse within Closed Area in the vicinity of Liantang/ Heung Yuen Wai BCP shall still need to be addressed in the upcoming EIA.

(5) Lok Ma Chau Loop

The development at Lok Ma Chau Loop (LMC Loop) is one of the ten major infrastructure projects for economic growth of the HKSAR. Higher education might be developed as the leading land use with some elements of high-tech research and development facilities and creative industries, which would provide impetus for human resources development in the South China region and enhance the competitiveness of the Pearl River Delta, as well as benefit the long-term economic development of the two cities. The development proposal is being investigated and formulated under Agreement No. CE 53/2008 (CE) Planning and Engineering Study on Development of Lok Ma Chau Loop – Investigation. Since the development plans are yet to be determined, the potential air quality implication on the proposed landuse within Closed Area in the vicinity of LMC Loop shall be addressed in the upcoming EIA and LMC Loop Project.

(6) Industrial Emissions

A desktop study and site surveys were carried out and no major industrial chimneys were found within and in the vicinity of 500m of the Study Area on Hong Kong side.

However, a cement storage plant is found near Muk Wu Nga Yiu. Based on site observations, the plant consists of six silos. According to EPD's record (Environmental Compliance Division, Regional Office (North)) and their site verification, it was advised that there is no cement work on site and the plant is used for storage only.

(7) Public Transport Interchange (PTI)

Vehicles are normally not in idling mode inside the PTIs. It is considered that potential vehicular emission impacts on the future sensitive uses of the proposed development areas are not significant for all PTIs.

(8) Firing Ranges

The planned ex-Lung Kai Public School and Kong Nga Po Comprehensive Development Area are located within 500m of the Lo Wu Classification Range and 100m from Kong Nga Po Shooting range respectively. Potential impacts due to lead and dust emission from the firing practice will be reviewed.

(9) Other Potential Pollution Sources in Shenzhen

According to the Draft Comprehensive Planning of Shenzhen City (2007-2020), the planned land use of Shenzhen within 500m from the study boundary comprises mainly residential, commercial, government and community uses. The nearest potential industrial zones are identified in Liantang Area of Luohu District to the north of Pak Fu Shan (**Figure 7.1.7**) which is located outside 500m of the planned recreational area. There are existing industrial developments to the north-east of Pak Fu Shan in Liantang located close to the Study Area.

Similarly, vehicles are normally not in idling mode inside the PTIs in Shenzhen. It is considered that potential vehicular emission impacts on the future sensitive uses of the proposed development areas are not significant.

The existing open roads, existing BCPs in Huanggang, opposite of Man Kam To and Sha Tau Kok as well as the planned BCP in Liantang on Shenzhen side are potential air pollution sources and its cumulative impacts will be reviewed.

7.1.2.4 Summary of Pollution Sources

Table 7.1.1 summarises the identified air emission sources located within 500m radius of the planned development areas. **Figure 7.1.1 to 7.1.6** shows an overlay of landuse proposals, locations of potential air pollution sources and air sensitive receivers.

Table 7.1.1 Summary of potential air quality impact on the proposed development area

Proposed Development	Open Road [1]	Boundary Crossing Point	Industrial Emission	Shortest Separation Distance (m)
Planning Area 1 (Figure 7.1.1)				
Eco-Lodge	Yes	Nil	Nil	10m to Boundary Patrol Road
Lok Ma Chau Village Zone	Yes	Nil	Nil	10m to Boundary Patrol Road
Planning Area 2 (Figure 7.1.2)				
Eco-Lodge	Yes	Nil	Nil	10m to Boundary Patrol Road
ex-Lung Kai Public School	Yes	Nil	Nil	170m to Ma Tso Lung Road 250m to Lo Wu Classification Range
Liu Pok Village Zone	Yes	Nil	Nil	20m to Boundary Patrol Road
Planning Area 3 (Figure 7.1.3)				
Man Kam To Development Corridor	Yes	Nil	Nil	10m to Man Kam To Road
Kong Nga Po Comprehensive Development Area	Yes	Nil	Nil	10m to Kong Nga Po Road 100m to Kong Nga Po Shooting range
Hung Lung Hang Residential Area	Yes	Nil	Nil	10m to Kong Nga Po Road
Planned Recreational Area near Fung Wong Wu	Yes	Nil	Cement Storage Plant	10m to Lin Ma Hang Road 320m to Cement Storage Plant
ex-Sam Wu Public School	Yes	Man Kam To BCP	Nil	10m to Lin Ma Hang Road 490m to BCP
San Uk Ling Village Zone	Yes	Man Kam To BCP	Nil	10m to Man Kam To Road 270m to BCP
Muk Wu Village Zone	Yes	Man Kam To BCP	Nil	130m to Lin Ma Hang Road 270m to BCP
Muk Wu Nga Yiu Village Zone	Yes	Nil	Cement Storage Plant	10m to Lin Ma Hang Road 100m to Cement Storage Plant
Chow Tin Village Zone	Yes	Nil	Nil	160m to Lin Ma Hang Road
Fung Wong Wu Village Zone	Yes	Nil	Nil	140m to Ping Che Road
Planning Area 4 (Figure 7.1.4)				
Planned Recreational Area near Pak Fu Shan	Yes	Liantang / Heung Yuen Wai BCP	Nil	10m to Lin Ma Hang Road 20m to BCP
Planned Recreational Area near Fung Wong Wu	Yes	Liantang / Heung Yuen Wai BCP	Nil	10m to Lin Ma Hang Road 10m to BCP
Kan Tau Wai Village Zone	Yes	Nil	Nil	10m to Ping Che Road
Tong Fong Village Zone	Yes	Nil	Nil	10m to Ping Che Road
Tsung Yuen Ha Village Zone	Yes	Liantang / Heung Yuen Wai BCP	Nil	60m to Lin Ma Hang Road 60m to BCP
Ha Heung Yuen Village Zone	Yes	Nil	Nil	230m to Lin Ma Hang Road
Heung Yuen Wai Village Zone	Yes	Nil	Nil	250m to Lin Ma Hang Road
Chuk Yuen Village Zone	Yes	Liantang / Heung Yuen Wai BCP	Nil	80m to Liantang Highway 380m to BCP
Planning Area 5 (Figure 7.1.5)				
ex-King Sau Public School	Yes	Nil	Nil	330m to Lin Ma Hang Road
Lin Ma Hang Village Zone	Yes	Nil	Nil	60m to Lin Ma Hang Road
San Kwai Tin Village Zone	Yes	Nil	Nil	10m to Lin Ma Hang Road

Proposed Development	Open Road ^[1]	Boundary Crossing Point	Industrial Emission	Shortest Separation Distance (m)
Planning Area 6 (Figure 7.1.6)				
ex-Kwan Ah Public School	Yes	Sha Tau Kok BCP	Nil	330m to Sha Ho Road 450m to BCP
Planned Recreational Area near Tong To Ping Tsuen	Yes	Nil	Nil	10m to Sha Tau Kok Road
Tong To Village Zone	Yes	Nil	Nil	290m to Sha Tau Kok Road
San Tsuen Village Zone	Yes	Nil	Nil	10m to Sha Tau Kok Road
Muk Min Tau Village Zone	Yes	Sha Tau Kok BCP	Nil	10m to Sha Tau Kok Road
Ha Tam Shui Hang Village Zone	Yes	Sha Tau Kok BCP	Nil	10m to Sha Tau Kok Road
Sheung Tam Shui Hang Village Zone	Yes	Sha Tau Kok BCP	Nil	60m to Sha Ho Road 150m to BCP
Shan Tsui Village Zone	Yes	Sha Tau Kok BCP	Nil	20m to Sha Ho Road 10m to BCP

Notes:

^[1] Cumulative impacts from induced traffic due to concurrent projects including Liantang and NENT NDA are included.

^[2] Potential sources are within 500m of the proposed development areas and village zones

7.1.2.5 Potential odour impacts of the existing and planned polluting sources

There are also a number of existing and planned odour emission sources within and in the vicinity of the FCA that may have potential impacts on the future sensitive uses of the proposed development areas. They are summarised in **Table 7.1.2**.

Table 7.1.2 Potential odorous sources

Potential odorous source	Proposed Landuse Potentially Affected	Shortest Separation Distance (m)
Planning Area 1 (Figure 7.1.1)		
Shenzhen River	Lok Ma Chau Village Zone	90
	Eco-Lodge	480
Planning Area 2 (Figure 7.1.2)		
Binhe Sewage Treatment Plant	Liu Pok Village Zone	850
Shenzhen River	Liu Pok Village Zone	400
	Eco-Lodge	480
Planning Area 3 (Figure 7.1.3)		
Planned Poultry Slaughtering Centre	Man Kam To Development Corridor	260
Sheung Shui Slaughter House	Man Kam To Development Corridor	460
Sha Ling Livestock Waste Composting Plant	Man Kam To Development Corridor	<10
	Kong Nga Po Comprehensive Development Area	320
	Hung Lung Hang Residential Area	480
Man Kam To Animal Inspection Station	ex-Sam Wu Public School	490
	San Uk Ling Village Zone	35
	Muk Wu Village Zone	390
Active Livestock Farms	Man Kam To Development Corridor	280
	Kong Nga Po Comprehensive Development Area	One within the proposed landuse and one at less than 250m from the proposed landuse
	Hung Lung Hang Residential Area	One within the proposed landuse and one at 80m from the proposed landuse
Luofang Sewage Treatment Plant	Muk Wu Nga Yiu Village Zone	350
	Chow Tin Village Zone	260
	Fung Wong Wu Village Zone	330
	Planned REC near Fung Wong Wu	60
Shenzhen River	Muk Wu Village Zone	55
	Muk Wu Nga Yiu Village Zone	40
	Fung Wong Wu Village Zone	270
	Chow Tin Village Zone	200
	Planned REC near Fung Wong Wu	<10

Potential odorous source	Proposed Landuse Potentially Affected	Shortest Separation Distance (m)
Planning Area 4 (Figure 7.1.4)		
NENT Landfill and Extension (Leachate Treatment Plant)	Ha Heung Yuen Village Zone	340
	Heung Yuen Wai Village Zone	410
	Planned REC near Pak Fu Shan	500
Luofang Sewage Treatment Plant	Kan Tau Wai Village Zone	270
	Planned REC near Fung Wong Wu	60
Proposed Horse Riding School	Heung Yuen Wai Village Zone	290
	Ha Heung Yuen Village Zone	410
Shenzhen River	Kan Tau Wai Village Zone	220
	Tong Fong Village Zone	510
	Tsung Yuen Ha Village Zone	190
	Ha Heung Yuen Village Zone	540
	Heung Yuen Wai Village Zone	520
	Chuk Yuen Village Zone	270
	Planned REC near Pak Fu Shan	<10
Planned REC near Fung Wong Wu	<10	
Planning Area 5 (Figure 7.1.5)		
Shenzhen River	Lin Ma Hang Village Zone	80
	San Kwai Tin Village Zone	35
	King Sau Public School	300
Planning Area 6 (Figure 7.1.6)		
Sha Tau Kok Sewage Treatment Work (STW)	San Tsuen Village Zone	450
	Muk Min Tau Village Zone	300
	Ha Tam Shui Hang Village Zone	130
	Sheung Tam Shui Hang Village Zone	190
	Shan Tsui & Nga Yiu Tau Village Zone	310
	ex-Kwan Ah Public School	490
	Tsiu Hang Village Zone	300

7.1.3 Environmental Legislation, Standards and Guidelines

7.1.3.1 Air Quality Objectives

The principal legislation for controlling air pollutants is the Air Pollution Control Ordinance (APCO) (Cap 311) and its subsidiary regulations, which define statutory Air Quality Objective (AQOs) for 7 common air pollutants. The AQOs for these air pollutants are tabulated in **Table 7.1.3** below.

Table 7.1.3 Hong Kong air quality objectives

Pollutant	Concentration in micrograms per cubic metre ^[1] (Parts per million, ppm in brackets)				
	1 Hour ^[2]	8 Hours ^[3]	24 Hours ^[3]	3 Months ^[4]	1 Year ^[4]
Sulphur Dioxide	800 (0.3)		350 (0.13)		80 (0.03)
Total Suspended Particulates	500 ^[7]		260		80
Respirable Suspended Particulates ^[5]			180		55
Carbon Monoxide	30,000 (26.2)	10,000 (8.7)			
Nitrogen Dioxide	300 (0.16)		150 (0.08)		80 (0.04)
Photochemical Oxidants (as ozone) ^[6]	240				
Lead				1.5	

Notes:

- ^[1] Measured at 298K (25°C) and 101.325 kPa.
- ^[2] Not to be exceeded more than three times per year.
- ^[3] Not to be exceeded more than once per year.
- ^[4] Arithmetic mean.
- ^[5] Respirable suspended particulates means suspended particulates in air with a nominal aerodynamic diameter of 10 micrometres or smaller.
- ^[6] Photochemical oxidants are determined by measurement of ozone only.
- ^[7] Not an AQO but is a criterion for evaluating air quality impacts as stated in Technical Memorandum on Environmental Impact Assessment Process.

7.1.3.2 Criteria for Non-AQO Pollutant

For air pollutant not established under the APCO or EIAO, the standards stipulated by recognized international organization, such as the World Health Organization (WHO) are adopted.

Dioxins, hydrogen chloride (HCl) and mercury (Hg) are the identified toxic air pollutant of concern in relation to the proposed crematorium in this study. Recommendation of chronic and acute criteria for toxic air pollutants from the abovementioned international organization are adopted, as presented in **Table 7.1.4**. It should be noted that the cancer risk of dioxin impacts is outside the scope of this study and shall be addressed in separate EIA for the proposed crematorium which is a DP under EIAO.

Table 7.1.4 Acute and chronic criteria for toxic air pollutants

Pollutant	Unit	Criteria	
		1-hour	Annual
Dioxins	pg I-TEQ/m ³	N/A	1 ^[1]
HCl	µg/m ³	2100 ^[2]	20 ^[3]
Hg	µg/m ³	0.6 ^[2]	1 ^[4]

Note:

- [1] Primary Ambient Air Quality Standard for Dioxin, Department of Environmental Protection, State of Connecticut, USA
- [2] Reference Exposure Limit, Office of Environmental Health Hazard Assessment, California, USA
- [3] Integrate Risk Information System, USEPA
- [4] WHO Air Quality Guideline

7.1.3.3 Odour Criteria

In accordance with Annex 4 of TM-EIAO, the limit of 5 odour units based on an averaging time of 5 seconds for odour prediction assessment should not be exceeded at any receiver.

7.1.3.4 Hong Kong Planning Standards and Guidelines (HKPSG)

The HKPSG provides the principal framework for planning against air pollution and broad guidelines of location for major polluting uses with a view to improving the general air quality in the preparation of land use plans. The minimum buffer distance on usage of open spaces is given in **Table 7.1.5** and the locational guidelines relevant to the proposed landuse framework are presented in the section below.

Table 7.1.5 Guidelines on usage of open space site

Pollution Source	Parameter	Buffer Distance	Permitted Uses
Road and Highways	Type of Road		
	Trunk Road and Primary Distributor	>20m	Active and passive recreational uses
		3 - 20m	Passive recreational uses
		<3m	Amenity areas
	District Distributor	>10m	Active and passive recreational uses
		<10m	Passive recreational uses
	Local Distributor	>5m	Active and passive recreational uses
<5m		Passive recreational uses	
Under Flyovers	-	Passive recreational uses	
Industrial Areas	Difference in Height between Industrial Chimney Exit and the Site		
	<20m	>200m	Active and passive recreational uses
		5 - 200m	Passive recreational uses
	20 - 30m (*)	>100m	Active and passive recreational uses
		5 - 100m	Passive recreational uses
	30m - 40m	>50m	Active and passive recreational uses
5 - 50m		Passive recreational uses	
>40m	>10m	Active and passive recreational uses	
Construction and earth moving activities	-	<50m	Passive recreational uses
	-	>50m	Active and passive recreational uses

Note:

- (a) In situations where the height of chimneys is not known, use the set of guidelines marked with an asterisk for preliminary planning purpose and refine as and when more information is available.

- (b) The buffer distance is the horizontal, shortest distance from the boundary of the industrial lot, the position of existing chimneys or the edge of road kerb, to the boundary of open space sites.
- (c) The guidelines are generally applicable to major industrial areas but NOT individual large industrial establishments which are likely to be significant air pollution sources. Consult EPD when planning open space sites close to such establishments.
- (d) Amenity areas are permitted in any situation.

(1) Local Road Traffic

Table 7.1.5 provides details of the minimum buffer distances required between respective road types and open spaces.

(2) Industrial Zones

For general multi-storey industrial sites without chimneys a buffer distance of at least 100m from sensitive uses is normally required with reference to HKPSG. Acceptable uses in the buffer area include godowns, cold storages, carparks, amenity areas and open spaces. There are some constraints for active open space uses. Other less sensitive uses such as commercial and government/institutional facilities can also be considered. However, these uses should be comparatively low-rise, air-conditioned and the distance between buildings and the industrial sites should exceed 30m, in accordance with HKPSG.

(3) Slaughterhouses

Slaughterhouses and associated facilities for transporting livestock have the potential for odour nuisance from rendering operations and also have a pervading background odour from pens, paunch offal disposal and production areas. Their separation from any residential areas, hospitals, schools and commercial areas should not be less than 300m with a rendering plant or not be less than 200m without a rendering plant. Low-rise buildings with ample open space in the surrounding areas should be encouraged. In addition, shelving of the whole slaughterhouses to avoid potential odour nuisance can also be considered, which is subject to further study.

(4) Sewage Treatment Works

Sewage treatment works can create an odour nuisance to neighbouring uses. Suitable buffer and landscaping features should be provided to minimise environmental and visual impacts on adjacent sensitive uses. The required buffer distance varies considerably, depending on the types of treatment facilities and whether or not the treatment works are enclosed.

(5) Odour Sources

In accordance with HKPSG, some small scale community uses can cause significant air pollution nuisance, primarily due to odour. These include the following:

- Crematoria;
- Livestock yards;
- Stock wagon washing areas; and
- Wholesale fish and poultry markets

Usually a buffer distance of at least 200m from nearby sensitive uses is required. Acceptable uses in the buffer area include industrial areas, godowns, cold storages, carparks and amenity areas. Open space uses may also be tolerated.

7.1.3.5 EPD's Guidance Note

BPM 12/2 (06) "A Guidance Note on the Best Practical Means for Incinerators (Crematoria)" provides guidance for the control of specified processes and associated process in relation to the cremation of human remains under Part IV of the APCO. It sets out the basic requirements for the applicant to design the crematorium and provide and maintain the best practicable means for the prevention of the emission of air pollutants. The BPM 12/2 (06) also specifies the concentration limits of air pollutants from the cremation process as shown in **Table 7.1.6** below.

Table 7.1.6 Concentration limits for emission from cremators

Air Pollutants ^[1]	Concentration Limit ^[2]
Particulates	40 mg/m ³
Total Organic Carbon (TOC)	20 mg/m ³
Hydrogen Chloride (HCl)	30 mg/m ³
Carbon Monoxide (CO)	100 mg/m ³
Mercury (Hg) ^[3]	0.05 mg/m ³
Dioxins ^[3]	0.1 ng I-TEQ/m ³

Note:

^[1] 1-hour average value except for mercury and dioxins^[2] All pollutant concentrations are expressed at reference conditions of 273K, 101.325kPa, 11% O₂, and dry conditions^[3] Average time of mercury and dioxins emission limit: a minimum of three complete cremation cycles or the requisite number of complete cremation cycles to cover a minimum period of six hours, whichever is the longer duration**7.1.4 Description of the Environment****7.1.4.1 Baseline Condition**

The Study Area is located within the Deep Bay Airshed where the air pollution dispersion is inhibited. There is no existing fixed air quality monitoring station (AQMS) within the Study Area. AQMSs in the vicinity of the site include Yuen Long, Tai Po and Tap Mun AQMSs.

Annual reports are available online for air quality monitoring data from the above AQMSs (<http://www.epd-asg.gov.hk/english/report/aqr.php>). According to the Annual Air Quality Statistics published by EPD, Yuen Long and Tai Po are new towns, while Tap Mun is rural in nature serving as a background station for air quality in Hong Kong. In addition, there are monitoring station in the PRD Regional Air Quality Monitoring Network jointly established by the Hong Kong EPD and Guangdong Provincial Environmental Protection Monitoring Centre. The Network came into operation in late 2005 providing air quality data from 16 automatic air quality monitoring station across the PRD region; one of which is located in Liyuan, a developed town in Lo Wu of the Shenzhen side in close proximity to the Study Area. Reports are available online for the air quality monitoring results from this network (<http://www.gdepb.gov.cn/raqi>).

The annual average concentration of various air pollutants monitored at the abovementioned AQMSs over the past five years between 2003 and 2007 have been collated and summarized, in **Table 7.1.7** below.

Table 7.1.7 Air pollutant levels between 2003 and 2007

Parameter / Monitoring Station	Annual Average Concentration (µg/m ³) ^[1]					
	2003	2004	2005	2006	2007	5-Year Average
Sulphur dioxide (SO₂)						
Tai Po ^[2]	14	-	19	19	16	17.0
Yuen Long ^[2]	18	31	28	28	24	25.8
Tap Mun ^[2]	12	16	14	16	17	15.0
Liyuan ^[3]	-	-	-	27	29	28.0
Nitrogen dioxide (NO₂)						
Tai Po ^[2]	52	-	49	57	53	52.8
Yuen Long ^[2]	60	67	58	58	55	59.6
Tap Mun ^[2]	13	16	14	13	15	14.2
Liyuan ^[3]	-	-	-	61	46	53.5
Carbon monoxide (CO)						
Tai Po ^[2]	-	-	-	-	-	-
Yuen Long ^[2]	-	917	1,038	841	969	941.3
Tap Mun ^[2]	793	787	759	726	847	782.4

Parameter / Monitoring Station	Annual Average Concentration ($\mu\text{g}/\text{m}^3$) ^[1]					
	2003	2004	2005	2006	2007	5-Year Average
Liyuan ^[3]	-	-	-	-	-	-
Ozone (O₃)						
Tai Po ^[2]	46	-	34	37	38	38.8
Yuen Long ^[2]	31	35	32	32	36	33.2
Tap Mun ^[2]	72	80	66	68	66	70.4
Liyuan ^[3]	-	-	-	39	40	39.5
Total suspended particulates (TSP)						
Tai Po ^[2]	71	-	61	66	73	67.8
Yuen Long ^[2]	98	113	104	101	97	102.6
Tap Mun ^[2]	-	-	-	-	-	-
Liyuan ^[3]	-	-	-	-	-	-
Respirable suspended particulates (RSP)						
Tai Po ^[2]	54	-	51	51	53	52.3
Yuen Long ^[2]	61	71	62	62	64	64.0
Tap Mun ^[2]	47	53	50	48	53	50.2
Liyuan ^[3]	-	-	-	60	67	63.5
Dioxin						
Tsuen Wan ^[4]	0.071	0.055	0.071	0.066	0.083	0.069
Mercury (Hg)						
Yuen Long ^[2]	0.00024	0.00023	0.00023	0.00023	0.00024	0.00023

Notes:

^[1] Measured at 298 K (25 °C) and 101.325 kPa (1 atm); “ - ” denotes data not determined.

^[2] Air Quality in Hong Kong and Annual Air Quality Statistics, EPD.

^[3] Report of Monitoring Results, PRD Regional Air Quality Monitoring Network

^[4] Annual Dioxin concentration in unit of pgI-TEQ/m³

The compliance status with the respective air quality objectives/standards in Hong Kong (AQO) or the Mainland (NAAQS, **Table 7.1.32**) of the above AQMSs over the past five years between 2003 and 2007 are shown in **Table 7.1.8**.

Table 7.1.8 Compliance status of air quality objectives/standards between 2003 and 2007

Parameter / Monitoring Station	Compliance Status ^[1]				
	2003	2004	2005	2006	2007
Annual					
Sulphur dioxide (SO₂)					
Tai Po ^[2]	Complied	-	Complied	Complied	Complied
Yuen Long ^[2]	Complied	Complied	Complied	Complied	Complied
Tap Mun ^[2]	Complied	Complied	Complied	Complied	Complied
Liyuan ^[3]	-	-	-	Complied	Complied
Nitrogen dioxide (NO₂)					
Tai Po ^[2]	Complied	-	Complied	Complied	Complied
Yuen Long ^[2]	Complied	Complied	Complied	Complied	Complied
Tap Mun ^[2]	Complied	Complied	Complied	Complied	Complied
Liyuan ^[3]	-	-	-	Complied	Complied
Total suspended particulates (TSP)					
Tai Po ^[2]	Complied	-	Complied	Complied	Complied
Yuen Long ^[2]	Not complied	Not complied	Not complied	Not complied	Not complied
Tap Mun ^[2]	-	-	-	-	-
Liyuan ^[3]	-	-	-	-	-

Parameter / Monitoring Station	Compliance Status ^[1]				
	2003	2004	2005	2006	2007
Respirable suspended particulates (RSP)					
Tai Po ^[2]	Complied	-	Complied	Complied	Complied
Yuen Long ^[2]	Not complied	Not complied	Not complied	Not complied	Not complied
Tap Mun ^[2]	Complied	Complied	Complied	Complied	Complied
Liyuan ^[3]	-	-	-	Complied	Complied
24-hour					
Sulphur dioxide (SO₂)					
Tai Po ^[2]	100	100	100	100	100
Yuen Long ^[2]	100	100	100	100	100
Tap Mun ^[2]	100	100	100	100	100
Liyuan ^[3]	-	-	-	99.70	100
Nitrogen dioxide (NO₂)					
Tai Po ^[2]	100	100	100	99.69	100
Yuen Long ^[2]	100	99.18	100	99.45	100
Tap Mun ^[2]	100	100	100	100	100
Liyuan ^[3]	-	-	-	98.52	99.65
Total suspended particulates (TSP)					
Tai Po ^[2]	98.36	100	100	100	100
Yuen Long ^[2]	96.77	96.67	100	96.67	98.39
Tap Mun ^[2]	-	-	-	-	-
Liyuan ^[3]	-	-	-	-	-
Respirable suspended particulates (RSP)					
Tai Po ^[2]	99.72	100	100	100	100
Yuen Long ^[2]	99.17	99.16	99.43	99.72	99.18
Tap Mun ^[2]	100	100	100	100	99.44
Liyuan ^[3]	-	-	-	98.27	97.91
8-hour					
Carbon monoxide (CO)					
Tai Po ^[2]	-	-	-	-	-
Yuen Long ^[2]	-	100	100	100	100
Tap Mun ^[2]	100	100	100	100	100
Liyuan ^[3]	-	-	-	-	-
1-hour					
Sulphur dioxide (SO₂)					
Tai Po ^[2]	100	100	100	100	100
Yuen Long ^[2]	100	100	100	100	100
Tap Mun ^[2]	100	100	100	100	100
Liyuan ^[3]	-	-	-	100	100
Nitrogen dioxide (NO₂)					
Tai Po ^[2]	100	100	100	99.96	100
Yuen Long ^[2]	100	99.98	100	99.98	100
Tap Mun ^[2]	100	100	100	100	100
Liyuan ^[3]	-	-	-	99.73	99.99
Carbon monoxide (CO)					
Tai Po ^[2]	-	-	-	-	-
Yuen Long ^[2]	-	100	100	100	100
Tap Mun ^[2]	100	100	100	100	100
Liyuan ^[3]	-	-	-	-	-
Ozone					
Tai Po ^[2]	99.98	100	100	99.96	100
Yuen Long ^[2]	100	99.89	99.84	99.81	99.86
Tap Mun ^[2]	99.85	99.91	99.61	99.73	99.83
Liyuan ^[3]	-	-	-	99.46	99.87

Notes:

^[1] "-" denotes data not determined; figures indicate percentage compliance.

- [2] With regard to the Hong Kong AQO.
[3] With regard to the Mainland NAAQS (refer to Table 7.1.32).

Air quality monitoring data from the Liyuan AQMS indicate that air quality of the Shenzhen side in proximity to the Study Area largely complies with the Mainland NAAQS. Hence, significant air emission influence from the nearby area in Shenzhen on the air quality of the Study Area is not expected. In the absence of monitoring data specific to the Study Area, reference is made to EPD's AQMSs in proximity with due regard to the distance, land use and types of nearby air emission sources of these stations for the general background air quality of the Study Area.

The annual air quality at the above AQMSs generally complied with the Hong Kong AQO, except for particulates in Yuen Long. The high particulate levels in Yuen Long were due to local emissions from traffic, industries and constructions, but the activity levels of which are much lower in the Study Area. It is therefore anticipated that the general background air quality of the Study Area complies with the Hong Kong AQO, and is reasonably better than that of Yuen Long and Tai Po AQMSs with fewer developments and less traffic in view of its restricted nature.

For the western part of the Study Area (i.e. Area to the west of Ng Tung River), it is geographically closer to the Yuen Long AQMS that could be referenced to. The air quality of Yuen Long is nevertheless influenced by local emission sources. For instance, the high particulate levels due to vehicular emissions from road network nearby, industrial emissions from Yuen Long Industrial Estate and construction works of the area. The middle of the Study Area is closer to the Tai Po AQMS (i.e. Area within the east of Ng Tung River and Lin Ma Hang) that could be referenced to. Similarly, the air quality of Tai Po is affected by local emissions from Tai Po Industrial Estate and adjacent road network.

For the eastern portion of the Study Area (i.e. Area to the east of Lin Ma Hang), the area is equally close to both the Tai Po AQMS and Tap Mun AQMS. This area is generally rural in nature with hilly terrain. However, as Sha Tau Kok Area is influenced by local vehicular emission, it is considered similar to local condition in Tai Po area. As for worst-case scenario assessment, the monitoring data at Tai Po AQMS will be assumed as the background concentration for the eastern portion.

The background concentration reference for each portion of the Closed Area is summarised below in **Table 7.1.9**:

Table 7.1.9 Summary of background concentration reference for closed area

Pollutant	Unit	Western Portion ^[1]	Middle Portion ^[2]	Eastern Portion ^[2]
SO ₂	µg/m ³	25.8	17	17
NO ₂	µg/m ³	59.6	52.8	52.8
CO ^[3]	µg/m ³	941.3	941.3	941.3
RSP	µg/m ³	64	52.3	52.3
O ₃	µg/m ³	33.2	38.8	38.8
Mercury ^[4]	µg/m ³	0.00023	0.00023	0.00023
Dioxins ^[5]	pgl-TEQ/m ³	0.069	0.069	0.069

Notes:

- [1] Background concentration referenced to Yuen Long AQMS in general
 [2] Background concentration referenced to Tai Po AQMS in general
 [3] Background concentration of CO is not available at Tai Po AQMS, thus the concentration at Yuen Long AQMS is adopted
 [4] The background concentration of Mercury at the nearest monitoring station in Yuen Long is adopted
 [5] No data available. The background concentration of Dioxins in Tsuen Wan is adopted.

7.1.5 Air Sensitive Receivers (ASRs)

7.1.5.1 Existing ASRs

Representative air sensitive receivers (ASRs) within 500 m from the boundary of the Study Area consisting of residential premises, educational institutions, clinic and home of the aged have been identified in accordance with Annex 12 of the TM-EIAO (**Table 7.1.10**) and their locations are shown in **Figures 7.1.1 to 7.1.6**.

Table 7.1.10 Representative existing air sensitive receivers

ASR ID	Description	Use ^[1]	Potential Air Pollution Sources ^[2]
Western Portion			
A1	Lin Bam Tsuen	R	Open road
A2	Tung Chan Wai	R	Open road
A3	Mai Po Lo Wai	R	Open road
A4	Village House along Castle Peak Road	R	Open road
A5	Ha Wan Tsuen	R	Open road, Lok Ma Chau BCP
A6	Village House along Ha Wan Tsuen Road	R	Open road, Lok Ma Chau BCP
A7	Village House along Lok Ma Chau Road	R	Open road
A8	Lok Ma Chau Fishermen New Village	R	Open road
A9	Pun Uk Tsuen	R	Open road
A10	Ting Tsz School	E	Open road
A11	Lok Ma Chau Village	R	Open road
A12	Village House to the South of Lok Ma Chau Loop	R	Open road
A13	Lok Ma Chau Operation Base (Office)	GIC	Open road
A14	Village House at North of Shun Yee San Tsuen	R	Open road
A15	Village House to the West of Shun Yee San Tsuen	R	Open road
A16	Shun Yee San Tsuen	R	Open road
A17	Ma Tso Lung San Tsuen	R	Open road
A18	Village House to the West of Fong Kong Shan	R	Open road
A19	Ma Tso Lung Police Post	GIC	Open road
A20	Liu Pok	R	Open road
A21	Village House near Sheung Ma Lei Yue	R	Open road
A22	Tak Yuet Lau	R	Open road
A23	Village House near Ngam Bin	R	Open road
A24	Pai Tau Lo	R	Open road
A25	Lo Wu Saddle Club	GIC	Open road
A102	Lo Wu Correctional Institution	GIC	Open road
A103	Lo Wu Camp Football Field	GIC	Open road
Middle Portion			
A26	Lo Wu Station Staff Quarters	GIC	Open road, Proposed Crematorium
A27	Lo Wu Tsuen	R	Open road, Proposed Crematorium
A28	Village House along Lo Wu Station Road	R	Open road, Proposed Crematorium
A29	Village House along Man Kam To Road (Southern Section)	R	Open road
A30	Village House at junction between Kong Nga Po Road and Man Kam To Road	R	Open road, Planned Poultry Slaughtering Centre
A31	Hung Kiu San Tsuen	R	Open road, Planned Poultry Slaughtering Centre
A33	Village House in Sha Ling (West of Man Kam To Road)	R	Open road, Proposed Crematorium
A35	Lo Wu Public School	E	Open road, Proposed Crematorium
A38	Village House in Sha Ling (East of Man Kam To Road)	R	Open road, Sha Ling Livestock Waste Composting Plant

ASR ID	Description	Use [1]	Potential Air Pollution Sources [2]
A39	Village House near Sha Ling Livestock Waste Composting Plant	R	Open road, Sha Ling Livestock Waste Composting Plant
A40	Temple near Sha Ling Livestock Waste Composting Plant	W	Open road, Sha Ling Livestock Waste Composting Plant
A41	Village House to the South of Man Kam To VHA	R	Open road, Man Kam To BCP
A42	Village House along Sha Ling Road	R	Open road, Man Kam To BCP
A44	Village House to the West of Man Kam To VHA	R	Open road, Man Kam To BCP
A45	San Uk Ling Village	R	Open road, Man Kam To BCP
A46	Village House next to San Uk Ling	R	Open road, Man Kam To BCP
A47	Village House along to the East of Man Kam To VHA	R	Open road, Man Kam To BCP
A48	Muk Wu Village	R	Open road, Man Kam To BCP
A49	Village House next to Muk Wu Village Zone	R	Open road, Man Kam To BCP
A50	Muk Wu Nga Yiu Village	R	Open road, Cement Storage Plant
A52	Village House to the North of Lo Shue Ling	R	Open road, Cement Storage Plant
A53	Village House near Chow Tin Tsuen	R	Open road
A54	Chow Tin Tsuen	R	Open road, Luofang Sewage Treatment Plant
A55	Fung Wong Wu	R	Open road, Luofang Sewage Treatment Plant
A56	Ta Kwu Ling Village	R	Open road, Luofang Sewage Treatment Plant
A57	Village House along Kong Nga Po Road	R	Open road, Sha Ling Livestock Waste Composting Plant
A61	Village House near Hung Lung Hang	R	Open road
A64	Village House along access road to Hung Lung Hang	R	Open road
A65	Lei Uk Village	R	Open road
A66	Ta Kwu Ling Farm	R	Open road
A67	Wun Chuen Sin Koon	W	Open road
A68	Village House next to Sing Ping Village	R	Open road
A70	Sing Ping Village	R	Open road
A71	Caritas Fung Wong Fung Ting Home (Home for aged)	H	Open road
A72	Village House near Tong Fong	R	Open road
A73	Tong Fong Village	R	Open road, Luofang Sewage Treatment Plant
A74	Kan Tau Wai	R	Open road, Luofang Sewage Treatment Plant
A75	Village House next to Ta Kwu Ling Village	R	Open road, Liantang-Heung Yuen Wai BCP
A76	Kaw Liu Village	R	Open road, Liantang-Heung Yuen Wai BCP
A77	Village House along access road to NENT Landfill	R	Open road, Liantang-Heung Yuen Wai BCP
A78	Tsung Yuen Ha Village	R	Open road, Liantang-Heung Yuen Wai BCP
A79	Village House to the South-west of Pak Fu Shan	R	Open road
A80	Ha Heung Yuen	R	Open road, Proposed Horse Stable
A81	Heung Yuen Wai	R	Open road, Proposed Horse Stable
A82	Village House to the South of Pak Fu Shan	R	Open road, Proposed Horse Stable
A83	Village House to the North of Pak Fu Shan	R	Open road, Proposed Horse Stable

ASR ID	Description	Use ^[1]	Potential Air Pollution Sources ^[2]
A84	Village House to the East of Pak Fu Shan	R	Open road, Proposed Horse Stable
A85	Village House along Lin Ma Hang Road near Wang Lek	R	Open road, Proposed Horse Stable
Eastern Portion			
A87	Lin Ma Hang Village	R	Open road
A88	Village House near Tong To Ping Tsuen	R	Open road
A89	Tong To Ping Tsuen	R	Open road
A90	Tong To Village	R	Open road
A91	Nga Yiu Tau	R	Open road
A92	San Tsuen	R	Open road
A93	Muk Min Tau	R	Open road, Sha Tau Kok STW
A94	Ha Tam Shui Hang Village	R	Open road, Sha Tau Kok STW
A95	Sheung Tam Shui Hang Village	R	Open road, Sha Tau Kok STW
A96	Green Castle	R	Open road, Sha Tau Kok STW, Sha Tau Kok BCP
A97	Shan Tsui Village	R	Open road, Sha Tau Kok STW, Sha Tau Kok BCP
A98	Shan Tsui Public School	E	Open road, Sha Tau Kok STW, Sha Tau Kok BCP
A99	Kong Ha	R	Open road, Sha Tau Kok STW, Sha Tau Kok BCP
A100	Sha Tau Kok Public School	R	Open road, Sha Tau Kok STW, Sha Tau Kok BCP
A101	Sha Tau Kok Chuen	R	Open road, Sha Tau Kok STW, Sha Tau Kok BCP

Note:

^[1] R – residential; E – educational; H – Home for the aged; C – Clinic; W – Place for public worship; GIC – Government / Institution / Community use

^[2] Potential air pollution sources are within 500m from the ASRs

7.1.5.2 Planned Air Sensitive Uses

All future sensitive uses proposed in the RDP, including the village zone, adaptive uses of the existing public schools for holiday camp, Ecologne, residential uses in Kong Nga Po, planned OU and planned recreational uses summarized in the following **Table 7.1.11** and illustrated in **Figures 7.1.1 to 7.1.6**.

Table 7.1.11 Representative planned air sensitive uses

ASR ID	Description	Use	Potential Air Pollution Sources ^[1]
Western Portion			
P1	Eco-Lodge	Tourist Accommodation	Open road, Shenzhen River
P2	ex-Lung Kai Public School	Holiday Camps/ Bird-watching and Visitor Centre	Open road, Lo Wu Classification Range
Middle Portion			
P3	Man Kam To Development Corridor	Commercial, retail, warehouse	Open road, Sheung Shui Slaughterhouse, Sha Ling Livestock Waste Composting Plant, Planned Poultry Slaughtering Centre, Kong Nga Po Shooting range, Active livestock farms
P4	Kong Nga Po Comprehensive Development Area	Residential Development	Open road, Sha Ling Livestock Waste Composting Plant, Kong Nga Po Shooting range, Active livestock farms
P5	Hung Lung Hang Residential Area	Residential Development	Open road, Sha Ling Livestock Waste Composting Plant, Kong Nga Po Shooting range, Active livestock farms

ASR ID	Description	Use	Potential Air Pollution Sources ^[1]
P6	ex-Sam Wu Public School	Holiday Camps/ Administration Centre for Sustainable Farming	Open road, Man Kam To BCP, Man Kam To Animal Inspection Station
P7	Planned recreational area near Pak Fu Shan	Residential Development and Horse Riding School ^[2]	Open road, Planned Liantang-Heung Yuen Wai BCP, Proposed Horse Stable, Shenzhen River, NENT Landfill and Extension
P12	Planned recreational area near Fung Wong Wu	Agri-tourism and residential development (in support of recreation)	Open road, Planned Liantang-Heung Yuen Wai BCP, Luofang Sewage Treatment Plant, Shenzhen River, Cement Storage Plant
Eastern Portion			
P8	ex-King Sau Public School	Holiday Camps/ Museum/ Field Study Centre	Open road
P9	ex-Kwan Ah Public School	Holiday Camps/ Country Park Visitor Centre	Open road, Sha Tau Kok STW, Sha Tau Kok BCP
P11	Planned recreational area near Tong To Ping Tsuen	Agri-tourism and residential development (in support of recreation)	Open road

Note: [1] Potential air pollution sources are within 500m from the ASRs

[2] The proposed horse riding school is just one of the RDP's proposal and is also the worst scenario for undertaking the technical assessment. It is subject to market determination and planning approval from the TPB.

The village zones (**Table 7.1.12**) are assessed for air quality impact at selected representative locations at their respective site boundary.

Table 7.1.12 Identified village zones

ASR ID	Description	Use ^[1]	Potential Air Pollution Sources ^[2]
V1	Planned Lok Ma Chau Village Zone	R	Open road, Shenzhen River
V2	Planned Liu Pok Village Zone	R	Open road, Shenzhen River
V3	Planned San Uk Ling Village Zone	R	Open road, Man Kam To BCP, Man Kam To Animal Inspection Station
V4	Planned Muk Wu Village Zone	R	Open road, Man Kam To BCP, Man Kam To Animal Inspection Station, Shenzhen River
V5	Planned Muk Wu Nga Yiu Village Zone	R	Open road, Luofang Sewage Treatment Plant, Shenzhen River, Cement Storage Plant
V6	Planned Chow Tin Village Zone	R	Open road, Luofang Sewage Treatment Plant, Shenzhen River
V7	Planned Fung Wong Wu Village Zone	R	Open road, Luofang Sewage Treatment Plant, Shenzhen River
V8	Planned Kan Tau Wai Village Zone	R	Open road, Luofang Sewage Treatment Plant, Shenzhen River
V9	Planned Tong Fong Village Zone	R	Open road, Shenzhen River
V10	Planned Tsung Yuen Ha Village Zone	R	Open road, Planned Liantang-Heung Yuen Wai BCP, Shenzhen River
V11	Planned Ha Heung Yuen Village Zone	R	Open road, NENT Landfill and Extension, Proposed Horse Stable, Shenzhen River
V12	Planned Heung Yuen Wai Village Zone	R	Open road, NENT Landfill and Extension, Proposed Horse Stable

ASR ID	Description	Use ^[1]	Potential Air Pollution Sources ^[2]
V21	Planned Chuk Yuen Village Zone	R	Open road, Planned Liantang-Heung Yuen Wai BCP, Shenzhen River
V13	Planned Lin Ma Hang Village Zone	R	Open road, Shenzhen River
V14	Planned San Kwai Tin Village Zone	R	Open road, Shenzhen River
V15	Planned Tong To Village Zone	R	Open road
V16	Planned San Tsuen Village Zone	R	Open road, Sha Tau Kok STW
V17	Planned Muk Min Tau Village Zone	R	Open road, Sha Tau Kok STW, Sha Tau Kok BCP
V18	Planned Ha Tam Shui Hang Village Zone	R	Open road, Sha Tau Kok STW, Sha Tau Kok BCP
V19	Planned Sheung Tam Shui Hang Village Zone	R	Open road, Sha Tau Kok STW, Sha Tau Kok BCP
V20	Planned Shan Tsui Village Zone	R	Open road, Sha Tau Kok STW, Sha Tau Kok BCP

Note: ^[1] R – residential; E – educational; H – Home for the aged; C – Clinic; W – Place for public worship; GIC – Government / Institution / Community use

^[2] Potential air pollution sources are within 500m from the ASRs

7.1.6 Assessment Methodology

7.1.6.1 Vehicular Emission from Open Road

In accordance with approved EIA reports (e.g. EIA report for Deep Bay Link Investigation and Preliminary Design, Liantang), NO₂ is the key parameter of air pollutants concern for vehicular emissions. If NO₂ complied with the AQO, the other pollutant parameters would also comply. Air quality assessment is therefore based on NO₂ concentration as the representative parameter.

According to the latest implementation programme, the commissioning year of the Road Improvement Work and all proposed developments is assumed to be Year 2020. In term of the traffic flow, the Year 2035 peak hourly traffic represents the maximum flow within 15 years of the commissioning year at Year 2020.

Emissions for all open roads are assessed in accordance with the methodology adopted by the approved EIA report for “Deep Bay Link Investigation and Preliminary Design” (Register No. EIA-078/2002). The Fleet Average Emission Factors for Hong Kong Vehicles corresponding to Euro IV/V standards and China fuel up to Year 2011, are made reference in this assessment, as shown in Table 7.1.13. This is also the same set of emission factors adopted in Liantang/Heung Yuen Wai BCP feasibility study. Given the long-term policy of tightening the vehicular emission standards, it is anticipated that the emission factors will be much smaller at the time the project is in operation (i.e. Year 2020) and then after. Also, with Liantang / Heung Yuen Wai BCP developed to cater for future demand of boundary traffic, the occurrence of traffic congestion situation will be unlikely. The emission factors adopted for the assessment of open road emission is therefore conservative for impact evaluation at this planning stage. When more design information becomes available at the next phase of the Closed Area study, the emission factors generated by Emfac-HK model should be adopted.

Table 7.1.13 Year 2011 emission factors of different vehicle categories (Sourced from Liantang/ Heung Yuen Wai BCP feasibility study)

Vehicle Type	Yr 2011 Emission Factors (g/km-veh)						
	P/C	Taxi	PLB	LGV ^[1]	HGV ^[1]	NFB ^[1]	FBDD/FBSD
NO _x	0.54	0.49	1.1	1.1	4.1	5.93	6.15

Note: P/C, Taxi, PLB, LGV, HGV, NFB, FBDD and FBSD denote private car, taxi, public light bus, light goods vehicle, heavy goods vehicle, non-franchised bus, franchised bus (double deck) and franchised bus (single deck) respectively.

^[1] Correction factor of crossing-boundary vehicle has been taken into account.

For worst-case assessment, the highest volume flow Year 2035 traffic data and Year 2011 emission factors are assumed.

The USEPA approved line source air dispersion model, CALINE4 developed by the California Department of Transport is used to assess vehicular emissions impact from existing and planned road network. In view of the limitation of the CALINE4 model in modelling elevated roads higher than 10m, the road heights of elevated road sections are set to 10m maximum in the CALINE4 model as the worst-case assumption. Modelling parameters adopted for the worst-case conditions were determined according to EPD’s “Guidelines on Choice of Models and Model Parameters “ as follows:

- Wind speed : 1 m/s
- Wind direction : worst angle
- Stability : F class
- Surface Roughness : 100cm (Eastern portion) ; 50cm (Western and Middle portions)
- Standard deviation : 5.5° (Eastern portion) ; 4.8° (Western and Middle portions)
- Mixing height : 500m
- Temperature : 25 °C

In determining the surface roughness, due consideration is given to the number of existing mid-rise and high-rise buildings sited within 1km study area in both Sha Tau Kok Area and the Mainland side for the eastern portion. A surface roughness of 100cm is therefore considered appropriate. The western and middle portions of the Closed Area have village houses and low-rise buildings generally found on both Hong Kong and Mainland side. A corresponding surface roughness of 50cm is therefore assumed.

Background concentrations are made reference to the recent 5-year mean (2003 – 2007) of the annual average NO₂ concentrations at Yuen Long AQMS for western portion and Tai Po AQMS for middle and eastern portions.

The Ozone Limiting Method (OLM) has been adopted for conversion of NO_x to NO₂. A tailpipe emission NO₂/NO_x ratio of 7.5% based on the EPD’s “Guidelines on Choice of Models and Model Parameters” is assumed. The recent 5-year (2003 – 2007) annual average of daily hourly maximum ozone concentrations recorded at Yuen Long AQMS and Tai Po AQMS of 78.3 and 80.2 µg/m³ are respectively adopted in OLM calculations.

In addition, with reference to the Screening Procedures for Estimating the Air Quality Impact of Stationary Source (EPA-454/R-92-019), a conversion factor of 0.4 is used to convert the 1-hour average concentrations to 24-hour average concentrations.

7.1.6.2 Vehicular Emission from Idling Vehicles at BCPs

In determining the emission factors from idling engines in the kiosks and loading/unloading bay, the same established methodology in the Feasibility Study for the Liantang/Heung Yuen Wai BCP has been adopted. The calculation follows the methodology of PIARC 2004 paper on road tunnels: Vehicle Emission and Air Demand for Ventilation which takes account of the latest implementation programme of vehicle emission standard, vehicle age distribution and technology fraction of different engine types.

For conservative analysis, it is assumed that buses and coaches have the same idling emission factors as heavy good vehicles. A more conservative idling emission factor of 0.2 g/min as given in the Consultation Paper - A Proposal to Ban Idling Vehicles with Running Engines is assumed for private car. **Table 7.1.14** summarizes the idling emission factors adopted for different vehicle types in the assessment year of 2035.

Table 7.1.14 NO_x emission factors of various types of vehicles

Vehicle Type	Idling Emission Factor of NO _x (g/min-veh)
Passenger Car	0.2

Vehicle Type	Idling Emission Factor of NO _x (g/min-veh)
Goods vehicle	1.024
Container Truck	1.024
Bus / Coach	1.024

Based on the proposed landuse framework, Lok Ma Chau (**Figure 7.1.1**), Man Kam To (**Figure 7.1.3**), Sha Tau Kok (**Figure 7.1.6**) and the planned Liantang / Heung Yuen Wai BCPs (**Figure 7.1.4**) will be located within 500m of the future sensitive uses of the proposed development areas. Each vehicle crossing the kiosks will be idling for an average of 40 seconds. Bus and coach idling will occur at the loading / unloading (L/UL) bays. According to a recent traffic survey, the idling time period is 4 minutes for unloading and 5 minutes for loading at the L/UL bays of Man Kam To and Sha Tau Kok BCPs. For the planned Liantang / Heung Yun Wai BCP and existing Lok Ma Chau BCP (where no traffic survey has been conducted), the design parameters of 4 minutes for unloading and 15 minutes for loading will be assumed as conservative estimates for this study.

Similar to the methodology of vehicular emission from open road, the potential air quality impact due to idling emissions at BCPs was assessed by the EPD's approved model, CALINE4. Emissions from the kiosks as well as at the loading/unloading bays were modelled as "parking lot" in the CALINE model.

7.1.6.3 Chimney Emission from the Proposed Crematorium at Sandy Ridge

The latest BPM 12/2 (06) emission concentration limits stipulate requirements for the design of new cremators. There will be 3 cremators in the proposed crematorium at Sandy Ridge. The design and operation parameters will be similar to the Diamond Hill crematorium. Hence, assessment has been made reference to the approved EIA Study "*Re-provisioning of Diamond Hill Crematorium*" (EIA-092/2003). Its adoption in this assessment is more conservative than that stipulated in BPM 12/2 (06). Details are given as follows:

Table 7.1.15 Assumptions of operation details for the proposed cremators (sourced from EIA-092/2003)

Description	Details
Maximum capacity of cremators	3 x 250 kg
Design exit temperature of flue gas emission to atmosphere	Minimum 120°C (design exit temperature after passing through air pollution control system)
Design efflux velocity	15 m/s (minimum requirement in BPM 12/2 (06))
Stack design	3 nos, each with diameter: 0.30m Height: 28.5m above local ground
Fuel usage	Light diesel

Table 7.1.16 Emission rate of pollutants (Sourced from the approved EIA study "Re-provisioning of Diamond Hill Crematorium" (EIA-092/2003))

Pollutant	Emission Rate (g/s)
Particulates (regarded as 100% RSP)	0.06439
Hydrogen chloride	0.06439
Carbon monoxide	0.06439
TOC	0.01288
SO ₂	0.1159
NO ₂	0.04894
Mercury	0.0001288
Dioxins	0.6439 x 10 ⁻⁹
Odour	261.6 ^[1]

Note: ^[1] Odour emission rate in unit of OU/s.

The potential air quality impacts are assessed by the USEPA approved dispersion model, ISCST3. Hourly meteorological data recorded at Ta Kwu Ling monitoring station in 2007 has been adopted. **Table 7.1.17** presents the modelling parameters.

Table 7.1.17 Modelling parameters

Input Item	Details
Meteorological Data	Hourly meteorological data recorded at Ta Kwu Ling Monitoring Station in 2007
Modelling Mode	Rural without terrain effect
Background Concentration	5-year annual averaged value recorded at Tai Po Air Quality Monitoring Station
Operating hours	0900-1900
ASR assessment height [1]	1.5m, 5m and 10m above ground

Note:

[1] The buildings are in general 3 storeys high and hence assessments heights are up to 10m above ground.

The odour impact from the proposed crematorium is assessed by ISCST3 model at different stability classes of the meteorological data, namely A & B, C, D, and E & F. The model hourly odour concentrations were converted to 5-second average odour concentration by the methodology proposed by Duffee et al. and Keddie. In addition, Turner has identified that the Pasquill-Gifford vertical dispersion parameters used in the ISC3 model is around 3 to 10 minutes. As a conservation assumption, the hourly average estimated by ISCST3 model is assumed as 15 minutes, and the conversion factors adopted for 15-minute to 3-minute average and 3-minute to 5-second average of the different stability classes were shown in **Table 7.1.18**.

Table 7.1.18 Conversion factors for odour

Stability Class	Conversion factor for 15-min to 3-min average	Conversion factor for 3-min to 5-sec average	Overall Conversion factor for 15-min to 5-sec average
A,B	2.23	10	22.3
C	1.70	5	8.5
D	1.38	5	6.9
E,F	1.31	5	6.55

7.1.6.4 Fugitive Emission from the Existing Cement Storage Plant

According to EPD’s record (Environmental Compliance Division, Regional Office (North)) and their site verification, it was advised that there is no cement work on site and the plant is used for storage only. It is not regarded as a Specified Process under the APCO. Further information on the plant is not available. The potential cumulative air quality impacts due to the cement storage plant have been reviewed and addressed in qualitative manner in **Section 7.1.7.3**.

7.1.6.5 Odour Emissions

According HKPSG, a buffer distance of at least 200m from the site boundary is recommended for small scale community uses such as crematoria, abattoirs, livestock yards, stock wagon washing areas and wholesale fish and poultry markets, where appropriate. For other odorous sources not stipulated in the HKPSG, e.g. Sha Ling Livestock Waste Composting Plant, sewage treatment plants, landfill site and proposed horse stable of the proposed horse riding school, qualitative assessment has been made reference to the available and relevant environmental impact assessment reports and mitigation measures have been recommended where necessary.

7.1.6.6 Potential Emission Sources from BCPs and Open Road in Shenzhen

Information on the BCPs and open roads in Shenzhen is not available. The potential cumulative air quality impacts due to these sources are reviewed and addressed in qualitative manner in **Section 7.1.7.4**.

7.1.7 Prediction and Evaluation of Environmental Impacts

7.1.7.1 Vehicular Emission

The maximum concentrations of NO₂ at representative ASRs are predicted. The following **Table 7.1.19**, **Table 7.1.20** and **Table 7.1.21** summarise the cumulative NO₂ impacts due to the emissions from open roads, BCPs, planned NENT NDA and Liantang / Heung Yuen Wai BCP projects, taking into account the background concentration in the Western, Middle, and Eastern portions respectively.

Table 7.1.19 Predicted cumulative 1-hour and 24-hour concentration of NO₂ in western portion of Closed Area (with background concentration of 59.6 µg/m³)

ASR_ID	Description	1-hour Concentration (µg/m ³) at Various Assessment Height			24-hour Concentration (µg /m ³) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 300			Criteria = 150		
Existing ASRs							
A1	Lin Barn Tsuen	154.7	154.5	153.7	97.6	97.5	97.2
A2	Tung Chan Wai	192.6	190.2	185.2	112.8	111.8	109.8
A3	Mai Po Lo Wai	181.0	179.9	177.5	108.2	107.7	106.8
A4	Village House along Castle Peak Road	174.5	171.5	168.3	105.6	104.4	103.1
A5	Ha Wan Tsuen	218.3	213.7	200.4	123.1	121.2	115.9
A6	Village House along Ha Wan Tsuen Road	204.3	199.7	187.3	117.5	115.7	110.7
A7	Village House along Lok Ma Chau Road	222.2	215.3	196.5	124.6	121.9	114.3
A8	Lok Ma Chau Fishermen New Village	196.3	192.4	181.1	114.3	112.7	108.2
A9	Pun Uk Tsuen	196.3	193.1	183.9	114.3	113.0	109.3
A10	Ting Tsz School	176.0	174.8	171.2	106.2	105.7	104.2
A11	Lok Ma Chau Village	181.3	179.3	173.4	108.3	107.5	105.1
A12	Village House to the South of Lok Ma Chau Loop	159.8	158.9	157.8	99.7	99.3	98.9
A13	Lok Ma Chau Operation Base (Office)	152.5	152.2	151.5	96.8	96.7	96.4
A14	Village House at North of Shun Yee San Tsuen	150.6	150.1	149.3	96.0	95.8	95.5
A15	Village House to the West of Shun Yee San Tsuen	149.3	149.1	149.2	95.5	95.4	95.5
A16	Shun Yee San Tsuen	151.6	151.3	150.9	96.4	96.3	96.1
A17	Ma Tso Lung San Tsuen	154.5	154.5	154.4	97.6	97.6	97.5
A18	Village House to the West of Fong Kong Shan	159.3	159.2	159.1	99.5	99.4	99.4
A19	Ma Tso Lung Police Post	149.3	149.2	149.1	95.5	95.5	95.4
A20	Liu Pok	151.6	151.2	150.5	96.4	96.2	96.0
A21	Village House near Sheung Ma Lei Yue	151.7	150.8	150.6	96.4	96.1	96.0
A22	Tak Yuet Lau	152.5	151.7	151.4	96.8	96.5	96.3
A23	Village House near Ngam Bin	156.8	156.5	156.3	98.5	98.4	98.3
A24	Pai Tau Lo	158.1	157.9	157.7	99.0	98.9	98.8
A25	Lo Wu Saddle Club	159.0	158.9	158.8	99.4	99.3	99.3
A102	Lo Wu Correctional Institution	161.0	160.9	160.6	100.1	100.1	100.0
A103	Lo Wu Camp Football Field	162.9	162.9	162.7	100.9	100.9	100.8
Planned Air Sensitive Landuse							
P1	Eco-Lodge	152.1	151.9	151.1	96.6	96.5	96.2
P2	ex-Lung Kai Public School	153.7	153.6	153.5	97.2	97.2	97.2

ASR_ID	Description	1-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height			24-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 300			Criteria = 150		
Village Zones							
V1	Planned Lok Ma Chau Village Zone	180.6	179.1	174.7	108.0	107.4	105.7
V2	Planned Liu Pok Village Zone	150.8	150.7	150.5	96.1	96.0	95.9

Table 7.1.20 Predicted cumulative 1-hour and 24-hour concentration of NO₂ in middle portion of Closed Area (with background concentration of 52.8 $\mu\text{g}/\text{m}^3$)

ASR_ID	Description	1-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height			24-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 300			Criteria = 150		
Existing ASRs							
A26	Lo Wu Station Staff Quarters	147.9	147.9	147.8	93.4	93.1	92.4
A27	Lo Wu Tsuen	154.2	153.6	151.9	93.4	93.1	92.4
A28	Village House along Lo Wu Station Road	161.9	161.5	160.4	96.4	96.3	95.8
A29	Village House along Man Kam To Road (Southern Section)	195.8	192.3	183.1	110.0	108.6	104.9
A30	Village House at junction between Kong Nga Po Road and Man Kam To Road	180.2	179.3	176.5	103.8	103.4	102.3
A31	Hung Kiu San Tsuen	192.1	189.9	184.3	108.5	107.6	105.4
A33	Village House in Sha Ling (West of Man Kam To Road)	197.6	193.3	184.6	110.7	109.0	105.5
A35	Lo Wu Public School	147.5	147.4	147.1	90.7	90.6	90.5
A38	Village House in Sha Ling (East of Man Kam To Road)	164.3	164.0	162.9	97.4	97.3	96.8
A39	Village House near Sha Ling Livestock Waste Composting Plant	173.1	172.6	170.9	100.9	100.7	100.1
A40	Temple near Sha Ling Livestock Waste Composting Plant	172.1	171.3	168.8	100.5	100.2	99.2
A41	Village House to the South of Man Kam To VHA	224.6	211.7	195.1	121.5	116.4	109.7
A42	Village House along Sha Ling Road	147.3	147.1	146.8	90.6	90.5	90.4
A44	Village House to the West of Man Kam To VHA	161.1	158.4	147.9	96.1	95.1	90.8
A45	San Uk Ling Village	208.6	206.0	198.5	115.1	114.1	111.1
A46	Village House next to San Uk Ling	161.7	161.5	160.7	96.4	96.3	96.0
A47	Village House along to the East of Man Kam To VHA	173.6	173.0	171.2	101.1	100.9	100.2
A48	Muk Wu Village	154.5	153.8	151.9	93.5	93.2	92.4
A49	Village House next to Muk Wu Village Zone	164.9	164.6	163.6	97.6	97.5	97.1
A50	Muk Wu Nga Yiu Village	164.3	163.9	162.7	97.4	97.3	96.8
A52	Village House to the North of Lo Shue Ling	160.7	154.9	151.0	96.0	93.6	92.1
A53	Village House near Chow Tin Tsuen	149.1	149.0	148.9	91.3	91.3	91.2
A54	Chow Tin Tsuen	148.0	148.0	147.8	90.9	90.9	90.8

ASR_ID	Description	1-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height			24-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 300			Criteria = 150		
A55	Fung Wong Wu	147.4	147.3	147.2	90.6	90.6	90.6
A56	Ta Kwu Ling Village	168.1	158.4	150.5	98.9	95.1	91.9
A57	Village House along Kong Nga Po Road	157.0	156.8	156.2	94.5	94.4	94.2
A61	Village House near Hung Lung Hang	155.1	154.9	154.4	93.7	93.6	93.4
A64	Village House along access road to Hung Lung Hang	151.8	151.7	151.4	92.4	92.4	92.2
A65	Lei Uk Village	148.3	148.2	148.1	91.0	91.0	90.9
A66	Ta Kwu Ling Farm	156.5	154.4	151.0	94.3	93.4	92.1
A67	Wun Chuen Sin Koon	152.0	150.9	148.4	92.5	92.0	91.1
A68	Village House next to Sing Ping Village	161.7	159.8	154.8	96.4	95.6	93.6
A70	Sing Ping Village	159.6	156.0	148.7	95.5	94.1	91.2
A71	Caritas Fung Wong Fung Ting Home (Home for aged)	155.4	154.8	153.4	93.8	93.6	93.0
A72	Village House near Tong Fong	150.1	149.9	149.2	91.7	91.6	91.4
A73	Tong Fong Village	151.8	150.1	148.7	92.4	91.7	91.1
A74	Kan Tau Wai	154.7	153.0	149.5	93.5	92.9	91.5
A75	Village House next to Ta Kwu Ling Village	178.9	165.9	156.1	103.3	98.0	94.1
A76	Kaw Liu Village	152.6	152.1	151.0	92.7	92.5	92.1
A77	Village House along access road to NENT Landfill	169.4	169.2	167.4	99.5	99.4	98.6
A78	Tsung Yuen Ha Village	148.4	148.3	148.0	91.0	91.0	90.9
A79	Village House at SW of Pak Fu Shan	164.0	151.1	147.0	97.3	92.1	90.5
A80	Ha Heung Yuen	147.3	147.3	147.0	90.6	90.6	90.5
A81	Heung Yuen Wai	148.1	147.0	146.5	90.9	90.5	90.3
A82	Village House to the South of Pak Fu Shan	158.1	157.6	156.1	94.9	94.7	94.1
A83	Village House to the North of Pak Fu Shan	151.1	150.9	150.2	92.1	92.0	91.8
A84	Village House to the East of Pak Fu Shan	155.0	154.6	153.2	93.7	93.5	93.0
A85	Village House along Lin Ma Hang Road near Wang Lek	164.7	160.2	152.7	97.6	95.8	92.8
Planned Air Sensitive Landuses							
P3	Man Kam To Development Corridor	193.3	190.3	184.0	109.0	107.8	105.3
P4	Kong Nga Po Comprehensive Development Area	171.6	166.1	159.6	100.3	98.1	95.5
P5	Hung Lung Hang Residential Area	155.7	153.1	150.9	94.0	92.9	92.1
P6	ex-Sam Wu Public School	169.5	169.1	167.8	99.5	99.3	98.8
P7	Planned Recreational Area near Pak Fu Shan	165.3	161.4	160.1	97.8	96.2	95.7
P12	Planned Recreational Area near Fung Wong Wu	187.3	188.2	187.3	106.6	107.0	106.6
Village Zones							
V3	Planned San Uk Ling Village Zone	181.2	180.4	178.4	104.2	103.8	103.0

ASR_ID	Description	1-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height			24-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 300			Criteria = 150		
V4	Planned Muk Wu Village Zone	151.5	151.3	150.6	92.3	92.2	91.9
V5	Planned Muk Wu Nga Yiu Village Zone	162.3	162.1	161.2	96.6	96.5	96.2
V6	Planned Chow Tin Village Zone	147.8	147.8	147.7	90.8	90.8	90.7
V7	Planned Fung Wong Wu Village Zone	148.1	147.8	147.2	90.9	90.8	90.6
V8	Planned Kan Tau Wai Village Zone	157.2	152.1	149.9	94.6	92.5	91.6
V9	Planned Tong Fong Village Zone	163.7	156.1	148.9	97.1	94.1	91.2
V10	Planned Tsung Yuen Ha Village Zone	154.6	154.4	153.4	93.5	93.4	93.0
V11	Planned Ha Heung Yuen Village Zone	147.4	147.4	147.1	90.7	90.6	90.5
V12	Planned Heung Yuen Wai Village Zone	147.6	147.0	146.7	90.7	90.5	90.4
V21	Planned Chuk Yuen Village Zone	154.4	154.2	153.4	93.5	93.4	93.0

Table 7.1.21 Predicted cumulative 1-hour and 24-hour concentrations of NO₂ in eastern portion of Closed Area (with background concentration of 52.8 $\mu\text{g}/\text{m}^3$)

ASR_ID	Description	1-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height			24-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 300			Criteria = 150		
Existing ASRs							
A87	Lin Ma Hang Village	138.9	138.8	138.7	87.2	87.2	87.2
A88	Village House near Tong To Ping Tsuen	157.5	157.2	156.1	94.7	94.5	94.1
A89	Tong To Ping Tsuen	137.2	137.1	136.1	86.5	86.5	86.1
A90	Tong To Village	136.7	136.6	136.4	86.3	86.3	86.2
A91	Nga Yiu Tau	158.0	157.5	155.9	94.9	94.7	94.0
A92	San Tsuen	163.1	162.1	159.9	96.9	96.5	95.6
A93	Muk Min Tau	151.9	151.4	150.0	92.5	92.2	91.7
A94	Ha Tam Shui Hang Village	153.7	153.3	152.3	93.2	93.0	92.6
A95	Sheung Tam Shui Hang Village	146.6	144.8	142.6	90.3	89.6	88.7
A96	Green Castle	156.8	154.3	148.0	94.4	93.4	90.9
A97	Shan Tsui Village	156.4	153.7	146.6	94.3	93.2	90.3
A98	Shan Tsui Public School	215.1	201.6	177.5	117.7	112.3	102.7
A99	Kong Ha	233.3	198.6	155.7	125.0	111.1	93.9
A100	Sha Tau Kok Public School	170.7	165.6	153.4	99.9	97.9	93.0
A101	Sha Tau Kok Chuen	175.3	171.7	157.2	101.8	100.4	94.6
A87	Lin Ma Hang Village	138.9	138.8	138.7	87.2	87.2	87.2
A88	Village House near Tong To Ping Tsuen	157.5	157.2	156.1	94.7	94.5	94.1
A89	Tong To Ping Tsuen	137.2	137.1	136.1	86.5	86.5	86.1
A90	Tong To Village	136.7	136.6	136.4	86.3	86.3	86.2
A91	Nga Yiu Tau	158.0	157.5	155.9	94.9	94.7	94.0
A92	San Tsuen	163.1	162.1	159.9	96.9	96.5	95.6

ASR_ID	Description	1-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height			24-hour Concentration ($\mu\text{g}/\text{m}^3$) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 300			Criteria = 150		
A93	Muk Min Tau	151.9	151.4	150.0	92.5	92.2	91.7
A94	Ha Tam Shui Hang Village	153.7	153.3	152.3	93.2	93.0	92.6
A95	Sheung Tam Shui Hang Village	146.6	144.8	142.6	90.3	89.6	88.7
A96	Green Castle	156.8	154.3	148.0	94.4	93.4	90.9
A97	Shan Tsui Village	156.4	153.7	146.6	94.3	93.2	90.3
A98	Shan Tsui Public School	215.1	201.6	177.5	117.7	112.3	102.7
A99	Kong Ha	233.3	198.6	155.7	125.0	111.1	93.9
A100	Sha Tau Kok Public School	170.7	165.6	153.4	99.9	97.9	93.0
A101	Sha Tau Kok Chuen	175.3	171.7	157.2	101.8	100.4	94.6
Planned Air Sensitive Landuse							
P8	ex-King Sau Public School	138.8	138.6	138.4	87.2	87.1	87.0
P9	ex-Kwan Ah Public School	145.7	144.9	142.6	89.9	89.6	88.7
P11	Planned Recreational Area near Tong To Ping Tsuen	136.1	136.1	136.1	86.1	86.1	86.1
Village Zones							
V13	Planned Lin Ma Hang Village Zone	148.0	147.3	145.2	90.9	90.6	89.8
V14	Planned San Kwai Tin Village Zone	154.5	152.2	147.6	93.5	92.5	90.7
V15	Planned Tong To Village Zone	137.7	137.6	137.3	86.7	86.7	86.6
V16	Planned San Tsuen Village Zone	186.5	182.1	173.0	106.3	104.5	100.9
V17	Planned Muk Min Tau Village Zone	144.5	144.3	143.7	89.5	89.4	89.2
V18	Planned Ha Tam Shui Hang Village Zone	158.9	157.2	155.5	95.3	94.6	93.9
V19	Planned Sheung Tam Shui Hang Village Zone	152.9	150.5	145.7	92.8	91.9	89.9
V20	Planned Shan Tsui Village Zone	221.6	192.7	156.8	120.3	108.8	94.4

The assessment results indicate that the 1-hour and 24-hour NO₂ concentrations at all the identified ASRs are below the respective criteria of 300 and 150 $\mu\text{g}/\text{m}^3$. Contours of 1-hour and 24-hour NO₂ concentrations are presented in **Appendix F** for the proposed development areas of air quality concerns, including the area adjacent to Man Kam To Road and Man Kam To BCP, area adjacent to Lin Ma Hang Road and the planned Liantang/Heung Yuen Wai BCP, as well as the area adjacent to Sha Tau Kok Road and the Sha Tau Kok BCP. They all comply with the respective AQOs. It should be noted that Lok Ma Chau village zone (V1; **Figure 7.1.1**) is not a proposed landuse, but only reflects the existing zoning of the statutory OZP S/YL-ST/8 - San Tin. However, contours of 1-hour and 24-hour NO₂ concentrations are also plotted to cover this area.

7.1.7.2 Chimneys Emission from Proposed Crematorium

With reference to the approved EIA Study “*Re-provisioning of Diamond Hill Crematorium*” (EIA-092/2003), the maximum concentrations of odour, NO₂, SO₂, RSP, CO, HCL, Mercury, TOC and dioxins are predicted at the identified ASRs located within 500m from the crematorium. They include A27, A28, A33, A35 and A42 (**Figure 7.1.3**). No planned sensitive uses are within the 500m zone. Assessment results are shown in the following **Tables 7.1.22 – 7.1.31**. For NO₂, the overall predicted concentrations have included the cumulative contribution from vehicular emission.

Table 7.1.22 Predicted 5-second average odour concentration

ASR ID	Location	5-second Odour Concentration (OU) at Various Assessment Height		
		1.5m	5.0m	10.0m
		Criterion = 5		
A27	Lo Wu Tsuen	0.7	0.7	0.7
A28	Village House along Lo Wu Station Road	0.6	0.6	0.6
A33	Village House in Sha Ling (West of Man Kam To Road)	0.7	0.7	0.7
A35	Lo Wu Public School	0.8	0.8	0.8
A42	Village House along Sha Ling Road	0.4	0.4	0.4

Table 7.1.23 Predicted 1-hour NO₂ concentration (with background of 52.8 µg/m³)

ASR_ID	Description	1-hour Concentration (µg/m ³) at Various Assessment Height			Overall 1-hour ^[1] Concentration (µg/m ³) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 300			Criteria = 300		
A27	Lo Wu Tsuen	58.8	58.8	58.7	160.2	159.6	157.8
A28	Village House along Lo Wu Station Road	57.9	58.2	58.8	167.0	166.9	166.4
A33	Village House in Sha Ling (West of Man Kam To Road)	58.6	58.6	58.6	201.2	197.1	188.7
A35	Lo Wu Public School	59.4	59.4	59.5	154.1	154.0	153.7
A42	Village House along Sha Ling Road	57.6	57.6	58.1	152.0	152.0	151.8

Note: ^[1] Contribution of vehicular emission included.

Table 7.1.24 Predicted 24-hour NO₂ concentration (with background of 52.8 µg/m³)

ASR_ID	Description	24-hour Concentration (µg/m ³) at Various Assessment Height			Overall 24-hour ^[1] Concentration (µg/m ³) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 150			Criteria = 150		
A27	Lo Wu Tsuen	53.5	53.5	53.5	94.1	93.8	93.1
A28	Village House along Lo Wu Station Road	53.6	53.6	53.6	97.2	97.1	96.6
A33	Village House in Sha Ling (West of Man Kam To Road)	53.6	53.6	53.6	111.1	109.4	106.0
A35	Lo Wu Public School	53.6	53.6	53.6	91.5	91.5	91.4
A42	Village House along Sha Ling Road	53.5	53.5	53.5	91.1	91.1	91.0

Note: ^[1] Contribution of vehicular emission included.

Table 7.1.25 Predicted 1-hour and 24-hour SO₂ concentration (with background of 17 µg/m³)

ASR_ID	Description	1-hour Concentration (µg/m ³) at Various Assessment Height			24-hour Concentration (µg/m ³) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 800			Criteria = 350		
A27	Lo Wu Tsuen	31.1	31.1	31.1	18.6	18.6	18.7
A28	Village House along Lo Wu Station Road	29.2	29.7	31.3	18.9	18.9	19.0
A33	Village House in Sha Ling (West of Man Kam To Road)	30.6	30.6	30.7	18.9	18.9	19.0
A35	Lo Wu Public School	32.7	32.7	32.8	18.9	19.0	19.0

ASR_ID	Description	1-hour Concentration (µg/m³) at Various Assessment Height			24-hour Concentration (µg/m³) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 800			Criteria = 350		
A42	Village House along Sha Ling Road	28.3	28.4	29.5	18.7	18.7	18.8

Table 7.1.26 Predicted 24-hour RSP concentration (with background of 52.3 µg/m³)

ASR_ID	Location	24-hour Concentration (µg/m³) at Various Assessment Height		
		1.5m	5.0m	10.0m
		Criterion = 180		
A27	Lo Wu Tsuen	53.2	53.2	53.2
A28	Village House along Lo Wu Station Road	53.4	53.4	53.4
A33	Village House in Sha Ling (West of Man Kam To Road)	53.4	53.4	53.4
A35	Lo Wu Public School	53.4	53.4	53.4
A42	Village House along Sha Ling Road	53.2	53.2	53.3

Table 7.1.27 Predicted 1-hour and 8-hour CO concentration (with background of 941.3 µg/m³)

ASR_ID	Description	1-hour Concentration (µg/m³) at Various Assessment Height			8-hour Concentration (µg/m³) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 30,000			Criteria = 10,000		
A27	Lo Wu Tsuen	949.2	949.1	949.1	943.9	943.9	943.9
A28	Village House along Lo Wu Station Road	948.1	948.3	949.2	944.2	944.2	944.3
A33	Village House in Sha Ling (West of Man Kam To Road)	948.9	948.9	948.9	944.1	944.1	944.1
A35	Lo Wu Public School	950.0	950.0	950.1	944.4	944.4	944.4
A42	Village House along Sha Ling Road	947.6	947.6	948.2	943.3	943.3	943.3

Table 7.1.28 Predicted 1-hour and Annual HCL concentration

ASR_ID	Description	1-hour Concentration (µg/m³) at Various Assessment Height			Annual Concentration (µg/m³) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 2,100			Criteria = 20		
A27	Lo Wu Tsuen	7.9	7.8	7.8	0.1	0.1	0.1
A28	Village House along Lo Wu Station Road	6.8	7.0	7.9	0.1	0.1	0.1
A33	Village House in Sha Ling (West of Man Kam To Road)	7.6	7.6	7.6	0.1	0.1	0.1
A35	Lo Wu Public School	8.7	8.7	8.8	0.1	0.1	0.1
A42	Village House along Sha Ling Road	6.3	6.3	6.9	0.0	0.0	0.0

Table 7.1.29 Predicted 1-hour and 24-hour TOC concentration

ASR_ID	Description	1-hour Concentration (µg/m ³) at Various Assessment Height			24-hour Concentration (µg/m ³) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = Nil			Criteria = Nil		
A27	Lo Wu Tsuen	1.6	1.6	1.6	0.2	0.2	0.2
A28	Village House along Lo Wu Station Road	1.4	1.4	1.6	0.2	0.2	0.2
A33	Village House in Sha Ling (West of Man Kam To Road)	1.5	1.5	1.5	0.2	0.2	0.2
A35	Lo Wu Public School	1.7	1.7	1.8	0.2	0.2	0.2
A42	Village House along Sha Ling Road	1.3	1.3	1.4	0.2	0.2	0.2

Table 7.1.30 Predicted 1-hour and annual mercury concentration (with background of 0.00023 µg/m³)

ASR_ID	Description	1-hour Concentration (µg/m ³) at Various Assessment Height			Annual Concentration (µg/m ³) at Various Assessment Height		
		1.5m	5.0m	10.0m	1.5m	5.0m	10.0m
		Criteria = 0.6			Criteria = 1.0		
A27	Lo Wu Tsuen	0.0160	0.0160	0.0159	0.0004	0.0004	0.0004
A28	Village House along Lo Wu Station Road	0.0138	0.0143	0.0161	0.0004	0.0004	0.0005
A33	Village House in Sha Ling (West of Man Kam To Road)	0.0154	0.0154	0.0154	0.0003	0.0003	0.0003
A35	Lo Wu Public School	0.0177	0.0177	0.0178	0.0005	0.0005	0.0005
A42	Village House along Sha Ling Road	0.0128	0.0129	0.0141	0.0003	0.0003	0.0003

Table 7.1.31 Predicted annual dioxins concentration (with background of 0.069 pg I-TEQ/m³)

ASR_ID	Location	Annual Concentration (pg I-TEQ/m ³) at Various Assessment Height		
		1.5m	5.0m	10.0m
		Criterion = 1.0		
A27	Lo Wu Tsuen	0.06990	0.06991	0.06995
A28	Village House along Lo Wu Station Road	0.07003	0.07005	0.07012
A33	Village House in Sha Ling (West of Man Kam To Road)	0.06955	0.06955	0.06957
A35	Lo Wu Public School	0.07011	0.07013	0.07019
A42	Village House along Sha Ling Road	0.06939	0.06939	0.06940

Results show that the predicted maximum concentrations of all the air pollutants at the representative ASRs are below the relevant criteria. The overall NO₂ impacts including the vehicular emission are also complied with the relevant criteria. Contours of 1-hour and 24-hour NO₂ concentrations together with contribution of vehicular emission impacts for the concerned area are presented in **Appendix F**.

Notwithstanding, the proposed crematorium is a Designated Project under the EIAO. A statutory environmental impact assessment (EIA) is required to assess and confirm its potential environmental impact and recommended mitigation measures. The assessment result in this report is subject to the future EIA.

7.1.7.3 Fugitive Emission from the Cement Storage Plant

Potential impacts due to fugitive emissions from the existing cement storage plant in Muk Wu Nga Yiu on the sensitive uses of the proposed development areas have been reviewed.

As mentioned in **Section 7.1.6.4**, according to EPD's record (Environmental Compliance Division, Regional Office (North)) and their site verification, it was advised that there is no cement work on site and the plant is used for storage only. It is therefore not regarded as a Specified Process under the APCO. Significant fugitive emission impact is not expected on the existing ASRs at Muk Wu Nga Yiu which is located at about 80m from the plant. Given that the proposed Muk Wu Nga Yiu Village Zone (V5; **Figure 7.1.3**) and the Planned Recreational Area near Fung Wong Wu (P12; **Figure 7.1.3**) are located at much larger separation distances of 100m and 320m respectively from the plant, adverse air quality impact is also not expected. Since the proposed crematorium is located at over 2km to the east of the cement storage plant, the cumulative air quality impacts are also considered insignificant.

7.1.7.4 Potential Cumulative Impact from Shenzhen Side

Potential cumulative impacts due to vehicular and industrial emissions from Shenzhen on the sensitive uses of the proposed development areas have been reviewed.

By the time in 2020, the only potential industrial zones are identified in Liantang Area of Luohu District to the north of Pak Fu Shan (**Figure 7.1.7**) which is also located outside 500m of the planned recreational area. Potential industrial emission impact on the proposed landuse planning framework is not expected. There are existing industrial developments to the north-east of Pak Fu Shan in Liantang located close to the Study Area. However, should the existing industrial developments in Liantang Area not be phased out in future before population intake of the proposed uses in Pak Fu Shan, potential industrial emission impacts cannot be ruled out and shall be tackled by proper mitigation measures in future development to be investigated by the future project proponent.

The major trunk roads are in general at more than ~400-500m away from the future sensitive uses of the proposed development areas, and hence the cumulative vehicular emission impacts are unlikely. There is no available information on the BCPs in Shenzhen. However, the separation distances from the existing BCPs in Huanggang, opposite of Man Kam To and Sha Tau Kok, as well as the planned BCP in Liantang to the nearest planned sensitive areas are about >500m, 380m, 180m and 200m, respectively. It should also be noted that the EIA of Liantang/Heung Yuen Wai BCP is currently being carried out. Detailed assessment of the potential environmental impacts on nearby Tsung Yuen Ha village zone (V10; **Figure 7.1.4**) shall be conducted taking into account the latest BCP layout and design to ensure full compliance of EIAO requirements.

Notwithstanding the above, the air quality in Mainland is also controlled by the National Ambient Air Quality Standard (GB3095-1996) which stipulates the ambient air quality standard for three grades of functional zones, including:

- 1) Grade I – Nature reserves, scenic spots and other areas requiring special protection;
- 2) Grade II – Residential areas, commercial, mixed transportation and residential areas, cultural areas, and general industrial areas as specified in urban planning and rural areas;
- 3) Grade III – Specific industrial zones

The concentration limits of air pollutants in **Table 7.1.32** shall not be exceeded:

Table 7.1.32 Concentration limits for air pollutants

Pollutant	Averaging Time	Concentration limit ($\mu\text{g}/\text{m}^3$)		
		Grade I	Grade II	Grade III
SO ₂	Annual	20	60	100
	Daily	50	150	250
	Hourly	150	500	700

Pollutant	Averaging Time	Concentration limit ($\mu\text{g}/\text{m}^3$)		
		Grade I	Grade II	Grade III
TSP	Annual	80	200	300
	Daily	120	300	500
PM ₁₀ (regarded as 100% RSP)	Annual	40	100	150
	Daily	50	150	250
NO _x	Annual	50	50	100
	Daily	100	100	150
	Hourly	150	150	300
NO ₂	Annual	40	40	80
	Daily	80	80	120
	Hourly	120	120	240
CO	Daily	4000	4000	6000
	Hourly	10000	10000	20000
O ₃	Hourly	120	160	200
Pb	Quarterly	1.5		
	Annual	1		

According to the Draft Comprehensive Planning of Shenzhen City (2007-2020), the planned land use of Shenzhen within 500m from the study boundary comprises mainly residential, commercial, government and community uses. Thus, Grade II ambient air quality standards are applicable to Shenzhen, of which the NO₂ annual average limit is comparable with the background concentration currently assumed in the Closed Area (52.8 $\mu\text{g}/\text{m}^3$ for eastern portion and 59.6 $\mu\text{g}/\text{m}^3$ for western portion). The 1 hour NO₂ criterion of 120 $\mu\text{g}/\text{m}^3$ is also very stringent which shall be met at the existing receivers in Shenzhen. In consideration of large separation distance from these emission sources to the future sensitive uses of the proposed development areas and the stringent NAAQS imposed in Shenzhen, the pollutant concentration will be dispersed and further diluted.

In addition, based on the modelling results, the maximum predicted 1-hour concentrations for NO₂ at the receivers closest to the Sha Tau Kok and Liantang / Heung Yuen Wai BCPs (Shenzhen side) are only 154.6 $\mu\text{g}/\text{m}^3$ (at Tsung Yuen Ha Village), 165.3 $\mu\text{g}/\text{m}^3$ (at Pak Fu Shan recreational area) and 221.6 $\mu\text{g}/\text{m}^3$ (at Shan Tsui village). They are well within the AQO (51-74% only) and still have a large margin to the limit. Notwithstanding this, for any future development uses requiring planning approval from TPB in future, detailed assessment shall be carried out by the respective project proponent to confirm there are no cumulative air quality impacts on the proposed sensitive uses taking into consideration the potential contribution from BCPs on Shenzhen side.

7.1.7.5 Odour Emissions

Potential impacts of various odour emission sources on the existing, planned and proposed sensitive uses in the vicinity of the Closed Area are discussed in the following:

(1) NENT Landfill and its Extension

An extension of the existing NENT Landfill is planned in place for solid waste disposal after the existing NENT Landfills (**Figure 7.1.4 & 7.1.5**) reaches its capacity by mid-2010s in order to meet the waste disposal needs of Hong Kong until 2020 or beyond. The proposed NENT Extension is about 63 ha in size with an estimated waste capacity of 21.4 Mm³. The NENT Landfill Extension is forecasted to operate for about 10 to 12 years.

With reference to the approved EIA study for NENT Landfill Extension (EIA-133/2007), the worst-case cumulative odour impact scenario would likely occur when an active tipping area of about 1200 m² within the NENT Extension is in operation. During this period, the existing NENT Landfill would be fully capped with impermeable material, and other inactive tipping area of the NENT Landfill Extension would be covered up with plastic sheet and controlled

by extraction system. All the existing and future leachate treatment plants would also be in operation.

The EIA Study has identified that the ASR would be worst affected during the operation of northern tipping area. The predicted odour concentration is 1.1 odour unit at the existing Ha Heung Yuen and 1.7 odour unit at the existing Lin Ma Hang (at 900m from the northern tipping area), both complying with the respective odour criterion. For the future village expansion zones in Ha Heung Yuen (V11; **Figure 7.1.4**) and Heung Yuen Wai (V12; **Figure 7.1.4**), and the Planned Recreational area near Pak Fu Shan (P7; **Figure 7.1.4**) which are at more than 1200m away from the northern tipping area, the only major odour emission source within 500m study area by the time the project commissions in Year 2020 and thereafter would be the existing leachate treatment plant at 340m, 410m, and 500m respectively. Drawing on from the findings of the NENT Extension EIA study, odour impact at the designated Ha Heung Yuen village zone (V11) and Heung Yuen Wai village zone (V12), and the Planned Recreational area near Pak Fu Shan (P7) of further distance away than the existing villages at Lin Ma Hang from NENT Extension is not anticipated.

(2) Man Kam To Animal Inspection Station

Live food animals are imported to Hong Kong by vehicles via Man Kam To BCP. They are temporarily stored at the Man Kam To Animal Inspection Station (**Figure 7.1.3**). All the proposed landuses at ex-Sam Wu Public School (P6; **Figure 7.1.3**) and Muk Wu village zone (V4; **Figure 7.1.3**) have satisfied the HKPSG's recommended buffer distance of 200m for small scale odour source.

The San Uk Ling Village Zone (V3; **Figure 7.1.3**) is located at about 35m from Man Kam To Animal Inspection Station. There are also existing village houses located at similar distance. It should be noted that the San Uk Ling Village Zone is not a proposed landuse. The village zone only reflects the existing zoning, i.e. Village Type Development (V) of the statutory OZP S/NE-FTA/10 Fu Tei Au & Sha Ling for which the houses (New Territories Exempted House only) are always permitted under Column I. The explanatory statement in OZP S/NE-FTA/10 has only highlighted the potential traffic noise impact generated by the cross-boundary traffic along Man Kam To Road. The odour impact due to the Man Kam To Animal Inspection Station was not mentioned to be a concern in the OZP S/NE-FTA/10.

(3) Sheung Shui Slaughter House

Sheung Shui Slaughter House (SSSH) is located at about 300m to the south of study boundary in Sheung Shui (**Figure 7.1.2**). It is designed to be a centralized and environmental-friendly facility. The site covers an area of about 58,600m² and comprises several functional blocks. It can accommodate 12,000 pigs, 2,200 cattle and 300 goats, and the designed daily production throughput is 5,000 pigs, 200 cattle and 300 goats.

Major sources of odour emission are originated from the lairage, slaughter block, by-product plant, wastewater treatment plant, and livestock unloading area. With reference to the "Supplementary EIA Study for Sheung Shui Slaughter House" (EIA-069/BC) and the case study conducted by Hong Kong University (http://www.hku.hk/mech/sbe/case_study/case/hk/sheungsh/sheungsh.html), it is stipulated that odour control technologies have been incorporated in order to minimize the odour concentration to acceptable level. These technologies include wet scrubbers, ozone systems and neutralizing agent systems. In particular, water hose points are also provided for floor cleansing of the lairages and external unloading area to reduce odour. Lorry washing bay is provided for lorries before leaving the slaughterhouse. Enclosed design in forms of collection skips and containers is given to minimize odour during transportation of odorous waste. With provision of these control measures, an overall odour removal efficiency of 99.5% was achieved.

According to assessment for the worst-case scenario conducted in the EIA Study, the odour impacts are within the criterion of 5 odour unit and the slaughter house would not pose any nuisance on the surrounding sensitive receivers, where the nearest one is located at about

150m away. In the proposed landuse framework, the nearest planned sensitive uses is the Man Kam To Development Corridor (P3; **Figure 7.1.3**) which is located at about 460m from the slaughter house. With reference to the odour concentration contour established in the EIA Study, odour impact is not anticipated and no constraints would be imposed on the proposed landuses.

(4) Sha Ling Livestock Waste Composting Plant

Sha Ling Livestock Waste Composting Plant (**Figure 7.1.3**) is located at about 320m to the east of the proposed Kong Nga Po Comprehensive Development Area (P4; **Figure 7.1.3**), about 480m to the east of planned Hung Lung Hang Residential Area (P5; **Figure 7.1.3**), and is immediately adjacent to the planned Man Kam To Development Corridor (P3; **Figure 7.1.3**). It provides a free livestock waste collection service to 80 livestock farms in order to tackle the pollution from the discharge of untreated livestock waste into watercourses (http://sc.info.gov.hk/gb/www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/livestock_waste.html).

The composting plant is currently semi-enclosed, where 2m high three-sided wall with top enclosure was provided. The maximum handling capacity is 20 tonnes of compost per day. In 2004, the operation had been upgraded by introducing forced aeration with air pumped into the compost through air pipes. Odour emission had been significantly reduced.

It was also advised by EPD (Environmental Compliance Division) that during the past one year (May 08 to May 09), there is only one odour complaint on the Sha Ling Livestock Waste Composting Plant. As revealed in EPD's investigation, the complainant is about 200m from the plant, and the complaint was however not substantiated.

According to the latest information when preparing this report, the use of the Sha Ling Livestock Waste Composting Plant will be limited to handling and storage of partially mature compost only by late 2010 and the site is tentatively planned for an Organic Waste Treatment Facilities (OWTF) which is not yet confirmed. OWTF is a Designated Project under the EIAO. A statutory EIAO process shall be followed if the site is confirmed for an OWTF. It shall assess its potential environmental impact and recommend appropriate design/mitigation measures to ensure the proposed OWTF would fully comply with all relevant environmental legislation and requirements. The EIA also needs to take account of the latest landuse planning intention and address the potential environmental impacts on all existing and future sensitive uses. In this regard, it is expected that the Sha Ling Livestock Waste Composting Plant would not impose environmental constraints on any development areas.

(5) Sha Tau Kok Sewage Treatment Works

Sha Tau Kok Sewage Treatment Works (**Figure 7.1.6**) is a small scale secondary treatment works located to the west of Sha Tau Kok recreation ground and at 120m to the south of the existing Operation Base Sha Tau Kok Division Border District. The treatment capacity is 1,660m³ per day. Site inspection conducted on February, April and August 2009 identified that odour was not noticeable at both the existing receivers and at source.

There is no additional information about the odour control available from DSD, except it was verbally advised that an odour patrol was previously carried out by EPD and the finding has concluded that odour nuisance was not identified. It was also confirmed by EPD (Environmental Compliance Division) that there is no odour complaint on the Sha Tau Kok Sewage Treatment Works in the past year.

The nearest planned sensitive uses in the landuse framework include Ha Tam Shui Hang Village Zones (V18; **Figure 7.1.6**) which is at about 130m away from the sewage treatment work. In consideration of the small scale operation of the sewage treatment work, no past odour complaint records and the larger buffer distance compared to the existing receivers, the odour impact on all the planned sensitive uses and proposed village zones is unlikely,

yet cannot be totally ruled out. Should it be considered necessary in future, odour control on the sewage treatment work should be provided.

(6) Luofang Sewage Treatment Plant (羅芳污水處理廠)

Luofang Sewage Treatment Plant (**Figure 7.1.3 & 7.1.4**) is located in Shenzhen at about 100m to the north of the existing Ta Kwu Ling Village (A56; **Figure 7.1.3**). There is no available information about its process design and operation scale. According to GB14554-93 Odour Pollutant Emission Standard, an odour concentration limit of 20 odour unit at the site boundary of sewage treatment plant should be complied. It is not aware of any published odour complaints at the nearest existing receivers A56 and A75 in Ta Kwu Ling Tsuen which is at about 100m and 200m away respectively. The nearest planned sensitive uses in the landuse framework are Chow Tin Village zone (V6; **Figure 7.1.3**), Fung Wong Wu Village Zone (V7; **Figure 7.1.3**), Kan Tau Wai village zone (V8; **Figure 7.1.4**) and Muk Wu Nga Yiu village zone (V5; **Figure 7.1.3**) which are at much larger separation distance of about 260m, 330m, 270m and 350m away from the sewage treatment work.

The planned Recreational Area near Fung Wong Wu (P12; **Figures 7.1.4 – 7.1.5**) is located at a separation distance of about 60m from the Luofang Sewage Treatment Plant. In order to ensure minimal odour nuisance on the planned recreational area, sufficient setback distance should be allowed and necessary mitigation measures should be incorporated in the future development layout plan. No sensitive uses including any proposed residential development in support of the recreation should be allowed within the buffer zone. Nonetheless, since the development uses under the zoning for the planned Recreational Area near Fung Wong Wu (P12) are still subject to the planning approval from the Town Planning Board (TPB) in next stage of the study, the future project applicant shall carry out a detailed environmental assessment to confirm no adverse odour impact arising from the Luofang Sewage Treatment Plant.

(7) Binhe Sewage Treatment Plant (濱河污水處理廠)

Binhe Sewage Treatment Plant (**Figure 7.1.2**) is located at about 100m to the north of Hoo Hok Wai boundary. There is no available information about its process design and operational scale. The nearest sensitive uses of the proposed development area are Liu Pok Village Zone (V2; **Figure 7.1.2**) which is sited at 850m from the site boundary of the sewage treatment plant and odour impact is unlikely.

(8) Planned Poultry Slaughtering Centre

A poultry slaughtering centre is proposed in Sheung Shui along Man Kam To Road at the south of Sandy Ridge, at about 400m outside the study boundary. The nearest planned sensitive uses of the proposed development areas which may potentially be affected is the Man Kam To Development Corridor (P3; **Figure 7.1.3**) at 260m away.

The slaughtering centre is anticipated to operate all year round. The nearest existing sensitive receiver is found in Hung Kiu San Tsuen (A31; **Figure 7.1.3**) at about 10m away. With reference to the approved EIA Study “*Provision of a Poultry Slaughtering Centre in Sheung Shui*” (EIA-170/2009), an odour removal system comprising scrubbers and/or ionizers and/or biofilters would be installed to minimise the potential odour impacts from the odorous exhausts. This odour removal system would be capable of achieving a minimum combined odour removal efficiency of 95%. With the provision of an odour removal system, the maximum predicted odour concentration would be 1.7 OU at the existing Hung Kiu San Tsuen (A31), complying with the odour criterion. Therefore, odour impact is also not anticipated for the nearest planned ASR P3 at 260m away. No constraints would be imposed on the proposed development areas. In addition, shelving of the whole poultry slaughtering centre to avoid potential odour nuisance can also be considered, which is subject to further study.

(9) Livestock Farms

There were two active livestock farms identified in Year 2009 in the vicinity of the proposed Kong Nga Po Comprehensive Development Area (**Figures 7.1.3 and 7.1.4**). One livestock farm (F1; **Figure 7.1.3**) is located within the proposed development area for Kong Nga Po Comprehensive Development Area (P4; **Figure 7.1.3**). The other (F2; **Figure 7.1.3**) is located next to the Kong Nga Po Comprehensive Development Area (P4) at less than 250m within the proposed Hung Lung Hang Residential Area (P5; **Figure 7.1.3**). It was advised by EPD (Environmental Compliance Division) that there has been no odour complaint on the livestock farms in the areas of Kong Nga Po and Hung Lung Hang during the past one year (May 08 to May 09).

During the recent site inspection, the farm within the proposed Kong Nga Po Comprehensive Development Area originally held under short-term tenancy (STT) for a livestock keeping license (LKL) was found partially vacant and partially under operation and the one within Hung Lung Hang Residential Area is situated on private agriculture lots also by a valid LKL. Upon expiry of the waiver under the STT and STW to the operators of these two farms, should the proposed developments be proceeded upon release of FCA, it is recommended that LandsD shall, in considering the grant/renewal of a waiver to the operators in future, seek advice and take into account the latest land use intention in the area. The livestock farms shall be phased out before population intake of the proposed uses to tackle the potential odour nuisance. For livestock farms governed by STT, it is in theory terminable by exercising the termination clause under their respective tenancy agreements. Appropriate measures/ incentives/ compensation package to encourage voluntary cessation/ removal of such farms operation should be in place to encourage phasing out of such uses in the area.

(10) Proposed Horse Stable in Planned Recreational Area near Pak Fu Shan

Apart from the potential impacts arising from the existing and planned odour emission sources on the proposed development areas, the proposed horse riding school as a worst-case planning scenario for the planned Recreational Area near Pak Fu Shan (P7; **Figure 7.1.4**) would have potential to induce odour impacts on the nearby existing sensitive receivers and the proposed residential accommodation within the horse riding school. The proposed stables will accommodate a maximum of 68 horses. The nearest existing receivers that may be potentially affected are Ha Heung Yuen Village Zone (V11; **Figure 7.1.4**) and Heung Yuen Wai Village Zone (V12; **Figure 7.1.4**) at 410m and 290m respectively, measured from the proposed boundary of the recreational area as there is currently no available design layout for assessment.

It is noted that the same operation practice and mitigation measures as adopted in the horse stable proposed in 2008 Olympic Equestrian Event can be adopted in the design of the proposed horse stable to minimise the odour impacts as far as practicable. With reference to the findings of the odour patrol conducted in the approved EIA Study for “*Main Arena of the 2008 Olympic Equestrian Event*” (EIA-118/2005) for which the proposed horse stable could accommodate 216 horses, it suggested a distance of insignificant odour at around 100m from the boundary. Given the smaller scale of horse stable proposed in the horse riding school, it is a safe approach to adopt a buffer distance of 100m for planning the stable location within the proposed recreational area if the Olympic stable design is adopted. Thus, sufficient setback distance should be allowed between the horse stable and any planned sensitive receivers including the proposed residential uses within the horse riding school. Otherwise, proper at source mitigation measures shall be provided in the design of the horse stable in order to minimise the odour impacts.

Should the horse riding school be actually proposed, an animal waste composting plant as recommended in **Section 7.6** would be one of the possible enhancement measure options for future consideration. The associated odour impacts on nearby existing and planned sensitive uses will be subject to the siting and design of the proposed composting plant for

which the information are not available at this planning stage. Nonetheless, the animal composting plant will be a Designated Project under the EIAO, a statutory EIA is required to assess and confirm its potential environmental impact and recommended mitigation measures.

(11) Shenzhen River

Potential odour nuisance arising from the municipal domestic sewage in the Shenzhen River on the nearby proposed development areas has been reviewed.

In order to enhance the flood protection to the areas along the Shenzhen River, the Regulation of Shenzhen River Stage I, II and III had been completed jointly by the Drainage Service Department (DSD) of HKSAR and the Water Resources Bureau (WRB) of the Shenzhen Municipal Government from 1995 to 2006. With reference to the approved EIA Study “Shenzhen River Regulation Project Stage III” (EIA-039/2000), it is understood that after the completion of Stage II Project, large quantity of mud and heavily polluted silt would be removed, which would greatly improve the water quality of the Shenzhen River. The flow in the river would also be improved, and the dilution and diffusion capacity of the river would be enhanced which in turn would also improve the water quality. To this end, the odour emitted from the river would be decreased. Nonetheless, since this approved EIA report is 10 year old, it shall be updated by relevant government departments to reflect the latest existing situation and follow-up investigation studies shall also be carried out to identify the need of further additional improvement measures for Shenzhen River. Any the improvement measures required shall be implemented and monitored by relevant government departments to ensure the prediction given in the EIA report is genuinely materialised.

In addition, in association with the development of the proposed Liantang / Heung Yuen Wai BCP, the Regulation of Shenzhen River Stage IV (ESB-200/2008) is also proposed to train the relevant section of Shenzhen River (from Ping Yuen River to Pak Fu Shan) in order to meet the required flood protection standard for the BCP. The regulation works will commence in mid 2013 and will be completed by mid 2017. Hence, by the time in Year 2020 (i.e. commissioning year of the proposed developments), the water quality and odour nuisance will be further improved.

It should also be acknowledged that it might take some years to phase out this pollution source. With the completion of Regulation of Shenzhen River and close monitoring by the governmental joint working group, it is expected that the water quality and odour nuisance would be improved in future years. However, given there are uncertainties of future environmental conditions, the potential odour nuisance due to Shenzhen River still cannot be ruled out.

Notwithstanding this, it should also be noted that the development uses under recreational areas in Pak Fu Shan and Fong Wong Wu are still subject to the planning approval from the TPB. Such application for permission of use or development shall be accompanied by a layout plan and all necessary documents for consideration of the TPB, including an environmental impact study report which shall fully examine the environmental concerns (not limiting to odour issue) and propose mitigation measures to tackle them.

7.1.7.6 Other Pollutants from Shooting Range

The planned ex-Lung Kai Public School (P2; **Figure 7.1.2**) and Kong Nga Po Comprehensive Development Area (P4; **Figure 7.1.3**) are located at about 250m from the Lo Wu Classification Range (**Figure 7.1.2**) and 100m from Kong Nga Po Shooting range (**Figure 7.1.3**), respectively. Due to security reason, information on the number and types of bullets fired is not available from Hong Kong Police Force.

Reuse of the ex-school is subject to private initiative. With reference to **Section 7.2**, fixed window and central air conditioning including mechanical ventilation are recommended for ex-Lung Kai Public School to mitigate noise impacts. Hence, potential lead and dust

emission impacts are also not anticipated, but during design stage of the project, necessary consideration for the incorporation of metal and dust filters is required to ascertain the indoor air quality is not compromised. It is therefore considered that an integrated approach to mitigation measures required for future development uses in this zone should be studied in conjunction with the noise impacts. Relevant bureau's support on the re-development proposals for adaptive reuse of the former school should also be sought in future. On the other hand, the Kong Nga Po Comprehensive Development Area (P4) is a residential development which relies on opened window for ventilation and central air conditioning is not a provision. However, the zoning would still be subject to the planning approval from the Town Planning Board (TPB) in next stage, the future project applicant shall carry out a detailed environmental assessment to confirm no adverse air quality impact arising from the existing shooting range.

7.1.8 Mitigation Measures

The design and emission limits of the proposed crematorium shall need to comply with BPM 12/2 (06), A Guidance Note on the Best Practicable Means for Incinerators (Crematoria). In addition, adequate setback in accordance with the current proposed landuse framework shall be maintained or justified otherwise in accordance with HKPSG and TM-EIAO as appropriate. It should also be noted that the proposed crematorium is a Designated Project under the EIAO. A statutory environmental impact assessment (EIA) is required to assess and confirm its potential environmental impact and recommended mitigation measures. The assessment of the proposed crematorium in this report is subject to the future EIA.

In respect of the odorous sources, the following mitigation measures are recommended for the proposed development areas in order to mitigate the impacts:

- i) ***Proposed Horse Stable in Planned Recreational Area near Pak Fu Shan (P7; Figure 7.1.4)*** – Same operation practice and mitigation measures as adopted in the horse stable proposed in 2008 Olympic Equestrian Event are recommended in the design of the proposed horse stable to minimise the odour impacts as far as practicable. Reference shall be made to the approved EIA Study for “*Main Arena of the 2008 Olympic Equestrian Event*” (EIA-118/2005). Details of the recommended mitigation measures are listed below:
 - a. Temperature and humidity should be maintained at about 22°C and 70% inside the stable boxes throughout the seasons. Thus, significant variation of the odour source emission strength due to variation of ambient temperature in different seasons should be not anticipated.
 - b. Sheet cover and water spraying system should be installed at the waste storage area to control odour emission.
 - c. The new stable should be designed to a higher standard of full enclosure construction and equipped with activated carbon filter of minimum 90% odour removal efficiency at the exhaust. In addition, properly enclosed containers should also be provided for the stockpiling of stable waste.
 - d. Sufficient buffer distance from the horse stable should be adopted to avoid odour impacts. Air sensitive uses including the proposed residential development within the horse riding school should not be sited within the recommended buffer zone, unless otherwise justified.

In addition, any potential odour nuisance due to Shenzhen River on this development area should be avoided by proper layout and development design. It should be noted that the extent of mitigation measures and the required buffer distance should still be subject to detailed investigation in the submission for Section 16 planning application in the next stage.

The animal waste composting plant if proposed will be a Designated Project under the EIAO, a statutory EIA is required to assess and confirm its potential environmental impact and recommended mitigation measures.

- ii) **Planned Recreational Area near Fung Wong Wu (P12; Figures 7.1.4 – 7.1.5)** – Sufficient setback distance between Luofang Sewage Treatment Plant and any planned sensitive uses within the recreational area should be allowed in the future development plan and necessary mitigation measures should be incorporated. Any potential odour nuisance due to Shenzhen River on this development area shall also be avoided by proper layout and development design. No sensitive uses including any proposed residential development in support of the recreation should be allowed within the buffer zone. Any development uses under this zoning are still subject to the planning approval from the TPB. The actual buffer distance required should be reconfirmed by detailed investigation in the submission for future Section 16 planning application.

7.1.9 Conclusion

Air quality assessment has been conducted to evaluate the air quality impact of the proposed landuse framework in the RDP. It is recommended that the design and emission limits of the proposed crematorium shall need to comply with BPM 12/2 (06), A Guidance Note on the Best Practicable Means for Incinerators (Crematoria). In addition, adequate setback in accordance with the current proposed landuse framework shall be maintained or justified otherwise in accordance with HKPSG and TM-EIAO as appropriate. It should also be noted that the proposed crematorium is a Designated Project under the EIAO. A statutory environmental impact assessment (EIA) is required to assess and confirm its potential environmental impact and recommended mitigation measures. The assessment in this report is subject to the future EIA.

For odorous sources, mitigation measures in terms of setback distance, odour removal systems and administrative control by phasing out the sources before population intake of the proposed uses are recommended to tackle the problem. It should however be noted that this study is broad bush assessment only and when individual project is implemented, the detailed assessment shall be carried out by the respective proponent taking into consideration the cumulative contribution due to all other sources including those from Shenzhen side, and the recommended mitigation measures options shall be evaluated and confirmed subject to detailed investigation.

7.2 Noise Impact

7.2.1 Introduction

This section presents the assessment of potential noise impacts to all existing, committed planned and proposed noise sensitive uses in areas from which developments are proposed under the landuse planning. It evaluates the potential noise implications of the proposed landuse framework, including the identification and assessment of the road traffic noise, rail noise and fixed noise such as shooting ranges, helipads, BCPs etc on the existing, committed, planned and proposed sensitive receivers. Potential noise impacts on the representative Noise Sensitive Receivers (NSRs) have been assessed in accordance with the requirements of Hong Kong Planning Standards and Guidelines (HKPSG), Annex 5 and Annex 13 of the TM-EIAO as well as the requirements set out under the Study Brief. Proposals of mitigation measures required to reduce the noise impacts have been recommended.

7.2.2 Overview of Potential Noise Implications of the Landuse Framework

The Recommended Development Plan (RDP) is illustrated in **Figures 4.11, 4.27, 4.43, 4.59, 4.75 and 4.91**. The proposed road improvement works will have the potential to affect the existing, committed planned and proposed sensitive uses in the Study Area. There are also various existing and planned polluting uses in and near the Study Area which will potentially

pose environmental noise impacts on the future sensitive use of the proposed development areas such as low-rise residential development at comprehensive development in Kong Nga Po, residential development in Hung Lung Hang, Ecolodge at Ma Tso Lung, recreational areas at/near Pak Fu Shan, Fung Wong Wu and Tong To Ping Tsuen, village expansion, adaptive reuse of the existing schools for holiday camps, etc. Major noise sources in the Study Area can be broadly categorised as follows:

- road traffic noise;
- fixed noise;
- helicopter noise; and
- rail noise.

7.2.2.1 Road traffic noise

Figures 2.4.1 shows the road improvement network for the Closed Area. Major roads encroaching and in the vicinity of the Study Area include San Tin Highway, Fanling Highway, Castle Peak Road, Lok Ma Chau Road, Man Kam To Road, Sha Tau Kok Road and Kwu Tung Road. Local roads with light traffic volume are also present, including Ma Tso Lung Road, Lin Ma Hang Road, Lo Wu Station Road, Ping Che Road and Wo Keng Shan Road. Small access roads connecting villages are common in the Study Area as well.

Before the opening up of the FCA and its village roads to the general public, road improvement / upgrading work is required. It is assumed that road improvement works as well as all other proposed developments are expected to be completed by Year 2020. With more traffic flow induced upon opening up of the FCA, a corresponding induced traffic are to be expected, and thus the potential road traffic noise impacts on the existing, committed, planned and proposed sensitive uses.

Furthermore, the associated traffic generation from the following concurrent projects which may likely have cumulative noise impacts have been identified below:

NENT New Development Areas (NDAs) - According to Project Profile (PP-337/2007), Kwu Tung North and Fanling North NDAs comprise residential development with associated employment and community facilities. Ping Che/Ta Kwu Ling NDA provides a 'reception area' for open storage and rural industries that are affected by the development clearance for the other two NDAs. The first population intake year for NDAs is expected to be around 2019. Since the EIA is currently being undertaken by other consultant team, development plan for transportation of the study is not available during preparation of this report. However, potential cumulative noise impact from induced traffic will also be included in the assessment.

Liantang / Heung Yuen Wai BCP – With closer economic integration with the Mainland in particular the neighbouring cities and provinces, there is a need to further facilitate movement of people and goods across the boundary in the east. The new BCP will provide an efficient access to the eastern part of Guangdong, Fujuan, and Jiangxi Provinces.

From local perspective, the proposed new BCP will satisfy the long-term transport need and help re-distribute the cross-boundary traffic from existing Man Kam To and Sha Tau Kok BCP. Potential traffic noise impact associated with the BCP is expected. For the purpose of cumulative road traffic noise assessment, the latest road alignment connecting to the BCP has been assumed.

Lok Ma Chau Loop - The development at Lok Ma Chau Loop (the LMC Loop) is one of the ten major infrastructure projects for economic growth of the HKSAR. Higher education might be developed as the leading land use with some elements of high-tech research and development facilities and creative industries, which would provide impetus for human resources development in the South China region and enhance the competitiveness of the Pearl River Delta, as well as benefit the long-term economic development of the two cities. The development proposal is being investigated and formulated under Agreement No. CE

53/2008 (CE) Planning and Engineering Study on Development of Lok Ma Chau Loop – Investigation. Since the development plans are yet to be determined, the potential noise implication on the proposed landuse within Closed Area in vicinity of LMC Loop shall be addressed in the upcoming EIA and LMC Loop Project.

7.2.2.2 Fixed Noise

(1) Shooting range

Three shooting ranges are identified within and in the vicinity of Closed Area, namely Lo Wu Classification Range, Kong Nga Po Shooting range and Table Hill Shooting range, as described below. Noise is emanated from these shooting ranges during firing practices.

Lo Wu Classification Range – **Figure 7.2.2** illustrates the location of the Lo Wu Classification Range. It is a firing practice site for the Hong Kong Police Force (HKPF), located in a valley between Crest Hill (or Tai Shek Mo) and Fung Kong Shan. Both revolver and rifle would be used during firing practice. The shooting range operates from 0830 to 1830 from Monday to Friday, and 0830 to 1430 on Saturday. There will be no shooting practice on Sunday or General Holiday.

Kong Nga Po Shooting range – **Figure 7.2.3** illustrates the location of the Kong Nga Po Shooting range. It is a firing practice site for the Special Duties Unit (SDU) of HKPF. Both shot gun and machine gun would be used by the SDU. The shooting range operates from 0830 to 1830 from Monday to Friday, and 0830 to 1430 on Saturday. There will be no shooting practice on Sunday or General Holiday.

Table Hill Shooting range – **Figure 7.2.3** illustrates the location of the Table Hill Shooting range. It is located at Cheung Po Tau, about 120m outside the site boundary. It is used by members of the RHKR Sport Shooting Association for pistol and rifle shooting practice on Sunday.

In the current landuse proposal, Kong Nga Po Comprehensive Development Area is located at about 450m from the Table Hill shooting range and at about 100m from the Kong Nga Po shooting range. The ex-Lung Kai Public School which will be refurbished and reused for holiday camp is located at about 250m from the Lo Wu Classification Range; and the proposed Hung Lung Hang Residential Area near Kong Nga Po is located at about 260m from the Kong Nga Po shooting range.

In elevations, the base levels of the Kong Nga Po shooting range, Kong Nga Po Comprehensive Development Area and Hung Lung Hang Residential Area are +30 mPD, +64 mPD, and +27 mPD respectively. The topography of Kong Nga Po Comprehensive Development Area would totally block the line of sight to the planned Hung Lung Hang Residential Area, thus acting as a natural barrier to screen noise from the shooting range. Hence, potential fixed noise impact on the planned Hung Lung Hang Residential Area is not anticipated. The Kong Nga Po Comprehensive Development Area will also be blocked by a cut slope at 120 mPD to the Table Hill shooting range at a base level of 100mPD.

The Eco-lodge is located at about 650m from the Lo Wu Classification Range and is screened by the terrain. Potential noise impacts are not expected.

(2) Railway Stations

There is no proposed development area located within 300m from the boundary of the existing Lo Wu station.

The planned Northern Link (NOL) and Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) are another potential rail noise sources in the western part of the Study Area. The proposed NOL will connect the existing West Rail and LMC Spur Line. However, the NOL alignment has not yet been finalised and is still being investigated. It is unknown whether there is railway station within FCA at this stage. Nevertheless, the NOL is a Designated Project and the environmental impacts will

be addressed in the respective EIA to meet all statutory criteria and requirements under NCO and EIAO so as to seek the approval from EPD.

With reference to the approved EIA Study “*Hong Kong Section of Guangzhou – Shenzhen – Hong Kong Express Rail Link*” (EIA-169/2009), there is only one railway station at the West Kowloon Terminus in Hong Kong section. Potential fixed noise impacts on the proposed development areas within FCA are therefore not anticipated.

(3) Boundary Crossing Points

The Man Kam To BCP and Sha Tau Kok BCP operate from 0700 to 2200 and from 0700 to 2000 respectively, whilst the Lok Ma Chau BCP operates 24hours. Potential fixed noise impacts may arise from the BCPs. In the current landuse proposal, the proposed Shan Tsui Village Zone and Sheung Tam Shui Hang Village Zone are located at about 10m and 150m from the existing Sha Tau Kok BCP respectively; and the proposed San Uk Ling Village Zone and Muk Wu Village Zone are both located at 270m from Man Kam To BCP.

In addition, the planned Liantang / Heung Yuen Wai BCP would also have potential noise impact on the nearby Tsung Yuen Ha village zone, Recreational Area near Fung Wong Wu and Recreational Area near Pak Fu Shan at 60m, 10m and 20m away respectively.

(4) Cement Storage Plant

An existing cement storage plant is found at about 100m from the proposed Muk Wu Nga Yiu village zone (V5; **Figure 7.2.3**). Based on the site observation, the plant consists of six silos. According to EPD’s record (Environmental Compliance Division, Regional Office (North)) and their site verification, it was advised that there is no cement work on site and the plant is used for storage only. Further information on the plant is not available. Potential fixed noise impacts from the cement storage plant are not anticipated.

(5) NENT Landfill and its Associated Plants

NENT Landfill and its associated plants, including leachate treatment plant and ammonia stripping plant, operate 24 hours a day and all year round. The nearest Ha Heung Yuen Village Zone is located at 120m from the boundary of the existing NENT Landfill; however, it is located at more than 300m away from the fixed noise sources (i.e. leachate treatment plant) in the NENT Landfill. Potential fixed noise impact is therefore not anticipated.

(6) Cumulative Fixed Noise from Shenzhen Development Plan

The Futian, Luohu and Yantian districts are adjacent to the Study Area. According to the draft Comprehensive Planning of Shenzhen City (2007-2020), the future land uses of these districts are: Futian for residential, non-polluting industrial, and government and community uses; Luohu for residential, commercial, and governmental and community uses; Yantian for Wutongshan National Forest Park, residential and few commercial uses. The nearest potential industrial zones are identified in Liantang Area of Luohu District to the north of Pak Fu Shan which is located outside 300m of the planned recreational area (**Figure 7.1.7**). Potential fixed noise impact is therefore not expected. There are existing industrial developments to the north-east of Pak Fu Shan in Liantang located close to the Study Area. Should the existing industrial developments in Liantang Area not be phased out in future before population intake of the proposed uses in Pak Fu Shan, potential noise impacts cannot be ruled out and shall be tackled by proper mitigation measures in future development to be investigated by the future project proponent.

(7) Muk Wu Pumping Station

The Muk Wu Village boundary is located at about 70m from the Muk Wu pumping station. There are also existing village houses located nearby. Based on our site inspection, the pumping station is enclosed and there is no noticeable noise generated from the existing Muk Wu Pumping Station on the Muk Wu Village Zone. Potential noise impacts are not expected.

7.2.2.3 Helicopter Noise

A number of helipads/ helicopter landing sites have been identified within the Study Area. They are numerically listed in the table below and their locations are shown in **Figure 7.2.1 to 7.2.6**. Noise associated with the proposed helipad will be generated during helicopter manoeuvring over the helipad and during lateral flight.

In the current landuse proposal, the planned sensitive uses which may be potentially affected by the helicopter noise include the following:

- Ex-Lung Kai Public school (P2; **Figure 7.2.2**) at 250m from Lo Wu Classification Range (H3).
- Planned recreational area near Pak Fu Shan (P7; **Figure 7.2.4**) at 85m and 110m from the Pak Fu Shan Operational Base (H7) and Pak Fu Shan Camp (H8), respectively.
- Ex-King Sau Public School (P8; **Figure 7.2.5**) and Lin Ma Hang Village Zone (V13; **Figure 7.2.5**) at 350m and 370m from Kong Shan (H9), respectively.
- Ha Tam Shui Hang Village Zone (V18; **Figure 7.2.6**), Sheung Tam Shui Hang Village Zone (V19; **Figure 7.2.6**), Shan Tsui Village Zone (V20; **Figure 7.2.6**), Muk Min Tau and Tsui Hang Village Zone (V17; **Figure 7.2.6**) and San Tsuen Village Zone (V16; **Figure 7.2.6**) at 80m, 290m, 300m, 315m and 370m from the Sha Tau Kok Operational Base (H12), respectively.

The proposed Eco-lodge is also found within 100m of the Lok Ma Chau Operational Base (i.e. Sandy Spur Camp, H2). It was however confirmed by Government Flying Service (GFS) that the helipad has already been closed and there are no plans to build any further sites in the area. Hence potential helicopter noise on Eco-lodge is not anticipated.

Table 7.2.1 Identified helipads

Helipad ID	Location
H1 (Figure 7.2.1)	Lok Ma Chau
H2 (Figure 7.2.1)	Lok Ma Chau Operational Base (Sandy Spur Camp)
H3 (Figure 7.2.2)	Lo Wu Range
H4 (Figure 7.2.2)	Crest Hill Operation Base
H5 (Figure 7.2.3)	Sandy Ridge
H6 (Figure 7.2.3)	Man Kam To
H7 (Figure 7.2.4)	Pak Fu Shan Operational Base
H8 (Figure 7.2.4)	Pak Fu Shan Camp
H9 (Figure 7.2.5)	Kong Shan
H10 (Figure 7.2.5)	Robin's Nest Alternate
H11 (Figure 7.2.6)	Pak Kong Au
H12 (Figure 7.2.6)	Sha Tau Kok Operational Base
H13 (Figure 7.2.6)	Robin's Nest

7.2.2.4 Rail noise

Two existing rails are found in the Study Area, including (i) East Rail at Lo Wu running along Ng Tung River and (ii) Lok Ma Chau (LMC) Spur Line running along LMC BCP. **Figures 7.2.1 and 7.2.2** show the locations of these railway lines. At present, the normal passenger train service hours of East Rail and LMC Spur Line are 0545-0040 hours and 0628-2305 hours respectively.

In general, noise emitted from the operation of railway is dominated by airborne noise from propulsion system, wheel/rail interaction and roof-mounted air-conditioning system. Trains moving on the viaduct will also excite vibration of the viaduct structure which then re-radiate as noise.

In the current landuse proposal, there is no proposed development area within 300m of the East Rail at Lo Wu.

As mentioned above, the planned NOL and XRL are another potential rail noise sources in the western part of the Study Area. The proposed NOL will connect the existing West Rail and LMC Spur Line. However, the NOL alignment has not yet been finalised and is still being investigated. No updated information is available at the time of preparing this report. Nevertheless, the NOL is a Designated Project and the environmental impacts will be addressed in the respective EIA to meet all statutory criteria and requirements under NCO and EIAO so as to seek the approval from EPD.

The proposed Hong Kong Section of Guangzhou-Shenzhen-Hong Kong ERL runs across the Mai Po area through tunnels that minimise environmental impact during operation. Existing and planning NSRs will therefore not be impacted as the ERL runs in tunnel. Potential rail noise impact from ERL is therefore not anticipated.

7.2.2.5 Summary

The following **Table 7.2.2** summarises the identified noise sources in vicinity of the proposed developments which may be potentially affected by the associated noise impact. **Figures 7.2.1 to 7.2.6** illustrate an overlay of landuse proposals, locations of potential noise sources and representative noise sensitive receivers.

Table 7.2.2 Summary of potential noise impact on the proposed development and village zone

Proposed Development	Fixed Noise Source	Traffic Noise	Rail Noise	Helicopter Noise	Shortest Separation Distance (m)
Planning Area 1 (Figure 7.2.1)					
Eco-Lodge	Nil	Yes	Nil	Nil	10m to Boundary Patrol Road
Lok Ma Chau Village Zone	Nil	Yes	Nil	Nil	10m to Boundary Patrol Road
Planning Area 2 (Figure 7.2.2)					
Eco-Lodge	Nil	Yes	Nil	Nil	10m to Boundary Patrol Road
ex-Lung Kai Public School	Lo Wu Classification Range	Yes	Nil	Lo Wu Range Helipad	170m to Ma Tso Lung Road 250m to shooting range & Helipad
Liu Pok Village Zone	Nil	Yes	Nil	Nil	20m to Boundary Patrol Road
Planning Area 3 (Figure 7.2.3)					
Kong Nga Po Comprehensive Development Area	Kong Nga Po Shooting range Table Hill Shooting range	Yes	Nil	Nil	10m to Kong Nga Po Road 100m to Kong Nga Po Shooting range 450m to Table Hill Shooting range
Hung Lung Hang Residential Area	Nil	Yes	Nil	Nil	10m to Kong Nga Po Road 260m to Kong Nga Po Shooting range
ex-Sam Wu Public School	Nil	Yes	Nil	Nil	10m to Lin Ma Hang Road
San Uk Ling Village Zone	Man Kam To BCP	Yes	Nil	Nil	10m to Man Kam To Road 270m to BCP
Muk Wu Village Zone	Man Kam To BCP	Yes	Nil	Nil	130m to Lin Ma Hang Road 270m to BCP
Muk Wu Nga Yiu Village Zone	Nil	Yes	Nil	Nil	10m to Lin Ma Hang Road
Chow Tin Village Zone	Nil	Yes	Nil	Nil	160m to Lin Ma Hang Road
Fung Wong Wu Village Zone	Nil	Yes	Nil	Nil	140m to Ping Che Road

Proposed Development	Fixed Noise Source	Traffic Noise	Rail Noise	Helicopter Noise	Shortest Separation Distance (m)
Planning Area 4 (Figure 7.2.4)					
Planned Recreational Area Near Fung Wong Wu	Liantang/Heung Yuen Wai BCP	Yes	Nil	Nil	10m to Liantang Highway 10m to Lin Ma Hang Road 10m to Ping Che Road 10m BCP
Chuk Yuen Village Zone	Nil	Yes	Nil	Nil	80m to Liantang Highway
Planned Recreational Area - near Pak Fu Shan	Liantang/Heung Yuen Wai BCP	Yes	Nil	Pak Fu Shan Operational Base & Pak Fu Shan Camp Helipad	10m to Lin Ma Hang Road 85m to Pak Fu Shan Operational Base Helipad 110m to Pak Fu Shan Camp Helipad 20m to BCP
Kan Tau Wai Village Zone	Nil	Yes	Nil	Nil	10 m to Ping Che Road
Tong Fong Village Zone	Nil	Yes	Nil	Nil	10 m to Ping Che Road
Tsung Yuen Ha Village Zone	Liantang/Heung Yuen Wai BCP	Yes	Nil	Nil	60m to Lin Ma Hang Road 60m to BCP
Ha Heung Yuen Village Zone	Nil	Yes	Nil	Nil	230m to Lin Ma Hang Road
Heung Yuen Wai Village Zone	Nil	Yes	Nil	Nil	250m to Lin Ma Hang Road
Planning Area 5 (Figure 7.2.5)					
ex-King Sau Public School	Nil	Yes	Nil	Kong Shan Helipad	330m to Lin Ma Hang Road 350m to Helipad
Lin Ma Hang Village Zone	Nil	Yes	Nil	Kong Shan Helipad	60m to Lin Ma Hang Road 370m to Helipad
San Kwai Tin Village Zone	Nil	Yes	Nil	Nil	10m to Lin Ma Hang Road
Planning Area 6 (Figure 7.2.6)					
Planned Recreational Area near Tong To Ping Tsuen	Nil	Yes	Nil	Nil	10m to Sha Tau Kok Road (but only the proposed ecolodge at the northern portion of the recreational area is noise sensitive use which is at 350m to Sha Tau Kok Road)
ex-Kwan Ah Public School	Nil	Yes	Nil	Nil	330m to Sha Ho Road
Tong To Village Zone	Nil	Yes	Nil	Nil	290m to Sha Tau Kok Road
San Tsuen Village Zone	Nil	Yes	Nil	Sha Tau Kok Operational Base Helipad	10m to Sha Tau Kok Road 370m to Helipad
Muk Min Tau and Tsiu Hang Village Zone	Nil	Yes	Nil	Sha Tau Kok Operational Base Helipad	10m to Sha Tau Kok Road 315m to helipad
Ha Tam Shui Hang Village Zone	Nil	Yes	Nil	Sha Tau Kok Operational Base Helipad	10m to Sha Tau Kok Road 80m to helipad

Proposed Development	Fixed Noise Source	Traffic Noise	Rail Noise	Helicopter Noise	Shortest Separation Distance (m)
Sheung Tam Shui Hang Village Zone	Sha Tau Kok BCP	Yes	Nil	Sha Tau Kok Operational Base Helipad	60m to Sha Ho Road 150m to BCP 290m to Helipad
Shan Tsui Village Zone	Sha Tau Kok BCP	Yes	Nil	Sha Tau Kok Operational Base Helipad	20m to Sha Ho Road 10m to BCP 300m to Helipad

Upon opening up of the FCA and commissioning of the proposed developments, on the other hand, all nearby existing sensitive receivers would also be potentially affected by the associated changes in traffic flow pattern as a result of the proposed road improvement scheme.

7.2.3 Environmental Legislation, Standards and Guidelines

The relevant legislation and associated guidance notes applicable to the study for the assessment of noise implications include:

- Hong Kong Planning Standards and Guidelines (HKPSG);
- Noise Control Ordinance (NCO), Cap 400;
- TM for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places); and
- Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO).

7.2.3.1 Guidelines for Developments in Rural Area

According to HKPSG, in planning any new development in rural areas, a more sensitive approach has to be taken in order to preserve the existing tranquil environment and the quality of life. As a general rule, any noise emitters introducing a fairly consistent excess of 10 dB(A) above the prevailing background should be avoided. If the noise emitters must be located in a rural setting, anti-noise design must be incorporated to reduce the noise impact. In most cases, this will involve the shielding of the sensitive use from the noise emitters by tunneling, cut and cover, barriers, enclosures, and acoustic design of noise emitters. In some cases, it may be necessary to impose restriction on operating hours.

7.2.3.2 Road Traffic Noise

The TM-EIAO and HKPSG provide guidance on acceptable road traffic noise levels for uses which rely on open windows for ventilation. The relevant criteria are shown in **Table 7.2.3**.

Table 7.2.3 Road traffic noise standards

Uses	Road Traffic Noise, L _{10, 1hr} dB(A)
Domestic Premises	70
Hotel and Hostels	70
Offices	70
Educational Institutions	65
Hospital & Clinics	55
Places of public worship and courts of law	65

Note:

- ⁽¹⁾ The above criteria apply to noise sensitive uses measured at 1m from external façade of premises which rely on open window for ventilation.

7.2.3.3 Fixed Noise

Noise generated by the fixed noise source during day-time (i.e. 0700 to 1900) and evening time (i.e. 1900 to 2300) and night-time (i.e. 2300 to 0700 on the following day) is governed by the TM-Places. Maximum allowable noise levels from the noise sources shall not exceed the specified Acceptable Noise Levels (ANLs). These ANLs are stipulated in accordance

with the Area Sensitivity Ratings (ASR) established for the NSRs. For planning purpose, the TM-EIAO and HKPSG have specified the following standards:

- 5 dB(A) below the appropriate ANLs in the TM-Places; or
- the prevailing background noise levels for quiet areas with ambient noise level at more than 5 dB(A) below the ANL.

The ANLs for different Area Sensitivity Ratings are summarised in **Table 7.2.4**.

Table 7.2.4 Acceptable Noise Levels (ANLs)

Time Period	ANL , dB(A)			ANL – 5 , dB(A)		
	A	B	C	A	B	C
Day (0700 to 1900 hours)	60	65	70	55	60	65
Evening (1900 to 2300 hours)						
Night (2300 to 0700 hours)	50	55	60	45	50	55

7.2.3.4 Helicopter Noise

According to Table 1A of Annex 5 “Criteria for Evaluating Noise Impact” in the TM-EIAO and HKPSG, the noise criteria for helicopter noise is 90 dB(A) L_{max} for offices and 85 dB(A) L_{max} for domestic premises, hotels, hostels, educational institutes, hospitals, clinics and places of worship during 0700 to 1900 hours. The standards apply to uses that rely on open windows for ventilation.

7.2.3.5 Rail Noise

The criteria for assessing rail noise is under the Noise Control Ordinance and shall comply with the Acceptable Noise Levels laid down in the TM-Places and TM-EIAO. In addition, noise level during the period between 11:00pm and 7:00am of the following day should not exceed 85 dB(A) L_{max} . In accordance with HKPSG, a noise level of 65 dB(A) $L_{eq (24hr)}$ should be satisfied at NSR. All these criteria apply to NSRs replying on open-windows for ventilation.

In addition, according to Section 4.2.10, Chapter 9 of HKPSG, a separation distance of 85m between the rail line and the development is recommended.

7.2.4 Description of the Environment

The noise condition of Closed Area is broadly sub-divided into three portions, namely western, middle and eastern portions. Each of these portions is unique in noise characteristics, and they are described as follows.

Western Portion

The western portion comprises the wetland and fishpond areas of Mai Po, San Tin and Lok Ma Chau. Low rise village-type developments are scattering to the south of the wetland and fishpond areas. The Lok Ma Chau Spur Line runs along Lung Hau Road to the Lok Ma Chau Spur Line BCP in the region. Four helipads/ helicopter landing sites were identified in the western portion. Neither major roads nor industrial premises were identified within the area. The Lo Wu Classification Range is located in a valley between Tai Shek Mo and Fung Kong Shan, and noise will be emanating from the Range during firing practice. The ambient noise environment is generally tranquil except at the areas adjacent to the noise sources.

Middle Portion

The middle portion spans across Lo Wu to the west of Heung Yuen Wai to the east, and covers Man Kam To and Kong Nga Po. It is served by three BCP namely Lo Wu, Man Kam To and the proposed Liantang/ Heung Yuen Wai BCP. The area is generally rural in character comprises agricultural lands, cemetery, with low rise village type development scattering in the area. The MTRC East Rail runs along Ng Tung River to Lo Wu Station in the region. The Sandy Ridge Cemetery is located between Lo Wu and Man Kam To BCP.

A total of four helipads/ helicopter landing sites and two shooting ranges were identified in the middle portion. The major noise sources in this area are vehicular traffic from Man Kam To Road, Lin Ma Hang Road, Kong Nga Po Road, Ping Che Road, railway noise from MTRC railway, and the BCPs. The ambient noise environment is generally tranquil except at the areas adjacent to the noise sources.

Eastern Portion

The eastern portion covers Sha Tau Kok and the areas to the east of Heung Yuen Wai, mainly with hilly/ mountainous terrain. The area is rural in character with low rise village type developments in Lin Ma Hang and Sha Tau Kok. Industrial premises were not identified within the area. The NENT Landfill and its Extension, however, are located to the south of Heung Yuen Wai outside the Study Area. A total of five helipads/ helicopter landing sites were identified in the eastern portion. The major road traffic noise sources in this area are from Sha Tau Kok Road and Lin Ma Hang Road. The ambient noise environment is generally tranquil except at the areas adjacent to the noise sources.

7.2.5 Noise Sensitive Receivers

7.2.5.1 Existing NSRs

Representative existing Noise sensitive receivers (NSRs) within 300m and in the vicinity of the Study Area that are potentially affected by the road improvement scheme are identified with reference to the HKPSG and Annex 13 of TM-EIAO. Noise sensitive uses including residential, educational, clinic and home for the aged have been identified in the Study Area. The identified NSRs are summarised in **Table 7.2.5** and their locations are shown in **Figures 7.2.1 to 7.2.6**.

Table 7.2.5 Identified existing noise sensitive receivers

NSR ID	Description	Use [1]	Potential Noise Sources [2]
Middle Portion			
N28	Village House along Lo Wu Station Road	R	Man Kam To Road
N29	Village House along Man Kam To Road (Southern Section)	R	Man Kam To Road
N30	Village House at junction between Kong Nga Po Road and Man Kam To Road	R	Man Kam To Road
N33	Village House in Sha Ling (West of Man Kam To Road)	R	Man Kam To Road
N38	Village House in Sha Ling (East of Man Kam To Road)	R	Man Kam To Road
N39	Village House near Sha Ling Livestock Waste Composting Plant	R	Man Kam To Road
N40	Temple near Sha Ling Livestock Waste Composting Plant	W	Man Kam To Road
N41	Village House to the South of Man Kam To VHA	R	Man Kam To Road
N44	Village House to the West of Man Kam To VHA	R	Man Kam To Road
N45	San Uk Ling Village	R	Man Kam To Road
N50	Muk Wu Nga Yiu Village	R	Lin Ma Hang Road
N52	Village House to the North of Lo Shue Ling	R	Lin Ma Hang Road
N53	Village House near Chow Tin Tsuen	R	Lin Ma Hang Road
N54	Chow Tin Tsuen	R	Lin Ma Hang Road
N55	Fung Wong Wu	R	Lin Ma Hang Road
N56	Ta Kwu Ling Village	R	Lin Ma Hang Road
N57	Village House along Kong Nga Po Road	R	Kong Nga Po Road
N74	Kan Tau Wai	R	Ping Che Road
N75	Village House next to Ta Kwu Ling Village	R	Lin Ma Hang Road
N76	Kaw Liu Village	R	Lin Ma Hang Road
N77	Village House along access road to NENT Landfill	R	Lin Ma Hang Road
N78	Tsung Yuen Ha Village	R	Lin Ma Hang Road
N79	Village House to the South-west of Pak Fu Shan	R	Lin Ma Hang Road

NSR ID	Description	Use [1]	Potential Noise Sources [2]
N80	Ha Heung Yuen	R	Lin Ma Hang Road
N81	Heung Yuen Wai	R	Lin Ma Hang Road
N82	Village House to the South of Pak Fu Shan	R	Lin Ma Hang Road
N84	Village House to the East of Pak Fu Shan	R	Lin Ma Hang Road
N85	Village House along Lin ma Hang Road near Wang Lek	R	Lin Ma Hang Road
Eastern Portion			
N87	Lin Ma Hang Village	R	Lin Ma Hang Road

Note:

[1] R – residential; E – educational; C – medical clinics; H – home for the aged; W – Place for Worship

[2] For existing receivers, only potential noise sources due to the proposed developments/works under the current landuse planning within 300m are considered.

7.2.5.2 Planned Noise Sensitive Uses

All future sensitive uses proposed in the RDP, including the village zone, adaptive uses of the existing public schools for holiday camp, Ecolodge, comprehensive development in Kong Nga Po, residential development in Hung Lung Hang, recreational areas, and planned GIC uses are summarized in **Table 7.2.6** and illustrated in **Figure 7.2.1 to 7.2.6**. All future NSRs are assumed with setback of 10m from road networks except for Kong Nga Po Comprehensive Development Area, Eco-Lodge and Recreational Area near Tong To Ping Tsuen which are based on the preliminary conceptual layout plan.

Table 7.2.6 Identified planned noise sensitive receivers

NSR ID	Location	Use	Potential Noise Source [1]
Western Portion			
P1	Eco-Lodge	Tourist Accommodation	Boundary Patrol Road
P2	ex-Lung Kai Public School	Holiday Camps/ Bird-watching and Visitor Centre	Ma Tso Lung Road, Lo Wu Classification Range, Lo Wu Classification Range Helipad
Middle Portion			
P4	Kong Nga Po Comprehensive Development Area	Residential Development	Kong Nga Po Road, Kong Nga Po Shooting range, Table Hill Shooting range
P5	Hung Lung Hang Residential Area	Residential Development	Kong Nga Po Road
P6	ex-Sam Wo Public School	Holiday Camps/ Administration Center for Sustainable Farming	Lin Ma Hang Road
P7	Planned Recreational Area near Pak Fu Shan	Residential Development and Horse Riding School	Lin Ma Hang Road, Pak Fu Shan Operational Base Helipad and Pak Fu Shan Camp Helipad, Liantang/Heung Yuen Wai BCP
P12	Planned Recreational Area near Fung Wong Wu	Agri-tourism and residential Development	Lin Ma Hang Road Ping Che Road Liantang Highway Liantang/Heung Yuen Wai BCP
Eastern Portion			
P8	ex-King Sau Public School	Holiday Camps/ Museum/ Field Study Center	Lin Ma Hang Road, Kong Shan Helipad
P9	ex-Kwan Ah Public School	Holiday Camps/ Country Park Visitor Center	Sha Ho Road
P11	Planned Recreational Area near Tong To Ping Tsuen	Ecolodge/ Farming/Camping ^[2]	Sha Tau Kok Road

Note:

[1] Included both existing and planned noise sources within 300m in general.

[2] According to the latest planning concept, camp site, fruit field, fish pond, prawn pond and prawn feeding pond are located at the southern part of the development area; whereas lotus pond, football court, playground, paddy rice field, organic farm, etc are located at the northern part of the development area. Eco-lodge is the only noise sensitive use which is planned further away at the northern end of the development area. NSRs are thus selected within this area for assessments.

The village zones (**Table 7.2.7**) are assessed for noise impacts at selected representative locations at their respective site boundary. All NSRs are assumed with setback of 10m from road networks.

Table 7.2.7 Identified noise sensitive receivers at village zones

NSR ID	Location	Use ^[1]	Potential Noise Source ^[2]
Western Portion			
V1	Planned Lok Ma Chau Village Zone	R	Boundary Patrol Road
V2	Planned Liu Pok Village Zone	R	Boundary Patrol Road
Middle Portion			
V3	Planned San Uk Ling Village Zone	R	Man Kam To Road, Man Kam To BCP
V4	Planned Muk Wu Village Zone	R	Man Kam To Road, Man Kam To BCP
V5	Planned Muk Wu Nga Yiu Village Zone	R	Lin Ma Hang Road
V6	Planned Chow Tin Village Zone	R	Lin Ma Hang Road
V7	Planned Fung Wong Wu Village Zone	R	Ping Che Road
V8	Planned Kan Tau Wai Village Zone	R	Ping Che Road
V9	Planned Tong Fong Village Zone	R	Ping Che Road
Eastern Portion			
V10	Planned Tsung Yuen Ha Village Zone	R	Lin Ma Hang Road, Liantang-Heung Yuen Wai BCP
V11	Planned Ha Heung Yuen Village Zone	R	Lin Ma Hang Road
V12	Planned Heung Yuen Wai Village Zone	R	Lin Ma Hang Road
V13	Planned Lin Ma Hang Village Zone	R	Lin Ma Hang Road, Kong Shan Helipad
V14	Planned San Kwai Tin Village Zone	R	Lin Ma Hang Road
V15	Planned Tong To Village Zone	R	Sha Tau Kok Road
V16	Planned San Tsuen Village Zone	R	Sha Tau Kok Road, Sha Tau Kok Operational Base Helipad
V17	Planned Muk Min Tau and Tsiu Hang Village Zone	R	Sha Tau Kok Road, Sha Tau Kok Operational Base Helipad
V18	Planned Ha Tam Shui Hang Village Zone	R	Sha Tau Kok Road, Sha Tau Kok Operational Base Helipad
V19	Planned Sheung Tam Shui Hang Village Zone	R	Sha Ho Road, Sha Tau Kok BCP, Sha Tau Kok Operational Base Helipad
V20	Planned Shan Tsui Village Zone	R	Sha Ho Road, Sha Tau Kok BCP, Sha Tau Kok Operational Base Helipad
V21	Planned Chuk Yuen Village	R	Lin Ma Hang Road, Liantang Highway

Note:

^[1] R – residential

^[2] Included both existing and planned noise sources within 300m in general.

7.2.6 Assessment Methodology

7.2.6.1 Road Traffic Noise

The assessment is undertaken in accordance with EPD's EIAO Guidance Note No. 12/2005 Road Traffic Noise Impact Assessment. Road traffic noise calculation is based on the method of UK Department of Transport "Calculation of road Traffic Noise (CRTN)". The predicted noise levels at the sensitive receivers include 2.5 dB(A) facade reflection and correction factors for effects due to gradient, distance, view angle, road surface and barriers.

The CRTN compliance computer programme, RoadNoise 2000, has been used to model traffic noise on the road networks. Road traffic noise levels are presented in terms of noise levels exceeded for 10% of the one-hour period during the peak traffic flow, i.e. L_{10,1hr} dB(A).

It was advised that the road improvement scheme is indicative and preliminary only. Upgrading and widening works are only required for Man Kam To Road, Lin Ma Hang Road and Kong Nga Po Road. Provision of passing-bays at existing local access roads in Muk Wu, Ha Heung Yuen, Chuen Yuen and Shan Tsui is also required, but this would involve only minor works and road widening is not proposed, thus they are not considered as "improved road" in this assessment. No land resumption is assumed at this planning stage.

In cases where the proposed road alignments would encroach onto the existing building premises, the feasibility of improvement works will be subject to further review. For the purpose of road traffic noise assessment, the concerned sections will be considered as existing roads.

All the proposed developments are expected to be completed in Year 2020. Calculations of future road traffic noise were based on the peak hourly flow in respect of the maximum traffic projected within a 15 year period upon completion of the road improvement scheme and all proposed developments (i.e. Year 2035). According to EPD's Guidance Note 12/2005, the traffic noise impact is considered significant if the traffic noise level at the NSRs with the project is greater than that without the project at Year 2035 by 1.0 dB(A) or more. The following two scenarios have been conducted:

- Predicted overall noise Levels with the project scenario after 15 years upon commissioning of all road improvement scheme and all proposed development areas (i.e. Year 2035)
- Predicted overall noise levels without the project scenario at the same year (i.e. without modification in Year 2035)

Where the predicted noise impacts exceed the applicable noise criteria, direct mitigation measures shall be considered on the proposed road project in an appropriate manner to reduce the noise from the improved road project to a level that it

- is not higher than the standard; and
- has no significant contribution to the overall noise from other existing roads, if the cumulative noise level, i.e. noise from the new road together with other existing roads, exceeds the standard (i.e. not more than 1.0dB(A))

According to EPD's Guidance Note 12/2005, in the case where NSRs are still exposed to noise levels exceeding the relevant noise criteria after the implementation of all direct mitigation measures, the total number of existing dwellings, classrooms and other noise sensitive elements which may qualify for indirect technical remedies, the associated costs and any implications for such implementation should be identified and estimated. The eligibility of the affected premises for indirect technical remedies is determined with reference to the following three criteria:

- the predicted overall noise level must be above a specified noise level (e.g. 70 dB(A) for domestic premises and 65 dB(A) for education institutions, all in $L_{10,1hr}$);
- the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the works to construct the road were commenced; and
- the contribution to the increase in the predicted overall noise level from the road project must be at least 1.0dB(A).

For planned sensitive uses of the proposed development areas which are also subject to potential road traffic noise impacts, the overall noise levels for maximum projected traffic within 15 years after its commissioning (i.e. Year 2035) have been predicted. In the case where the planned NSRs are exposed to excessive noise levels, direct mitigation measures shall be proposed to mitigate to within the relevant noise criteria.

7.2.6.2 Fixed Noise

Based on the current landuse proposal, the following noise sensitive uses of the proposed development areas are subject to potential fixed noise impacts:

- ex-Lung Kai Public School (P2; **Figure 7.2.2**) at about 250m from the Lo Wu Classification Range

- proposed Kong Nga Po Comprehensive Development Area (P4; **Figure 7.2.3**) at about 100m and 450m from the Kong Nga Po Shooting range and Table Hill Shooting range, respectively
- proposed San Uk Ling Village Zone (V3; **Figure 7.2.3**) and Muk Wu Village Zone (V4; **Figure 7.2.3**) are both at 270m from Man Kam To BCP, respectively
- proposed recreational area near Fung Wong Wu (P12; **Figure 7.2.4**), proposed recreational area near Pak Fu Shan (P7; **Figure 7.2.4**) and proposed Tsung Yuen Ha Village Zone (V10; **Figure 7.2.4**) at about 10m, 20m and 60m from the boundary of Heung Yuen Wai BCP, respectively
- proposed Shan Tsui Village Zone (V20; **Figure 7.2.6**) and Sheung Tam Shui Hang Village Zone (V19; **Figure 7.2.6**) are at about 10m and 150m from the existing Sha Tau Kok BCP, respectively

For fixed noise assessment, the Area Sensitivity Ratings at the NSRs are determined in accordance with the TM-Places. The Closed Area consists of Country Park, village type development and low density residential area. An Area Sensitivity Rating of “A” is therefore assigned.

The Area Sensitivity Ratings are determined based on the best available information at this stage. Nothing in this report shall bind the Noise Control Authority in the context of law enforcement against any fixed noise sources being assessed.

Noise monitoring were conducted at the representative Noise Sensitive Receivers (NSRs) affected by fixed noise sources to determine the prevailing noise levels. Where the prevailing background noise levels are at more than 5 dB(A) below the relevant ANL, for planning purpose the prevailing background noise levels shall be adopted as the fixed noise criteria in accordance with the TM-EIAO and HKPSG. The applicable daytime and evening noise criteria are determined and summarized in **Table 7.2.8** below. Night-time noise assessment for the identified fixed noise sources at Man Kam To and Sha Tau Kok BCPs and shooting ranges are not required as they are not in operation from 2300 to 0700 of the following day.

Table 7.2.8 Summary of noise criteria for fixed noise

NSR	Time Period	Prevailing Noise Level dB(A)	Area Sensitivity Rating	ANL-5 dB(A)	Criteria dB(A)
P2 – ex-Lung Kai Public School (Figure 7.2.2)	Day & Evening	42	A	55	42
P4 – Kong Nga Po Comprehensive Development Area (Figure 7.2.3)	Day & Evening	43	A	55	43
V3 – San Uk Ling Village Zone (Figure 7.2.3)	Day & Evening	75	A	55	55
V4 – Muk Wu Village Zone (Figure 7.2.3)	Day & Evening	47	A	55	47
V10 – Tsung Yuen Ha Village Zone (Figure 7.2.4) ^[1]	Day	52	A	55	52
	Evening	48	A	55	48
	Night	44	A	45	44
V20 – Shan Tsui Village Zone (Figure 7.2.6)	Day & Evening	57	A	55	55

Note:

^[1] The prevailing noise levels are referenced from the approved EIA Study “NENT Landfill Extension” (EIA-133/2007). There is no change in landuse and development within the closed area and change in the prevailing noise background is not expected. The data is considered valid for this SEA study.

^[2] When individual project is implemented in future, the adopted noise criteria shall be updated in the detailed studies.

The fixed noise assessment for the identified noise sources at existing BCPs, shooting ranges and railway station has been conducted based on the following general procedures:

- Carry out on-site noise measurement to determine the noise levels associated with the fixed noise sources at the nearest receiver, and/or, where applicable, at source;
- Identify the separation distance between the affected NSR and the noise source position, where applicable;
- Apply correction for the distance attenuation where applicable;
- Apply corrections for façade, barrier or topographical effect, acoustic reflection where applicable;
- Apply a positive correction of 3 dB(A) to take account of the impulsiveness nature of shooting range;
- Predict fixed noise source impact levels at the planned NSRs. For future sensitive receivers without block layout plan, assessment points are assumed at the site boundary. In case of exceedance, minimum setback distance required and possible mitigation options are determined.

Assessment of fixed noise from the planned Liantang / Heung Yuen Wai BCP will be made reference to the “*Planning Study on Liantang / Heung Yuen Wai BCP and its Associated Connecting Roads in Hong Kong – Feasibility Study*”.

7.2.6.3 Helicopter Noise

Information on the number of movements at each of the identified helipads between 1st Jan 2007 and 31st Dec 2008 has been provided by Government Flying Service (GFS). Details are listed in **Table 7.2.9** below.

Table 7.2.9 Identified helipads and number of movement

Helipad ID	Location	Number of Movement
H1	Lok Ma Chau	5
H2	Lok Ma Chau Operational Base (Sandy Spur Camp)	0 (Closed)
H3	Lo Wu Range	51
H4	Crest Hill Operation Base	0
H5	Sandy Ridge	0
H6	Man Kam To	8
H7	Pak Fu Shan Operational Base	0
H8	Pak Fu Shan Camp	1
H9	Kong Shan	2
H10	Robin's Nest Alternate	0
H11	Pak Kong Au	4
H12	Sha Tau Kok	4
H13	Robin's Nest	0

It was also advised by GFS that the helipads can be used for both emergency and pre-planned tasks by the government department. There are no fixed flight paths and routes. Currently, two types of helicopter are used, namely aircraft type Super Puma AS 332 L2 and EC 155 B1. The helipad at Sandy Spur Camp (H2) is closed. There are no plans to build any further sites in the area.

For helicopter noise impact assessment, reference has been made to the approved EIA Study “*Helipad at Yung Shue Wan, Lamma Island*” (EIA-114/2005). Noise associated with the helipad will be generated during helicopter manoeuvring over the helipad and during lateral (approach / departure) flight. It is identified in the EIA-114/2005 that the maximum noise level is generated when the helicopter is in the air without lateral movements (either during hovering or lift-off mode) and hence would be the representative worst assessment

scenario. The following summaries the helicopter operation mode (without lateral movement):

- ‘Hovering’ – helicopter turns on the spot over the helipad to achieve the desirable orientation for touchdown / lift-off;
- ‘Touchdown’ – helicopter descends on to the helipad surface;
- ‘Idling’ – helicopter remains on the helipad surface with its rotary blades kept running; and
- ‘Lift-off’ – helicopter ascends vertically from the helipad surface to achieve a hover before departure.

According to Table 1A, Annex 5 of the TM-EIAO, helicopter noise impacts shall be assessed in terms of the L_{max} level, which is the maximum instantaneous sound pressure level at the noise sensitive receiver. With reference to the EIA Study, the L_{max} for helicopter Super Puma AS 332 L2 and EC155 B1 in air were measured to be 90.6 and 87.7 dB(A), respectively, at a reference distance of 150 m (**Table 7.2.10**).

Table 7.2.10 Helicopter noise data

Configuration	L_{max} Noise Level ^[1,2]		Remarks
	Super Puma AS332 L2	EC 155 B1	
Without Lateral Movements			
Helicopter on ground, Idling	82.0	80.0	Free-field measurements
Helicopter in the air	90.6 ^[3]	87.7 ^[4]	

Notes:

- [1] Ref: EIA Study for Helipad at Yung Shue Wan, Lamma Island (EIA-114/2005)
- [2] Noise data at reference distance of 150m.
- [3] Noise level was measured during the hovering mode
- [4] Noise level was measured during lift-off mode

Helicopter noise can be considered as a ‘point’ source. The sound pressure level at NSRs can be evaluated based on standard acoustic principle of a point source propagation.

Corrections are applied for the distance attenuation, façade, barrier or topographical effect where applicable. In case of exceedance, minimum setback distance required for the proposed developments and possible mitigation options are determined.

7.2.7 Prediction and Evaluation of Environmental Impacts

7.2.7.1 Road Traffic Noise

Assessment results indicate that the overall noise levels without the project scenario at NSRs along major roads, such as Man Kam To Road, Ping Che Road, and Sha Tau Kok Road would also exceed the respective noise criteria. The traffic noise impact is considered significant only if the traffic noise level at the NSRs with the project is greater than that without the project at Year 2035 by 1.0 dB(A) or more. Where the predicted noise impacts exceed the applicable noise criteria, direct mitigation measures should be considered on the proposed road project to reduce the noise from the improved road project to a level that it:

- is not higher than the standard; and
- has no significant contribution to the overall noise from other existing roads, if the cumulative noise level, i.e. noise from the new road together with other existing roads, exceeds the standard (i.e. not more than 1.0dB(A))

Direct noise mitigation measures should be provided on the proposed road project in order to alleviate the adverse noise impacts at those affected NSRs. Details shall be referred to the **Section 7.2.8**.

7.2.7.2 Fixed Noise**(1) Shooting range**

The maximum unmitigated fixed noise impacts have been measured / predicted at the representative worst affected receiver locations, i.e. ex-Lung Kai Public School (P2; **Figure 7.4.2**) and Kong Nga Po Comprehensive Development Area (P4; **Figure 7.4.3**). Measurements were carried out to establish the noise levels at source and at receivers during firing practices and the results are presented in **Table 7.2.11**. Information on the types of gun used during the firing practice was not provided as the information was regarded as confidential to the public. However, it was advised by HKPF that during the time of the noise monitoring, the shooting ranges were operating at full capacity. Hence, the measurement taken should represent the typical worst-case scenario.

Table 7.2.11 Measured noise levels at shooting range during full-strength firing practice

Location	Measured Noise Level, L_{eq} (30-min) dB(A)
Lo Wu classification range^[1]	
At Lung Kai Public School	52
Background	42
Kong Nga Po shooting range^[2]	
At source (distance of 6m)	84
At distance (40m from range)	69
Background	43
Table Hill shooting range^[3]	
At source (distance of 1.5m)	95
At distance (100m from source)	55
Background	43

Notes:

- [1] Facade measurements made between 1100 and 1200 hours on 19 Feb 2009, and background measurements made between 1100 and 1200 hours on 19 Feb 2009
- [2] Free field measurements made between 1400 and 1600 hours on 18 Sept 2008, and background measurements made between 1000 and 1100 hours on 4 March 2009
- [3] Free field measurements made between 1400 and 1600 hours on 7 Sept 2008, and background measurements made between 1000 and 1130 hours on 4 March 2009
- [4] Microphone was located at 1.2 m above ground.

Fixed noise assessment results are summarised in **Table 7.2.12** below. Results indicate that the unmitigated fixed noise levels at ex-Lung Kai Public School (P2) and Kong Nga Po Comprehensive Development Area (P4) would expose to adverse noise impact during firing practice in Lo Wu Classification Range and Kong Nga Po shooting range with noise exceedance of 10 dB(A) and 25 dB(A) after correction for distance, facade and impulsiveness, respectively. Mitigation measures are required to alleviate the adverse noise impacts.

Table 7.2.12 Summary of unmitigated fixed noise levels at identified NSRs

NSR ID	Location	Shortest Distance from the Source (m)	Noise Criterion dB(A)	Noise Level dB(A)	Exceedance dB(A)
Lo Wu Classification Range					
P2	ex-Lung Kai Public School	250	42	52	10
Kong Nga Po Shooting range					
P4	Kong Nga Po Comprehensive Development Area	98	43	67 ^[1]	24
Table Hill shooting range					
P4	Kong Nga Po Comprehensive Development Area	450	43	42	0

Note: [1] Predicted maximum noise level with facade and impulsiveness correction applied

(2) Boundary Crossing Points**Man Kam To BCP**

Site survey identified that the existing noise environment at San Uk Ling Village Zone (V3; **Figure 7.2.3**) was dominated by traffic noise along Man Kam To Road, where noise from the vehicle holding area (VHA) and kiosks was insignificant that could not be distinguished from the traffic noise. The VHA is only designed for emergency purposes only and there was only a few numbers of vehicles observed parking inside during site survey. No noise from public address (PA) system was perceived. In addition, the dimensions of the existing Hong Kong Customs Import Cargo Examination Building are 58m (L) x 18m (W) x 15m (H) and the residential buildings behind are of 1 to 3 storeys high. The Hong Kong Customs Import Cargo Examination Building thus blocks the line of sight to the residential buildings, acting as a barrier to screen the noise from Man Kam To BCP. In addition, there was no noticeable fixed noise associated with the BCP at the site boundary of Muk Wu Village Zone (V4; **Figure 7.2.3**).

Noise measurements at San Uk Ling village zone (V3) were attempted during peak hours to determine the potential impacts arising from the Man Kam To BCP. Fixed noise was found insignificant and the measured noise levels were again dominated by road traffic noise only. Hence, the fixed noise impact of Man Kam To BCP on the planned receivers in San Uk Ling Village Zone (V3) and Muk Wu Village Zone (V4) are not anticipated. **Table 7.2.13** summarises the ambient noise measurement results.

Table 7.2.13 Measurement data for Man Kam To BCP

Location	Separation Distance (m)	Measured Noise Level, L_{eq} (30-min) dB(A) ^[1]
Ambient noise level at site boundary of San Uk Ling Village Zone ^[2]	270	71
Ambient noise level at 450m along the site boundary of San Uk Ling Village Zone away from Man Kam To BCP ^[2]	-	75

Notes:

- ^[1] Free-field measurements made between 1400 and 1500 hours on 19 Feb 2009, and background measurements made between 1500 and 1530 hours on 19 Feb 2009
- ^[2] San Uk Ling is affected by road traffic noise from Man Kam To Road at 10m and contribution from BCP is negligible

Sha Tau Kok BCP

Site survey identified that the major fixed noise sources arising from Sha Tau Kok BCP were the PA system and the idling vehicles at kiosks. A 8m high, 45m long noise barrier connecting to the existing 5m high noise barrier including concrete bund has been found along the site boundary of the planned Shan Tsui Village Zone (V20; **Figure 7.2.6**). Configuration of the proposed noise barrier has been obtained from Home Affairs Department. The noise barrier will provide noise screening to the future sensitive uses of the proposed village zones.

Noise measurements were conducted at Shan Tsui village zone (V20) (the nearest and worst affected planned receivers) during peak hours to determine the potential impacts arising from the Sha Tau Kok BCP. Results are summarised in **Table 7.2.14** below.

Table 7.2.14 Measurement data for Sha Tau Kok BCP (the worst affected receiver location)

Location	Separation Distance (m)	Measured Noise Level, L_{eq} (30-min) dB(A) ^[1]
Site boundary of Shan Tsui (the worst affected receiver location)	10	62
Background	-	57

Notes: ^[1] Free-field measurements made between 1200 and 1300 hours on 20 Feb 2009, and background measurements made between 1300 and 1330 hours on 20 Feb 2009

The fixed noise impact associated with the Sha Tau Kok BCP is predicted based on the measurement result with the correction for the facade effect applied (**Table 7.2.15**). A noise exceedance of 10 dB(A) is predicted. Mitigation measures are required to alleviate the adverse noise impacts.

Table 7.2.15 Predicted fixed noise level at Shan Tsui village zone (the worst affected receiver location)

NSR ID	Location	Predicted Noise Level dB(A)	Noise Criteria dB(A)	Exceedance dB(A)
V20	Shan Tsui Village Zone (the worst affected receiver location)	65	55	10

Liantang / Heung Yuen Wai BCP

With reference to the “*Planning Study on Liantang / Heung Yuen Wai BCP and its Associated Connecting Roads in Hong Kong – Feasibility Study*”, the identified noise sources in the BCP include kiosks and loading / unloading bay on the lower and upper floor. VHA is considered for emergency use only. Some 2-3 storeys high buildings were proposed along the east and south perimeters of the lower floor of the BCP in the approved feasibility study, acting as screening structure to protect the Tsung Yuen Ha village.

The planned Liantang / Heung Yuen Wai BCP would potentially impact the nearby planned Tsung Yuen Ha Village Zone (V10; **Figure 7.2.4**), Pak Fu Shan (P7; **Figure 7.2.4**) and Recreational Area near Fung Wong Wu (P12; **Figure 7.2.4**) at 60m, 20m and 10m away from the BCF boundary, respectively. Fixed noise impact assessment has been conducted with reference to the method established in feasibility study.

As for worst-case scenario assessment, the fixed noise impact assessment during night-time period has been conducted. The predicted fixed noise levels are presented in **Table 7.2.18** below. It is found that with the proposed building screening structures, Tsung Yuen Ha village zone and Recreational Area near Pak Fu Shan would comply with the noise criteria. However, an exceedance of 5 dB(A) at Recreational Area near Fung Wong Wu during night-time is found, and are therefore required to alleviate the adverse noise impacts. It should be noted that the findings would still be subject to detailed assessment under the EIA of Liantang/ Heung Yuen Wai BCP.

Table 7.2.18 Predicted night-time fixed noise at Tsung Yuen Ha village zone

NSR ID	Location	Predicted Noise Level dB(A)	Noise Criteria dB(A)	Exceedance dB(A)
V10	Tsung Yuen Ha Village Zone ^[1, 2]	42	44	0
P7	Recreational Area near Pak Fu Shan ^[1, 2]	41	44	0
P12	Recreational Area near Fung Wong Wu ^[1, 2]	49	44	5

Note:

^[1] Distances of 60m, 20m and 10m for Tsung Yuen Ha Village Zone, Pak Fu Shan and Recreational Area near Fung Wong Wu mentioned in the text are measured from the site boundaries. Assessment has taken into account the actual distances from various noise sources inside the BCF (i.e. the kiosks and loading/unloading bays).

^[2] Assessment in this study has adopted the same methodology as in the “*Planning Study on Liantang / Heung Yuen Wai BCP and its Associated Connecting Roads in Hong Kong – Feasibility Study*”. For unmitigated case, the screening effect due to the 2-3 storeys buildings proposed in the feasibility study has also been taken into account.

7.2.7.3 Helicopter Noise

Helipads, including Lo Wu Range (H3), Pak Fu Operation Base (H7), Pak Fu Shan Camp (H8), Kong Shan Operation Base (H9) and Sha Tau Kok Operation Base (H12) may have noise impacts on the ex-Lung Kai Public School (P2; **Figure 7.2.2**), ex-King Sau Public School (P8; **Figure 7.2.5**), the planned recreational area near Pak Fu Shan (P7; **Figure 7.2.4**), Lin Ma Hang Village Zone (V13; **Figure 7.2.5**), San Tsuen Village Zone (V16; **Figure 7.2.6**), Muk Min Tau and Tsiu Hang Village Zone (V17; **Figure 7.2.6**), Ha Tam Sheung

Hang Village Zone (V18; **Figure 7.2.6**), Sheung Tam Shui Hang Village Zone (V19, **Figure 7.2.6**) and Shan Shui Village Zone (V20; **Figure 7.2.6**). Since the helipad at Lok Ma Chau has been closed, helicopter noise impact on the proposed Eco-Lodge is not expected.

Table 7.2.21 summarises the predicted L_{max} noise level at the identified NSRs. Exceedances of noise criteria are found at all NSRs. Mitigation measures are required to alleviate the adverse noise impact.

Table 7.2.21 Summary of predicted L_{max} noise levels at identified NSRs

NSR ID	Location	Shortest Separation Distance (m)	Idling, dB(A)		Manoeuvring, dB(A)	
			Super Puma AS332 L2	EC 155 B1	Super Puma AS332 L2	EC 155 B1
P2	ex-Lung Kai Public School	250	80.6	78.6	89.2	86.3
P7	Planned Recreational Area - near Pak Fu Shan	85	89.9	87.9	98.5	95.6
P8	Ex-King Sau Public School	350	77.6	75.6	86.2	83.3
V13	Lin Ma Hang Village Zone	370	77.2	75.2	85.8	82.9
V16	San Tsuen Village Zone	370	77.2	75.2	85.8	82.9
V17	Muk Min Tau and Tsiu Hang Village Zone	315	78.6	76.6	87.2	84.3
V18	Ha Tam Shui Hang Village Zone	80	90.5	88.5	99.1	96.2
V19	Sheung Tam Shui Hang Village Zone	290	79.3	77.3	87.9	85
V20	Shan Tsui Village Zone	300	79	77.0	87.6	84.7

Note: ⁽¹⁾ Bold value indicates exceedance of the L_{max} 85 dB(A) limit.

7.2.8 Mitigation Measures

7.2.8.1 Road Traffic Noise

According to EPD's Guidance Note 12/2005, direct noise mitigation measures should be provided on the improved roads as far as practicable such that the overall noise levels would comply with the relevant standards, or the mitigated noise level from the improved road is not higher than the noise standards and its contribution to the overall noise levels is not more than 1.0 dB(A). Several feasible mitigation options have been investigated in this study. It should however be noted that this study is broad bush assessment only and could be used for indicative and illustrative purposes. When individual project is implemented, the detailed assessment shall be carried out by the respective proponent, and the recommended mitigation measures options shall be evaluated and confirmed subject to detailed investigation, including engineering practicability, land resumption, traffic engineering, cost and social implication, etc.

Option (1) - Setback

Setback distance required to avoid adverse traffic noise impact has been investigated for the planned sensitive uses of the proposed development areas and the planned village zones. However, sensitivity tests identified that a very large setback distance is required for most of the proposed development areas which is greater than 50m and would cover almost half of the village zones. It is therefore considered that distance setback is not feasible for village zones in the current landuse planning framework.

Since the development plan for the recreational areas is subject to development proposal to be submitted by the future project applicant, setback distance is considered effective to protect the future sensitive receivers. According to the latest planning concept for the planned Recreational Area for Tong To Ping Tsuen, eco-lodge is the only noise sensitive use which is planned at the northern end of the development area and a setback distance of 350m from Sha Tau Kok Road is allowed. For the planned Recreational Area near Fung Wong Wu, setback from Ping Che Road, Lin Ma Hang Road and Liantang Highway is recommended; while for the Recreational Area near Pak Fu Shan, setback option from Lin Ma Hang Road is also found as possible mitigation option to tackle adverse traffic noise impacts.

Option (2)- Noise Barrier and Enclosure

Noise mitigation measures in form of vertical barriers, cantilever barriers and full enclosure are practicable mitigation options that could reduce excessive road traffic noise impacts on the existing and planned NSRs. The proposed noise screening structures are mainly reflective type with transparent panels to reduce the visual intrusion and will be supported by structural steel frames fixed on concrete parapets. For barriers installed on a narrow road with receivers located on both sides, absorptive/partially adsorptive type barriers are recommended.

The following six types of the noise mitigation measures are investigated. In general, roadside noise barriers are recommended along the improved sections of Man Kam To Road, Lin Ma Hang Road and Kong Nga Po Road. For planned village zones in the Sha Tau Kok area, as Sha Tau Kok Road is not subject to any road improvement works, noise barrier are proposed along the site boundary of the village zones to protect the future receivers instead.

- 1m vertical barrier
- 3m vertical barrier
- 5m vertical barrier
- 5m high and 3m cantilever barrier
- 6m high and 3m cantilever barrier
- Full enclosure

For the option (2) - noise barrier and enclosure, and subsequent option (3) - low noise surface and option (4) proposed mitigation measures on existing roads, at source mitigation measures on San Sam Road and Liantang Highway are not considered as both do not require widening or improvement works and Liantang Highway is a new flyover road for which the alignment and mitigation measures are still being investigated under a separate EIA study. Setback distance from Liantang Highway for the planned Recreational Area near Fung Wong Wu has therefore been assumed in these three mitigation options.

With implementation of the recommended barriers and enclosure, the mitigated traffic noise levels at all the planned NSRs and village zones will comply with the relevant noise criteria. Adverse traffic noise impact are still found at some existing NSRs, however the exceedances are caused by the existing roads only and the contribution from the improved roads is very small, i.e. less than 1.0 dB(A).

Option (3) - Low Noise Surfacing

Provision of low noise surfacing materials along Man Kam To Road, Kong Nga Po Road and Lin Ma Hang Road where exceedances are found at receivers has also been investigated. With implementation of this mitigation option, the extent of the noise barrier recommended in Option (2) above could be reduced.

Option (4)- Proposed AT Source Mitigation Measures on Existing Roads

Considering various proposed village zones and proposed developments are close to some heavily trafficked roads such as Sha Ho Road, Sha Tau Kok Road, Ping Che Road, Man Kam To Road, Kong Nga Po Road and Lin Ma Hang Road, and implementation of the mitigation measures proposed within village zones under Column I uses might be less practicable, roadside noise barrier or low noise surfacing material would be possible at-source mitigation measures to protect these future sensitive uses as well as the existing receivers. They would be implemented by relevant government departments in later stage, and hence Option (4) is recommended.

Provision of low noise surfacing materials and proposed roadside noise barrier along the major roads including Sha Ho Road, Sha Tau Kok Road, Ping Che Road, Man Kam To Road, Kong Nga Po Road and Lin Ma Hang Road has been investigated and recommended to tackle the adverse traffic noise impacts on future NSRs.

7.2.8.2 Fixed Noise

Noise exceedances are found at P2 (ex-Lung Kai Public School) affected by Lo Wu Classification Range, P4 (Kong Nga Po Comprehensive Development Area) by Kong Nga Po Shooting range, P12 (Recreational Area near Fung Wong Wu) by Liantang / Heung Yuen Wai BCP, and V20 (Shan Tsui Village Zone) affected by Sha Tau Kok BCP. Mitigation measures are therefore required to alleviate the adverse impact on these planned developments. It should however be noted that this study is broad bush assessment only and could be used for indicative and illustrative purposes. When ex-Lung Kai Public School, Kong Nga Po Comprehensive Development Area, and recreational area near Fung Wong Wu are implemented individually, detailed assessment shall be carried out by the respective proponent with the recommended mitigation measures options evaluated and confirmed by detailed investigation that includes engineering practicability, land resumption, traffic engineering, cost and social implication, etc.

i) Ex-Lung Kai Public School – Figure 7.2.2

Fixing the windows directly facing the Lo Wu Classification Range are considered the most cost effective and practicable mitigation option to mitigate the fixed noise impact. Windows should only be openable on the other side of the building for ventilation. Alternatively, central air conditioning with mechanical ventilation could also be considered.

ii) Kong Nga Po Comprehensive Development Area – Figure 7.2.3

As the proposed residential development is 6-storeys high, barrier wall along the site boundary of the development area facing the shooting range is considered not practicable to mitigate the noise impacts. The option for in-situ mitigation remains to enclose the shooting range with provision of air conditioning, ventilation and sound attenuation system to eliminate the noise nuisance at source to the maximum practicable extent, if the premises is to be kept in place. Alternatively, relocation of the Kong Nga Po Shooting range before population intake of the proposed uses is considered more beneficial to address the interface problems with development potential in the area. Consideration shall also be given to grouping with the other existing shooting ranges within the FCA or in the vicinity. Technical feasibility is subject to further investigation.

Regardless, the implementation of this proposed development area is still subject to private developer's initiatives. Detailed assessment is required for any development proposal for submission of Section 16 planning application in the next stage.

iii) Recreational Area near Fung Wong Wu – Figure 7.2.4

The 2-3 storeys high building structures, as proposed in the Liantang/Heung Yuen Wai BCP Feasibility study are not adequate to protect the Recreational Area near Fung Wong Wu (P12). In order to protect the future sensitive receivers, it is necessary to include an additional barrier next to the outbound kiosks (i.e. the southern kiosks) at the lower floor of

the BCF to tackle the potential noise impacts. Notwithstanding, the proposed mitigation measures would be subject to detailed assessment under the EIA of Liantang/ Heung Yuen Wai BCP.

iv) Shan Tsui Village Zone – Figure 7.2.6

A 8m high noise barrier has been constructed along the boundary of Shan Tsui Village Zone (V20). It is recommended to extend the 8m noise barrier by 150m in order to fully screen the entire BCP and thus protect all concerned proposed village zones nearby including Shan Shui (V20), Sheung Tam Shui Hang Village Zone (V19) and Ha Tam Shui Hang (V18). This proposed barrier will also provide screening effect to protect the village zones from potential road traffic noise.

7.2.8.3 Helicopter Noise

The assessment has covered all NSRs with a setback distance of less than 405m from the helipads (i.e. the minimum setback distance as shown in point ii below) that may be potentially affected by the helicopter noise. Noise exceedances are predicted at P2 (ex-Lung Kai Public School; **Figure 7.2.2**) affected by Lo Wu Classification Range, P7 (Planned Recreational Area near Pak Fu Shan; **Figure 7.2.4**) affected by Pak Fu Shan Operational Base and Pak Fu Shan Camp, P8 (ex-King Sau School; **Figure 7.2.5**) affected by Kong Shan Helipad, V13 (Lin Ma Hang Village Zone; **Figure 7.2.4**) affected by Kong Shan Helipad, as well as V16 (San Tsuen Village Zone; **Figure 7.2.6**), V17 (Muk Min Tau and Tsiu Hang Village Zone; **Figure 7.2.6**), V18 (Ha Tam Shui Hang Village Zone; **Figure 7.2.6**), V19 (Sheung Tam Shui Hang Village Zone; **Figure 7.2.6**) and V20 (Shan Tsui Village Zone; **Figure 7.2.6**) affected by Sha Tau Kok Operational Base.

For village zones, direct mitigation measures are considered not practicable. With reference to the approved EIA Study “Helipad at Yuen Shue Wan, Lamma Island” (EIA-114/2005), it was identified that the duration of helicopter noise impact was short and the effect of the residual helicopter noise on public health was considered insignificant. According to the flight record at Kong Shan Helipad (H9; **Figure 7.2.5**) and Sha Tau Kok Operational Base Helipad (H12; **Figure 7.2.6**), the flight frequency is only once per year and once per 183 days, respectively. The duration of residual impact would be 5 – 10 seconds per exceedance event. Compared to the approved EIA-114/2005 study for which the residual impact was concluded to be not significant with flight movements of once per 2.8 days and 24.3 days for the helicopter model EC155 B1 and Super Puma respectively, the potential residual impacts on the proposed village zones should also be insignificant and would not cause long term noise nuisance taking into account the short impact duration as well as the much lower flight frequency. Nonetheless, the existing village houses are also exposed to infrequent and short duration noise impacts from the helicopter. It should also be noted that with the opening of Closed Area and increasing accessibility from improved road infrastructure, the reliance on helicopter transport to the Closed Area is expected to reduce from the already infrequent usage currently. The need for the helipad is still uncertain.

Various direct mitigation measures has been considered for other proposed development uses and discussed in the following sections. It should however be noted that this study is broad bush assessment only and could be used for indicative and illustrative purposes. When ex-Lung Kai Public School, recreational area near Pak Fu Shan and ex-King Sau School project is implemented individually, detailed assessment shall be carried out by the respective proponent, and the recommended mitigation measures options shall be evaluated and confirmed subject to detailed investigation, including engineering practicability, land resumption, traffic engineering, cost and social implication, etc.

i) Screening by Noise Tolerant Buildings for future development uses in Pak Fu Shan and village zones

Noise tolerant building can serve as a noise screen between the noise sensitive uses and the helipad, but it may not be effective to screen the airborne noise as the helicopter at

certain elevation above ground would be within the direct line of sight from the receivers. Thus, this mitigation measures is considered not effective.

ii) Distance Setback

Based on the assessment results, a setback distance of at least 405m is required in order to protect the future development uses (i.e. P7, V13, V16, V17, V18, V19 and V20). However, for Lin Ma Hang Village Zone (V13), San Tsuen Village Zone (V16), Muk Min Tau and Tsiu Hang Village Zone (V17), Ha Tam Shui Hang Village Zone (V18), Sheung Tam Shui Village Zone (V19) and Shan Tsui Village Zone (V20), the recommended buffer distance is not feasible since the buffer zone would cover over half of these proposed village development zones including the existing receivers. Distance setback is therefore considered not effective for these proposed village zones.

iii) Noise Barrier

Similar to noise tolerant building, noise barrier would not be effective to screen the airborne helicopter noise as the helicopter at certain elevation above ground would be within the direct line of sight from the receivers. Thus, this mitigation measure is considered not effective.

iv) Central air conditioning

For P2 (ex-Lung Kai Public School), P7 (Planned Recreational Area near Pak Fu Shan), and P8 (ex-King Sau Public School), consideration could also be given to the provision of central air conditioning to avoid the adverse helicopter noise impacts. However, it will deprive the premises of natural ventilation and hence mechanical ventilation has to be provided.

To conclude, buffer distance or central air conditioning for the future sensitive uses of the planned recreational area in Pak Fu Shan (P7) are recommended to avoid the adverse helicopter noise impacts. Appropriate measures should be considered during the relevant approval mechanisms to address private applications for occupation of these premises. Central air conditioning and mechanical ventilation should be provided to ex-Lung Kai Public School (P2) and ex-King Sau Public School (P8).

7.2.9 Conclusion

Noise assessment has been conducted to evaluate the noise implication of the proposed development areas of the RDP. The potential road traffic noise impacts caused by the proposed road improvement scheme as well as cumulative impacts from the planned projects including Liantang/Heung Yuen Wai and NENT NDAs on all existing and planned sensitive uses are predicted. Different options of direct mitigation measures are proposed to mitigate the noise from the improved roads to a level not higher than the respective standards and its contribution to the overall noise levels not more than 1dB(A). Fixed windows, barriers, setback and central air conditioning are also recommended to alleviate the fixed noise impacts.

For helicopter noise, mitigation options have been investigated to mitigate adverse noise impact on the affected receivers. Consideration is given to the direct mitigation measures including noise barrier, noise tolerant building and distance setback, etc. Distance setback is considered practicable and effective to mitigate the impacts on Planned Recreational Area near Pak Fu Shan (P7; **Figure 7.2.4**); while provision of central air conditioning shall be considered for ex-Lung Kai Public School (P2; **Figure 7.2.2**) and ex-King Sau School (P8; **Figure 7.2.5**). For Lin Ma Hang Village Zone (V13; **Figure 7.2.5**), San Tsuen Village Zone (V16; **Figure 7.2.6**), Muk Min Tau and Tsiu Hang Village Zone (V17; **Figure 7.2.6**), Ha Tam Shui Hang Village Zone (V18; **Figure 7.2.6**), Sheung Tam Shui Hang Village Zone (V19; **Figure 7.2.6**) and Shan Tsui Village Zone (V20; **Figure 7.2.6**), direct mitigation measures are considered not practicable. However, in consideration of the short impact

duration and low flight frequency, the residual impact would not give rise to any serious long term environmental implications.

It should be noted that this study is broad bush assessment only and could be used for indicative and illustrative purposes. When individual project is implemented, detailed assessment shall be carried out by the respective proponent, and the recommended mitigation measures options shall be evaluated and confirmed subject to detailed investigation, including engineering practicability, land resumption, traffic engineering, cost and social implication, etc. The actual implementation of the mitigation measures shall therefore be subject to further investigation and recommendation in next stage when the individual project is implemented. The future quantitative assessment should be based on reasonably worst case situation at the time of applications and the mitigation measures proposed and implemented in future may be a combination of self-protecting building design, setback, barriers, sensible building disposition/orientation, etc. not limiting to the mitigation measures recommended in this Study. For village development zones for which the houses (New Territories Exempted House only) are always permitted under Column I, explanatory statements in the future statutory OZP shall follow the same practices as the existing OZPs such as OZP S/NE-FTA/10 Fu Tei Au & Sha Ling to specify that the future village house development near the major noise sources should be avoided and suitable noise mitigation measures such as self-protective building design, noise barrier would be required. This will provide a guideline for relevant Government to vet small house applications through Lands Department.

7.3 Water Quality Impact

7.3.1 Introduction

This chapter presents the assessment of potential water quality impacts arising from the proposed developments in the RDP. Desktop review of background information on the existing water systems, the respective catchments and the water characteristics of important water bodies for Closed Area has been undertaken. Relevant water quality objectives, criteria and standards for the water systems and Water Sensitive Receivers (WSRs) have been reviewed. Flow and loads projections for the existing and potential water pollution sources together with the capability of the existing and future sewerage infrastructure and any measures to cope with the increased flow and loads of all pollution sources of the proposed developments have been evaluated. The need for follow-up investigations and their mitigation measures for avoiding and minimising the potential impacts are presented.

7.3.2 Environmental Legislation, Standards and Guidelines

The relevant legislation and associated guidelines applicable to the study for the assessment of water quality impacts associated with the construction and operation of the Project include:

- Water Pollution Control Ordinance (WPCO);
- Technical Memorandum on Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (WPCO, Cap. 358, S.21);
- Environmental Impact Assessment Ordinance (Cap. 499, S.16), Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO), Annex 6 and 14;
- Hong Kong Planning Standards and Guidelines (HKPSG); and
- Practice Note for Professional Persons (ProPECC), Construction Site Drainage (PN1/94)

7.3.2.1 Water Pollution Control Ordinance

The Water Pollution Control Ordinance (WPCO, Cap 358) provides the major statutory framework for the protection and control of water quality in Hong Kong. According to the

Ordinance and its subsidiary legislation, the entire Hong Kong waters are divided into ten Water Control Zones (WCZs) and four supplementary WCZs. Each WCZ has a designated set of statutory Water Quality Objectives (WQOs). The WQO set limits for different parameters that should be achieved in order to maintain the water quality within the WCZs. The Closed Area spans through the northern New Territories between the Deep Bay and Mirs Bay WCZs. The WQOs for Deep Bay and Mirs Bay WCZs are presented in **Table 7.3.1** and **Table 7.3.2** respectively.

Table 7.3.1 Summary of water quality objectives for marine waters of Deep Bay water control zone

Parameter	Objectives	WCZ
Dissolved Oxygen (DO)	Within 2 m of bottom: > 2 mg/L for 90% samples	Outer marine subzone except mariculture subzone
	Depth average: > 4 mg/L for 90% samples	Inner marine and outer marine subzone except mariculture subzone
	Mariculture: > 5 mg/L for 90% samples	Mariculture subzone
	Rest of water column: > 4 mg/L	Yuen Long & Kam Tin (Upper and Lower) subzones, Beas subzone, Indus subzone, Ganges subzone, water gathering ground subzones and other inland waters of the zone
E. coli	< 610 per 100 mL (annual geometric mean)	Secondary contact recreation subzone and mariculture subzone
pH	6.5 – 8.5 and change due to waste discharge < 0.2	Marine waters except Yung Long bathing beach subzone
Salinity	Change due to waste discharge < 10% of natural ambient level	Whole zone
Temperature	Change due to waste discharge < 2 °C	Whole zone
Suspended Solids (SS)	< 30% increase in the natural ambient level or not to cause the accumulation of suspended solids which may adversely affect aquatic communities	Marine waters
Toxicants	Not to be present at levels producing significant toxic effect	Whole zone
Un-ionized ammonia (UIA)	< 0.021 mg/L (annual mean)	Whole zone
Nutrients	< 0.7 mg/L (annual mean depth average)	Inner marine subzone
	< 0.5 mg/L (annual mean depth average)	Outer marine subzone

Table 7.3.2 Summary of water quality objectives for marine waters of Mirs Bay water control zone

Parameter	Objectives	WCZ
Dissolved Oxygen (DO)	Within 2 m of bottom: > 2 mg/L for 90% samples	Marine waters except fish culture subzones
	Depth average: > 4 mg/L for 90% samples	
	Mariculture: > 5 mg/L for 90% samples	Fish culture subzones
	Rest of water column: > 4 mg/L	Water gathering ground subzones and other inland waters
E. coli	< 610 per 100 ml (annual geometric mean)	Secondary contact recreation subzones and fish culture subzones
	0 per 100 ml	Water gathering ground subzones
	1000 per 100 ml	Other inland waters of the zone
pH	6.5 – 8.5 and change due to waste discharge < 0.2	Marine waters
Salinity	Change due to waste discharge < 10% of natural ambient level	Whole zone
Temperature	Change due to waste discharge < 2 °C	Whole zone

Parameter	Objectives	WCZ
Suspended Solids (SS)	< 30% increase in the natural ambient level or not to cause the accumulation of suspended solids which may adversely affect aquatic communities	Marine waters
Toxicants	Not to be present at levels producing significant toxic effect	Whole zone
Un-ionized ammonia (UIA)	< 0.021 mg/L (annual mean)	Whole zone
Nutrients	< 0.3 mg/L (annual mean depth average)	Marine waters

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

The Technical Memorandum (TM) was issued under section 21 of the WPCO. It sets the limits to control the physical, chemical and microbial quality of effluent discharges into foul sewers, storm water drains, inland and coastal waters.

The criteria for discharges to inland waters depend upon the beneficial uses of the waters. The majority of the inland water bodies potentially affected by the proposed developments are used for the agricultural purposes, which are classified as Group B inland waters, and for pond fish culture, classified as Group C inland waters. The standards for effluents discharged into Group B and Group C inland waters are provided in **Table 7.3.3** and **Table 7.3.4** respectively.

Table 7.3.3 Standards for effluents discharged into Group B inland waters (All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated)

Flow rate(m ³ /day) Determinand	≤ 200	> 200 and ≤ 400	> 400 and ≤ 600	> 600 and ≤ 800	> 800 and ≤ 1000	> 1000 and ≤ 1500	> 1500 and ≤ 2000	> 2000 and ≤ 3000
pH (pH units)	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
Temperature (°C)	35	30	30	30	30	30	30	30
Colour (lovibond units)(25mm cell length)	1	1	1	1	1	1	1	1
Suspended solids	30	30	30	30	30	30	30	30
BOD	20	20	20	20	20	20	20	20
COD	80	80	80	80	80	80	80	80
Oil & Grease	10	10	10	10	10	10	10	10
Iron	10	8	7	5	4	3	2	1
Boron	5	4	3	2.5	2	1.5	1	0.5
Barium	5	4	3	2.5	2	1.5	1	0.5
Mercury	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Selenium	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Other toxic metals individually	0.5	0.5	0.2	0.2	0.2	0.1	0.1	0.1
Total Toxic metals	2	1.5	1	0.5	0.5	0.2	0.2	0.2
Cyanide	0.1	0.1	0.1	0.08	0.08	0.05	0.05	0.03
Phenols	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Fluoride	10	10	8	8	8	5	5	3
Sulphate	800	800	600	600	600	400	400	400
Chloride	1000	1000	800	800	800	600	600	400

Flow rate(m ³ /day) Determinand	≤ 200	> 200 and ≤ 400	> 400 and ≤ 600	> 600 and ≤ 800	> 800 and ≤ 1000	> 1000 and ≤ 1500	> 1500 and ≤ 2000	> 2000 and ≤ 3000
Total phosphorus	10	10	10	8	8	8	5	5
Ammonia nitrogen	5	5	5	5	5	5	5	5
Nitrate + nitrite nitrogen	30	30	30	20	20	20	10	10
Surfactants (total)	5	5	5	5	5	5	5	5
<i>E. coli</i> (count/100ml)	100	100	100	100	100	100	100	100

Note: Source from TM, EPD.

Table 7.3.4 Standards for effluents discharged into Group C inland waters (All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated)

Flow rate (m ³ /day) Determinand	≤ 100	> 100 and ≤ 500	> 500 and ≤ 1000	> 1000 and ≤ 2000
pH (pH units)	6-9	6-9	6-9	6-9
Temperature (°C)	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1
Suspended solids	20	10	10	5
BOD	20	15	10	5
COD	80	60	40	20
Oil & Grease	1	1	1	1
Boron	10	5	4	2
Barium	1	1	1	0.5
Iron	0.5	0.4	0.3	0.2
Mercury	0.001	0.001	0.001	0.001
Cadmium	0.001	0.001	0.001	0.001
Silver	0.1	0.1	0.1	0.1
Copper	0.1	0.1	0.05	0.05
Selenium	0.1	0.1	0.05	0.05
Lead	0.2	0.2	0.2	0.1
Nickel	0.2	0.2	0.2	0.1
Other toxic metals individually	0.5	0.4	0.3	0.2
Total toxic metals	0.5	0.4	0.3	0.2
Cyanide	0.05	0.05	0.05	0.01
Phenols	0.1	0.1	0.1	0.1
Sulphide	0.2	0.2	0.2	0.1
Fluoride	10	7	5	4
Sulphate	800	600	400	200
Chloride	1000	1000	1000	1000
Total phosphorus	10	10	8	8
Ammonia nitrogen	2	2	2	1
Nitrate + nitrite nitrogen	30	30	20	20
Surfactants (total)	2	2	2	1
<i>E. coli</i> (count/100ml)	1000	1000	1000	1000

Note: Source from TM, EPD.

7.3.2.3 No Net Increase in Pollution Loads Requirement

In addition to the provisions of the TM, the ‘No Net Increase in Pollution Loads Requirement’ aims to provide protection to the inland and marine water quality of the Deep Bay WCZ. The pollutions entering into Deep Bay have exceeded the assimilative capacity of the water body. Any increase pollution loads to the water body is environmentally undesirable.

Therefore, new developments in the Deep Bay catchment should not result in an increase in pollution loads and the residual loading should be offset.

7.3.2.4 Environmental Impact Assessment Ordinance (EIAO), Cap. 499, S16

The general criteria and guidelines for evaluating and assessing water quality impacts are listed in Annexes 6 and 14 of the Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO).

7.3.2.5 Hong Kong Planning Standards and Guidelines

Chapter 9 of the Hong Kong Planning Standards and Guidelines (HKPSG) outlines environmental requirements that need to be considered in land use planning. The recommended guidelines, standards and guidance cover the selection of suitable locations for the developments and sensitive uses, provision of environmental facilities, and design, layout, phasing and operational controls to minimise adverse environmental impacts. It also lists out environmental factors influencing land use planning and recommend buffer distances for land uses.

7.3.2.6 Practice Note for Professional Persons on Construction Site Drainage

The Practice Note for Professional Persons (ProPECC Note PN1/94) on Construction Site Drainage provides guidelines for the handling and disposal of construction discharges. This note is applicable to this study for control of site runoff and wastewater generated during the construction phase. The types of discharges from construction sites outlined in the ProPECC Note PN1/94 include:

- Surface run-off;
- Groundwater;
- Boring and drilling water;
- Wastewater from concrete batching;
- Wheel washing water;
- Bentonite slurries;
- Water for testing and sterilization of water retaining structures and water pipes;
- Wastewater from building construction and site facilities; and
- Acid cleaning, etching and pickling wastewater.

7.3.3 Description of the Environment

The currently available background water quality data in the Study Area has been reviewed. The Study Area spans through the northern New Territories between the Deep Bay WCZ and subzones to the west and Mirs Bay WCZ and subzones to the east. Among other streams and inland waters, Ng Tung River (River Indus) and Ping Yuen River (River Ganges) are the major rivers in the Study Area. Situating on flat land, many of these rivers have been trained for flood prevention.

7.3.3.1 Marine Water Quality

According to the annual reports of Marine Water Quality in Hong Kong published by EPD, marine water quality monitoring stations in the vicinity of the Study Area are DM1 and MM1 in Deep Bay and Mirs Bay, respectively. **Tables 7.3.5** and **7.3.6** below summarises the monitoring results from these two stations over the past five years between 2004 and 2008.

Table 7.3.5 Marine water quality of Deep Bay between 2004 and 2008

Parameter	Deep Bay (DM1) ^[1]				
	2004	2005	2006	2007	2008
Dissolved oxygen (mg/l)	3.3	2.9	3.8	3.8	5.2
Ammonia nitrogen (mg/l)	5.68	4.84	3.07	5.62	2.88
Unionised ammonia (mg/l)	0.162	0.096	0.041	0.057	0.045
Nitrite nitrogen (mg/l)	0.27	0.29	0.269	0.256	0.284
Nitrate nitrogen (mg/l)	0.32	0.35	0.52	0.259	0.528
Total inorganic nitrogen (mg/l)	6.26	5.48	3.86	6.13	3.70

Parameter	Deep Bay (DM1) ^[1]				
	2004	2005	2006	2007	2008
Total Kjeldahl nitrogen (mg/l)	7.00	5.79	3.73	7.10	3.76
Total nitrogen (mg/l)	7.59	6.43	4.51	7.61	4.57
Orthophosphate phosphorus (mg/l)	0.55	0.48	0.35	0.549	0.278
Total phosphorus (mg/l)	0.79	0.68	0.51	0.73	0.41
<i>E. coli</i> (count/100 ml)	3,600	9,800	2,000	5,000	1,400
pH	7.7	7.5	7.3	7.1	7.4
Salinity (psu)	18.5	16.6	16.1	17.1	17.0
Suspended solids (mg/l)	74.3	49.5	58.5	20.7	41.5

Note:

^[1] DM1 is the monitoring station in Deep Bay;

^[2] Data is collected from annual reports of Marine Water Quality from year 2004 to 2008, EPD

Table 7.3.6 Marine water quality of Mirs Bay between 2004 and 2008

Parameters	Mirs Bay (MM1) ^[1]				
	2004	2005	2006	2007	2008
Dissolved oxygen (mg/l)	8.0	7.2	7.9	6.8	8.0
Ammonia nitrogen (mg/l)	0.08	0.11	0.08	0.07	0.05
Unionised ammonia (mg/l)	0.006	0.007	0.004	0.005	0.004
Nitrite nitrogen (mg/l)	<0.01	0.01	0.014	0.007	0.004
Nitrate nitrogen (mg/l)	0.01	0.04	0.03	0.038	0.039
Total inorganic nitrogen (mg/l)	0.10	0.17	0.13	0.12	0.09
Total Kjeldahl nitrogen (mg/l)	0.30	0.30	0.28	0.28	0.30
Total nitrogen (mg/l)	0.31	0.35	0.32	0.32	0.34
Orthophosphate phosphorus (mg/l)	0.01	0.01	<0.01	0.01	0.008
Total phosphorus (mg/l)	0.03	0.03	0.03	0.03	0.03
<i>E. coli</i> (count/100 ml)	44	96	39	29	21
pH	8.3	8.3	8.2	8.2	8.3
Salinity (psu)	32.3	31.5	31.7	32.2	31.4
Suspended solids (mg/l)	6	5.2	5	3.9	5.1

Note:

^[1] MM1 is the monitoring station at Starling Inlet in Mirs Bay;

^[2] Data is collected from annual reports of Marine Water Quality from year 2004 to 2008, EPD

Deep Bay has the poorest water quality in the territory with high concentrations of organic and inorganic pollutants and low levels of DO. In 2008, the WQO compliance in the Deep Bay WCZ (40%) was higher compared with that in 2007 (26%) but similar to that in 2006 (40%). In order to protect the important ecosystem and improve water quality of Deep Bay, a “No Net Increase in Pollution Loads Requirement” policy has been imposed by EPD on Deep Bay catchment areas, which prohibits any net increase in pollution load to the bay.

In 2008, the Mirs Bay WCZ fully met the WQOs for DO, TIN, NH₃ and *E.coli*. In fact, the WQO compliance of the Mirs Bay WCZ has been maintained at 100% since 1999, except for 2007 which was 89% due to a lower DO compliance of 64%. The *E.coli* counts in Mirs Bay were generally very low (1 to 2 cfu / 100mL) with Starling Inlet, which borders between Shenzhen and Sha Tau Kok, recorded a slightly higher count. The chlorophyll-a level in Mirs Bay remained stable in the past few years, indicating that there was little sign of increasing algal growth in the bay.

The Sha Tau Kok Fish Culture Zone (FCZ) is located in a sheltered bay on the Inner Starling Inlet, marginally outside the Study Area occupying a licensed raft area of 10,000 to 20,000 m². This part of Mirs Bay has an excellent history of compliance with WQOs.

7.3.3.2 River Water Quality

Shenzhen River is the boundary river between Hong Kong and Shenzhen, and is drainage outlets of various rivers in the two places. Its tributaries include Ng Tung River, Ping Yuen River and Sheung Yue River. Shenzhen River flows into Inner Deep Bay estuary, and so its water quality has significant effect on the water quality of Mai Po Ramsar Site.

Shenzhen River was highly polluted by industrial and domestic discharges due to the rapid development of industry and residential buildings in Shenzhen. In recent years, Hong Kong and Shenzhen governments jointly completed the three-stage Shenzhen River Regulation Project in order to enhance the flood protection to the areas along the Shenzhen River and dilution and diffusion capacity of the river, which in turn also improve the water quality. A summary of the water quality of various sections of Shenzhen River from 2006 to 2007 is presented in **Table 7.3.7**.

Table 7.3.7 River water quality at various sections of Shenzhen River between 2006 and 2007

Parameters	Shenzhen River Sections					
	Shenzhen River Mouth		Ta Sha Lok		Man Kam To	Ping Yuen River Mouth
	2006	2007 ^[2]	2006	2007 ^[2]	2006	2006
pH	6.86	7.25	6.81	6.9	6.71	6.93
DO (mg/L)	4.32	6.99	1.58	3.72	2.71	3.87
BOD ₅ (mg/L)	9.73	7.32	28.95	25.49	14.26	18.82
SS (mg/L)	43.73	51.87	66.02	41.86	62.3	69.19

Note:

1. Data was collected from the Environmental Impact Assessment Report of Construction of a Secondary Boundary Fence and New Sections of Primary Boundary Fence and Boundary Patrol Road, in 2009.
2. Only data from Jan to May for 2007 is available.
3. Data for Chemical Oxygen Demand (COD) is not available.

The water quality of Ng Tung River and Ping Yuen River are presented in **Table 7.3.8**. According to the annual reports of River Water Quality in Hong Kong published by EPD, inland water quality monitoring stations within the Study Area are IN1 and GR1 in Ng Tung River and Ping Yuen River, respectively. As the largest watercourse in the North District, Ng Tung River covers a catchment area of 43 km², with a total stretch of 49 km in length. The water quality of its upstream is good, but deteriorates as it runs through unsewered rural areas collecting runoff and discharge from villages and livestock farms in the Study Area. The downstream station (IN1) which is subject to backflow from Shenzhen River had only 33% compliance on WQO in 2008.

Covering an area of 18 km² and 31 km in length, Ping Yuen River receives discharge from pig and chicken farms. The water quality of its upstream is good, but deteriorates as it runs through unsewered rural areas collecting runoff and discharge from villages and farms. The downstream station GR1 has 47% compliance on WQO in 2008.

Table 7.3.8 Water quality of major rivers in the Study Area between 2004 and 2008

Parameter	Concentration				
	2004	2005	2006	2007	2008
Ng Tung River (River Indus) (IN1)^[1]					
Dissolved oxygen (mg/l)	3.9	3.6	3.8	5.8	29
5-day biological oxygen demand (mg/l)	15	11	7	6	10
Chemical oxygen demand (mg/l)	30	31	26	20	25
Suspended solids (mg/l)	37	34	25	16	35
pH	7.1	7.1	7.2	7.2	7.1
<i>E. coli</i> (cfu/100 ml)	190,000	320,000	140,000	68,000	210,000
Ammonia-nitrogen (mg/l)	5.85	5.80	5.35	1.45	9.75
Nitrate-nitrogen (mg/l)	1.05	1.00	1.20	3.30	1.30
Total Kjeldahl nitrogen (mg/l)	8.80	6.80	7.00	3.30	12.0

Parameter	Concentration				
	2004	2005	2006	2007	2008
Ortho-phosphate (mg/l)	0.64	0.63	0.70	0.54	0.44
Total phosphorus (mg/l)	1.40	1.15	1.04	0.79	0.94
Ping Yuen River (River Ganges) (GR1)^[2]					
Dissolved oxygen (mg/l)	3.9	4.8	6.2	6.6	6.1
5-day biological oxygen demand (mg/l)	16	32	38	7	8
Chemical oxygen demand (mg/l)	49	78	60	26	25
Suspended solids (mg/l)	79	29	50	14	22
pH	7.4	7.4	7.6	7.4	7.2
<i>E. coli</i> (cfu/100 ml)	130,000	120,000	230,000	67,000	35,000
Ammonia-nitrogen (mg/l)	17.50	20.50	36.00	4.7	6.05
Nitrate-nitrogen (mg/l)	0.21	0.25	0.28	0.80	0.61
Total Kjeldahl nitrogen (mg/l)	20.50	27.00	44.00	6.20	7.70
Ortho-phosphate (mg/l)	4.50	5.20	7.15	1.40	1.80
Total phosphorus (mg/l)	5.55	6.90	8.60	1.80	2.25

Notes:

- ^[1] IN1 is the monitoring station at Ng Tung River;
^[2] GR1 is the monitoring station at Ping Yuen River;
^[3] Data is collected from annual reports of River Water Quality from year 2004 to 2008, EPD
^[4] cfu - colony forming unit.

Lin Ma Hang Stream is a natural stream with riparian vegetation. The stream water is clean, slow flowing and relatively undisturbed. This stream is listed as a Site of Special Scientific Interest (SSSI), since it is one of the lowland streams recognized as having high ecological value. It supports a very high diversity of primary freshwater fish. Water quality data of Lin Ma Hang Stream was obtained and summarized in **Table 7.3.9**.

Table 7.3.9 Water quality of Lin Ma Hang stream in 2006

Parameters	Lin Ma Hang Stream	
	Downstream	Upstream
DO (mg/L)	7.85	8.15
pH	6.75	6.5
SS (mg/L)	2.75	7
BOD ₅ (mg/L)	3	3
COD (mg/L)	6	3.5
Ammonia-nitrogen (µg/L)	<10	15
Nitrite-nitrogen (µg/L)	<10	<10
Nitrate-nitrogen (µg/L)	<10	19.5
Zinc (ug/L)	<10	<10
Iron (µg/L)	310	270
Magnesium (µg/L)	605	400

Note:

- Data was collected from Environmental Impact Assessment Report of Construction of a Secondary Boundary Fence and New Sections of Primary Boundary Fence and Boundary Patrol Road, in 2009
- The "<" sign denotes that the actual value was below reporting limit.

7.3.3.3 Water quality of Fish Ponds

The Study Area includes a large number of fishponds. They are located in Mai Po, San Tin, Lok Ma Chau, Hoo Hok Wai, Lo Wu, Man Kam To and Ho Sheung Heung. Water quality monitoring data are only available for the three fishponds located near the boundary fence in Lok Ma Chau area as summarized in **Table 7.3.10**. High turbidity and level of suspended solid indicate poor water quality in the fishponds.

Table 7.3.10 Water quality of fish pond in Lok Ma Chau area

Parameter	Fish Pond
Dissolved Oxygen (mg/L)	4.1 (1.8 – 7.1)
Turbidity (NTU)	54.6 (6.6 – 206)
Suspended Solid (mg/L)	88 (11 – 1700)

Note:

1. Data was collected from Environmental Impact Assessment Report of Construction of a Secondary Boundary Fence and New Sections of Primary Boundary Fence and Boundary Patrol Road, in 2009
2. Samples were taken at water surface from Dec 2002 to Aug 2003.

7.3.3.4 Existing Drainage Systems

Flood Protection in New Territories

Most parts of Northern District are now protected against regional flooding to a reasonable level generally acceptable to the public. However, local flooding can still occur in the more upstream areas of Ng Tung River and Sheung Yue River, and in the older urban areas because of the inadequacy of drainage systems constructed long ago.

To further improve the situation, Drainage Services Department (DSD) has been planning a comprehensive programme of drainage improvement works with the aim to providing Hong Kong with a higher degree of flood protection in satisfying the future need of the community for sustainable development.

Flood prevention projects in the New Territories (NT) can broadly be classified into two main types, namely drainage channels to collect and convey floodwater to the sea and village flood pumping schemes to protect villages in low-lying areas.

With the completion of drainage channels in recent years, the flooding situation in the NT has been significantly improved, particularly in Lo Wu, Ho Sheung Heung, Yin Kong and Tin Ping Shan in the North New Territories (NNT) and Tin Shui Wai, Yuen Long and Kam Tin in the Northwest New Territories (NWNT). Tens of thousands of citizens in these flood-prone areas have been relieved of flood risks.

As regards low-lying villages in the flood plain areas, DSD had completed 27 village flood pumping schemes to address the flood risks at 35 low-lying villages. The last two schemes at Tai Kiu and Shui Pin Tsuen were completed in the end of year 2006. Over 240 hectares of low-lying village area accommodating a population of 30,000 people are now protected.

The majority of the Study Area falls within the catchment boundary of Shenzhen River. Under the present condition, the runoff from the site is conveyed to Shenzhen River through the primary drainage system and natural water courses for its discharge into Deep Bay. The flooding condition within the study area has improved considerably after the implementation of drainage improvement works proposed under various schemes. But, the capacity of trained rivers does not take into consideration any proposed landuse changes under this study and therefore mitigation measures in the form of detention tanks have been proposed for various developments under this study. The runoff from the proposed landuse changes will be conveyed to the nearest river/channel system through the internal drainage system. Adequate mitigation measures in the form of desilting traps and petrol interceptor as per DSD Practice Notes will be adopted at suitable locations to intercept sediment and other pollutants from the development site. Therefore, no pollutant will enter into river/ draining system after the development. The capacity of river/channel to cater for the additional flow from proposed developments and the necessity of any upgrading shall be investigated after taking into consideration the other developments with the catchment boundary of associated drainage system in the next study.

Shenzhen River Regulation Project

Shenzhen River is the boundary river between the Hong Kong Special Administrative Region (HKSAR) and the Shenzhen Special Economic Zone with a catchment area of

approximately 313 km². It is the drainage outlet of the San Tin River, Ng Tung River and Ping Yuen River on Hong Kong side as well as that of Shawan River, Buji River and Futian River on Shenzhen side. Regional flooding in these river catchments can only be alleviated after training of Shenzhen River.

A Joint Working Group on the Shenzhen River Regulation Project was set up between the Government of HKSAR and the Shenzhen Municipal Government for implementation of the Project. The project consists of four stages to straighten, widen and deepen some 18 km of the existing Shenzhen River. The trained Shenzhen River section has attained the required drainage capacity of a 50-year return period. The flooding problems in low-lying areas along the Shenzhen River such as Muk Wu, Man Kam To and Lo Wu have been alleviated. Together with the drainage improvement measures in NNT, the flooding problems in San Tin, Fanling, Sheung Shui and Ta Kwu Ling area can be resolved. Coupled with the completion of drainage improvement in Shenzhen, the flooding problem in Shenzhen City can be alleviated. The flood risk associated with Shenzhen Reservoir discharge would also be resolved.

Flood situation radically changed status of water ecosystem. Flooding will contribute considerable pollution of streams and rivers with contaminated suspended solids. The loading of pollutant entries to the water bodies via suspended solids might be very significant during the flood period. The extreme flows causing significant ecological streams disturbance are the natural phenomena which are multiplied by human activities. The human activities like agriculture, irrigation and urbanization change frequency and peak discharges in receiving water bodies. The effect of flood can be summarized into three groups: hydraulic and hydrological, chemical and morphological changes of the water body. All these groups have significantly effect on the benthic community structure. With the drainage mitigation measures, the flooding problem will be mitigated and hence the above adverse effects to water quality would be minimised.

7.3.3.5 Existing Sewerage System

Domestic sewage from unsewered areas in the North District is only partially treated by private treatment facilities before being discharged into Deep Bay via stormwater drains and streams. Most of these treatment facilities are septic tanks and soakaway systems in village houses. The effectiveness of these facilities in removing pollutants depends on their size, whether they are located in areas where the ground conditions are suitable for the soakaway systems to work properly and whether there is adequate maintenance of the systems.

The North District Sewerage Master Plan (SMP) was formulated in 1994 to extend the sewerage system to 74 unsewered villages in the North District and to upgrade the existing Shek Wu Hui Sewage Treatment Works (SWHSTW) to meet the demands of new developments.

Taking into account local circumstances in different areas and overall development needs, the village sewerage scheme under the SMP was divided into two stages. Stage 1 covers the extension of the existing sewerage network to 38 unsewered areas in the eastern and western parts of the North District catchment while Stage 2 covers the extension of sewerage to the remaining 36 unsewered areas in the southern and north-eastern parts of the catchment. The stage 1 of phase 1A works, which covers trunk sewerage works in the central and western parts of North District, was completed in March 2002.

The village sewerage scheme is designed to cater for increasing wastewater flow from the population growth within the catchment area of Fanling/Sheung Shui and committed extension of sewerage to unsewered areas. The mitigation measures of intercepting sewage from nearby unsewered villages to SWHSTW for treatment, the pollution loadings contributed by the unsewered areas and SWHSTW would be reduced and this is in line with

the “No Net Increase in Pollution Loads Requirement”. The village sewerage scheme also further helps to protect the water quality in Deep Bay.

The urban areas and some of the villages in the vicinity of the study area falls within the sewage catchment boundary of SWHSTW, while that of Sha Tau Kok and Lok Ma Chau area falls within the sewage catchment area of Sha Tau Kok Sewage Treatment Works (STKSTW) and Yuen Long Sewage Treatment Works (YLSTW). However, the proposed village zones within the Study Area are scattered village type developments with majority of them still using the septic tanks due to lack of sewerage facilities.

Currently, there is no sewerage system except for a rising main which convey sewage flows from North East New Territories (NENT) Landfill site and also from some of the villages located along with the Ping Che Road to SWHSTW. The location of existing rising main along with the pumping station is given in **Section 6.3** Sewerage Impact Assessment (SIA).

As detailed in the SIA, a number of village sewerage schemes have been planned (also refer to **Section 6.3** for locations). The majority of those schemes are in planning stage. The sewage from the villages would be progressively conveyed to the YLSTW, STKSTW and SWHSTW through either gravity sewer or rising mains.

However, these planned sewerage works are not designed to cater for additional sewage flow generated from proposed developments from this study. Additional proposed sewerage improvement works are detailed in **Section 6.3**.

7.3.4 Water Sensitive Receivers

Some proposed development areas are located in close proximity to a number of fish ponds and water courses. The Water Sensitive Receivers (WSRs) that may be affected by the construction and operation of the proposed developments include the following:

- Shenzhen River;
- Mai Po Inner Deep Bay Ramsar Site;
- Ng Tung River (River Indus);
- Ping Yuen River (River Ganges);
- Lin Ma Hang Stream SSSI;
- Natural streams within the Study Area (mainly at San Kwai Tin);
- Mangroves at Starling Inlet;
- Fish Ponds at Mai Po, San Tin, Lok Ma Chau, Hoo Hok Wai, Lo Wu and Man Kam To;
and
- Sha Tau Kok Fish Culture Zone.

The locations of these WSRs are shown in **Figures 7.3.1 to 7.3.6**

7.3.5 Identification and Evaluation of Environmental Impacts

7.3.5.1 Construction Phase

The general impact associated with the proposed development has been identified and included:

- construction site runoff and drainage;
- general construction activities;
- sewage effluent produced by on-site workforce.

Construction Site Runoff and Drainage

Runoff from the construction works areas may contain increased loads of sediments, other suspended solids and contaminants. Potential sources of pollution from site drainage include:

- runoff from and erosion of exposed soil surfaces, earth working areas and stockpiles;
- release of grouting, cement, and other materials with rain wash;
- wash water from dust suppression sprays; and
- fuel, oil and lubricants from maintenance of construction vehicles and mechanical equipment.

Sediment laden runoff particularly from works areas subjected to excavation or earth works, if uncontrolled, may carry pollutants (adsorbed onto the particle surfaces) into the streams or rivers nearby (WSRs). As a good site practice, mitigation measures should be implemented to control construction site runoff and drainage from the works areas, and to prevent runoff and drainage water with high levels of suspended solids from entering the WSRs or drainage channels discharging to Deep Bay. With the provision of sediment removal facilities, it is anticipated that unacceptable water quality impacts would not arise. The construction phase discharge would be collected by the temporary drainage system installed by the Contractor and then treated or desilted on-site.

General Construction Activities

On-site construction activities may cause water pollution from the following:

- uncontrolled discharge of debris and rubbish, such as packaging, construction materials and refuse; and
- spillages of liquids stored on-site, such as oil, diesel and solvents etc.

Good construction and site management practices should be observed, to ensure that litter, fuels and solvents do not enter the WSRs and the public drainage system.

Sewage Effluent from on-site Workforce

Domestic sewage would be generated from the workforce during the construction phase. However, portable chemical toilets can be installed within the construction site. The future Contractor will have the responsibility to ensure that chemical toilets are used and properly maintained, and that licensed Contractors will be employed to collect and dispose of the waste off-site at approved locations.

According to the information provided by Engineer, minimal sewage will be generated from the workforce during construction work and can be treated by chemical toilets. Therefore adverse water quality impacts would not be expected.

Cumulative Impacts

The following projects might be undertaken concurrently with the construction works for the proposed developments in Study Area.

- The proposed Liantang/Heung Yuen Wai BCP;
- The proposed Northern Link;
- The proposed Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link;
- The proposed NENT Landfill Extension;
- The proposed Kwu Tung North New Development Areas (NDA), Fanling North NDA and Ping Che/ Ta Kwu Ling NDA;

- The proposed Lok Ma Chau Loop Development.

The identified concurrent projects and other small-scale local construction activities to be undertaken within the Study Area may introduce pollution loadings to the local drainage systems. However, such impacts may be readily controlled by implementation of adequate mitigation measures, good site practices and effective site management under individual projects. Cumulative water quality impacts are not anticipated.

7.3.5.2 Operational Phase

The general impact associated with the proposed development has been identified and included:

- stormwater impact; and
- sewage generated by the proposed developments.

(1) Stormwater Impact

General

Runoff from the study area is conveyed to Shenzhen River through its tributary. There are a number of development proposals which include enhancement of environment, expansion of villages, new village type development and Government Institution and are spread from Lok Ma Chau to Sha Tau Kok. The development proposals will not have any adverse impact on the drainage system. However, drainage improvement works are required to provide the design flood protection level. It is proposed to include the proposed landuse changes for the design of river training works and also for the study on “Review of Drainage Master Plans in Yuen Long and North District”. However, detailed drainage impact assessment is recommended under the investigation stage to identify and for the design of mitigation measures due to proposed development.

Surface run-off contaminated by the stable complex

As a worst-case planning scenario, a Horse Riding School is proposed at Recreational Area near Pak Fu Shan in Planning Area 4. The construction of the stable will not cause additional catchment to the existing proposed drainage system and there will be no significant change to the site’s impermeable areas. The site is directly adjacent to the Shenzhen River, therefore, surface runoff can easily be discharged to the river channel.

Surface runoff at this proposed stables complex may be contaminated with horse manure due to the number of horses residing in the area. Mitigation measures are required to alleviate the impact to the Shenzhen River.

Surface run-off contaminated by landscaped areas

Rainwater falling on landscaped areas would infiltrate into the soil. Rainfall in excess of this capacity creates surface water run-off. Rainwater and surface run-off passes into surface drainage channels and eventually passes to the storm water drains.

Most of the water running off from the landscaped areas would drain into nearby surface channels along the road side. This type of surface channel would be connected to the storm water drain and diverted to the proposed public drainage system.

Environmental friendly fertiliser and pesticide in compliance with AFCD requirement under Pesticide Ordinance i.e. readily degradable with low residual half-life of less than 3 days and low toxicity, should be used at landscaped areas.

The application rate of fertilizer may vary due to status of turf growth and amount of rainfall. Fertility programme is based on observations on the turf conditions and the seasonal lifecycle of the grass to ascertain if optional fertilizers are applied. The microorganisms associated with turf are responsible for metabolizing fertilizers and using nutrients to support their growth. Nitrogen used by microorganisms is turned into complex organic compounds

within the microorganisms. These microorganisms are relatively short-lived, and when they die the nitrogen is released as complex forms of N. Microbial population turns this quick-release N (Fertilizer) into slow-release N. The rapidly utilized N results in very little mobile form of N (Free NO_3). Complex forms of N do not move downward to any extent in soils. Phosphorus will also be applied to turf to support healthy plant and root growth. Phosphorus generally does not move in soil because it binds with clay, aluminium and calcium. It is also applied less frequently and generally at much lower application rate than nitrogen fertilizers.

Pesticides

All pesticides used are registered under the Pesticide Ordinance. Pesticides are used with reference to lifecycle of particular pest. Other pest management strategies, including cultural and biological are utilized for the best of the turf conditions.

Considerations are given to minimize exposure to public and to avoid environmental contamination in the form of spray drift and chemical leaching by:

- No pesticide application on windy and rainy days policy;
- Proper disposal of pesticide containers;
- Observing safety regulation pertaining to the use of pesticide; and
- Warning sign to public.

Product with lower toxicity and environmental persistence should be used, given the same efficacy against the same target pest. In addition, pesticide application should be carried out by skilled and trained staff to meet the above criteria. The application rate of different chemicals should follow the recommended rate provided by the manufacturer.

It is expected that most of the applied fertiliser and pesticide would be retained within the soil/ plant matrix, e.g. absorbed onto the surface of soil particles. Any residual chemicals present in run-off water would likely be of very low concentration since most of the chemicals applied have a relatively high molecular weight and limited solubility in water, and are readily adsorbed onto particle surfaces. In addition, release of pesticides and fertilisers could be readily controlled by adoption of appropriate mitigation measures.

Pesticides and fertilisers should not be applied during or prior to forecast heavy rainfall, and readily degradable chemicals should be used and where possible “natural” rather than “artificial” compounds should be selected. For instance, certain pesticides are not chemicals but are actually microbes that can specifically attack pests. In addition, run-off will not be discharged directly to sea but will be collected in trenches (containing loose soil or other porous media) around or downstream of the landscaped areas. The trenches would act as temporary holding areas to collect the “first-flush” run-off and to allow particles that may have chemical content to settle out and to enhance infiltration and absorption of residual chemicals into the soil of the trenches.

(2) Sewage generated by the proposed developments

The urban areas and some of the villages in the vicinity of the study area falls within the sewage catchment boundary of SWHSTW, while that of Sha Tau Kok and Lok Ma Chau area falls within the sewage catchment area of Sha Tau Kok Sewage Treatment Works (STKSTW) and Yuen Long Sewage Treatment Works (YLSTW). More sewage will be generated from the proposed developments, which is however mainly due to the natural growth of population from the villages. The estimated sewage flow and loads from the proposed developments as well as proposed sewerage collection and treatment are detailed in the SIA in **Section 6.3**.

Sewage generated from the proposed developments will not be directly discharged to the nearby WSRs. The sewage generated will be treated by package STP or septic tank with leach field or STWs. In order to achieve the objective of total water management and to

meet “No Net Increase in Pollution Loads in Deep Bay”, effluent reuse is recommended for flushing and irrigation purposes and any excess effluent will be disposed by means of leach-field. The sewage generated from the proposed development will be collected and treated together with the current sewage to ensure no net increase in pollution loads discharged into the Deep Bay and any residual pollution loads should be offset. The effluent standard for respective package STP will be determined during detailed design stage.

As for San Kwai Tin, there are only 5 residents in that village currently. Should this village be expanded, a maximum of 123 residents are expected. With such small sewage flow, sewage flow of the village at is recommended to be treated using septic tanks with leach-field. Whilst the possible use of septic tank plus leach-field as a primitive treatment alternative for very small amount of sewage flow from San Kwai Tin should not be totally ruled out at this preliminary stage, more detailed assessment of whether it is suitable or not would be required at a later stage in future.

(3) Emergency Discharge

As detailed in the SIA, several sewerage improvement works such as construction of package STP as well as the provision of new STW and STW upgrading works are proposed. During operational phase, potential water quality impact issue as a result of pumping station failure, repairing and maintenance of pressurized sewers may be experienced. Under these circumstances, raw sewage will be overflow from the emergency discharge by gravity and enters the nearby water body. Recommendations for minimizing the duration of untreated sewage discharges are described in next section.

7.3.6 Mitigation Measures

7.3.6.1 Construction Phase

The general proposed mitigation measures for containing and minimizing water quality impacts are summarised below.

Construction Run-off and Drainage

The site practices outlined in ProPECC PN 1/94 “Construction Site Drainage” should be followed as far as practicable in order to minimise surface runoff and the chance of erosion. The following measures are recommended to protect water quality and sensitive uses of the Study Area, and when properly implemented should be sufficient to adequately control site discharges so as to avoid adverse water quality impacts:

- Before commencing any site formation work, all sewer and drainage connections should be sealed to prevent debris, soil, sand etc. from entering public sewers/drains;
- Temporary ditches should be provided to facilitate run-off discharge into appropriate watercourses, via a silt retention pond;
- Boundaries of earthworks should be marked and surrounded by dykes;
- Sand/silt removal facilities such as sand/silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the TM standard under the WPCO. The design of silt removal facilities should be based on the guidelines provided in ProPECC PN 1/94. All drainage facilities and erosion and sediment control structures should be inspected monthly and maintained to ensure proper and efficient operation at all times and particularly during rainstorms;
- Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be regularly removed, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times;
- Exposed soil surfaces should be covered;

- Water pumped out from foundation excavations should be discharged into silt removal facilities;
- If excavation cannot be avoided during rainy seasons, temporarily exposed slope/soil surfaces should be covered by a tarpaulin or other means, as far as practicable and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds. Interception channels should be provided (e.g. along the crest/ edge of the excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm;
- Exposed soil areas should be minimized to reduce the potential for increased siltation and contamination of run-off;
- Earthwork final surfaces should be well compacted and subsequent permanent work should be immediately performed;
- Open stockpiles of construction materials or construction wastes on-site of more than 50m³ should be covered with tarpaulin or similar fabric during rainstorms;
- Use of sediment traps wherever necessary; and
- Maintenance of drainage systems to prevent flooding and overflow.

With standard water pollution control measures set out in ProPECC PN1/94 in place, it is anticipated that the construction phase discharges would comply with the WPCO requirements.

General Construction Activities

Debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering any nearby water bodies and public drainage system. Stockpiles of cement and other construction materials should be kept covered when not being used.

Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to nearby water bodies and public drains, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.

Sewage Generated from On-site Workforce

Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site where necessary to handle sewage from the workforce. A licensed contractor would be responsible for appropriate disposal of waste matter and maintenance of these facilities.

With full mitigation measures implemented, adverse impacts to the WSRs during the construction phase are not anticipated.

7.3.6.2 Operational Phase

(1) Stormwater Impact

General

The operational stage mitigation measures shall take into account the guidelines published in ProPECC PN 5/93 "Drainage Plans subject to Comment by the EPD". The following mitigation measures will be considered to reduce storm water runoff:

- Provision of silt traps to reduce the concentration of silt/sediments in storm water runoff; and

- Regular inspection and maintenance of the drainage system should be conducted to ensure that sediment traps and other pollutant removal facilities are cleared and in good working order.

Surface run-off contaminated by the stable complex

Sewerage provision for the Stable Complex has been provided in **Section 6.3**, which consist of two systems: the low flow interceptor system and the foul water system. The low flow interceptor system shall be provided to intercept the first foul flush of surface runoff from the stables which may be contaminated with horse manure and convey it to the public sewerage system. This system will be designed with an attenuation tank and pumping station to ensure that the low flow run-off will be discharged to public sewer in a controlled manner during periods of low flow condition. The interceptor system capacity will be designed to intercept flows up to 10 minutes under 1 in 2 year storm event. Hydraulic design of interceptor system will be similar to the design of petrol interceptor for Public Transport Interchange, with the time of concentration for stabilising less than 10 minutes. Capacity of interceptor and its operation should be further reviewed in investigation stage after considering preliminary design of the stables.

Sand traps will be incorporated at the drainage outlet of the trotting ring to prevent sand being conveyed into the tank causing a build up of silt and damage to the pump impellers subject to detailed arrangement in the next stage of development study.

Surface run-off contaminated by landscaped areas

For the control of non-point source discharges, including run-off from landscaped areas that could contain residual pesticides, fertiliser or other such chemicals, the following measures should be adopted:-

- Where possible, surface run-off will be collected into a dedicated storage tank near the turf, to be re-used for irrigation water on landscaped areas;
- Potentially toxic chemicals including pesticides would not be applied during heavy rainfall, or if heavy rainfall were to be forecast imminently;
- Surface run-off will not be discharged direct to Shenzhen River, Ping Yuen River or Lin Ma Hang Stream SSSI but will pass through trenches or catch pits containing loose soil or other porous media to act as a delay to the “first-flush” run-off and to provide a certain amount of additional adsorption capacity; and
- Environmental friendly fertilisers and pesticides in compliance with AFCD requirement under Pesticide Ordinance would be selected where available in the market, either consisting of natural products and/ or having a rapid degradation half life of three days or less and a low toxicity to non-target animals.

(2) Sewage generated by the proposed developments

General

With the advancement in process technology, there are a number of options that could be considered suitable for package STP or upgrading STWs to ambitious treatment levels. These include MBR, BAF, SBR, etc. and are described as below.

The Membrane Bio-reactors (MBR) system consists of utilizing a bioreactor and microfiltration as on unit process for wastewater treatment thereby replacing, and in some cases supplementing, the solids separation function of secondary clarification and effluent filtration. MBR system has been consistently achieving Biochemical Oxygen Demand (BOD) <5 mg/L, Chemical Oxygen Demand (COD)<30 mg/L, ammonia (NH₃)<1 mg/L, Total Nitrogen (TN)<10 mg/L, turbidity<1 and suspended solids (SS)<1mg/L. The MBR system combined with Ultraviolet (UV) disinfection can achieve a higher *E.coli* removal (Metcalf &

Eddy, Inc, 1990). Currently, pilot studies of MBR are being conducted at SWHSTW, Stonecutters' Island STW, Sha Tin STW and Sai Kung STW.

Biological Aerated Filters (BAF) consists of upflow filtration through a submerged and floating fine granular media. It is capable of eliminating all biodegradable pollutants: carbon pollution (COD and BOD), SS, ammonia (N-NH₄) and nitrates (N-NO₃). However, due to an increased residual soluble BOD in the effluent of a BAF system (as a result of the relatively short system retention time), there is a higher element of risk that the system will not achieve an effluent discharge level of 3mg/l BOD: 3mg/l SS. Similar to MBR, with UV disinfection, *E.coli* removal will be enhanced. Should stringent effluent standards are to be met, further effluent polishing such as filter might be required.

The Sequencing Batch Reactors (SBR) is a fill-and-draw type of reactor system involving a single completed mix reactor in which all steps of the activated-sludge process occur. Mixed liquor remains in the reactor during all cycles, thereby eliminating the need for separate sedimentation tanks. It is capable of achieving a discharge level of 20mg/l BOD and 30mg/l SS alone. There have been proven cases of application to small plant in Hong Kong, such as Kennedy Town Refuse Transfer Station and Cage Collison/ Chi Ma Wan Prison. For effluent polishing, dual media tertiary filter is recommended to use with this plant. Reference could be made to Ngong Ping STW. The filter may comprise two layers of fine filter materials: an upper layer of carbon grinds (anthracites) and a layer of silicon sands below. This filter will increase the SS removal. With UV disinfection, bacteria and virus will be sterilized thereby.

The Fixed Media Aeration (FMA) system consists of a fixed media in an aeration tanks. The bacteria grow on the surface of the media and forced aeration is implemented. In this system, most of the bacteria remain fixed to the media and are not carried out of the treatment tank, so that settlement is not so important. However, as the bacteria film on the media grow thicker, the excess film falls off and the bacteria are carried out of the tank with the effluent. A clarifier is therefore necessary to produce an effluent with a low SS content. The settled sludge also requires disposal.

There are proprietary systems such as Biostyr package plant which is supplied by Veolia with a design capacity ranged from 64 to 9,600 m³/d ADWF (peaking factor of 3). The Biostyr process consists of upflow filtration through a submerged, floating fine granular polystyrene media bed.

Microfiltration and Reverse Osmosis (MF/RO) is also identified as appropriate effluent polishing methods to enhance the organic and nitrogenous removal. According to the results of the demonstration MF/RO pilot plant at SWHSTW, an effluent quality of pH 6-8, BOD <10mg/L, turbidity <2 NTU, non-detectable fecal coliform and residual chlorine of less than 1 mg/L could be attained for secondarily treated effluent.

Disposal strategy

A long term comprehensive sewerage scheme to upgrade and enhance the existing sewerage infrastructure works taking into account the latest land use intention in the area as a whole is considered necessary. This shall be coordinated and implemented by relevant government departments and implemented to ensure "No Net Increase in Pollution Loads" in Deep Bay. The recommended sewage treatment processes and upgrade are presented in **Section 6.3**. Sewage is proposed to be conveyed to existing STWs or new tertiary STWs

The capability of the proposed sewage treatment processes discharge into Deep Bay, such as from SWHSTW Upgrade Works, may need to be assessed by NENT NDA Planning and Engineering Study, taking all the proposed potential developments within the sewage catchment area of SWHSTW into consideration. Several advanced compact process technologies have been recommended. In consideration of the small amount of additional sewage flow from the Closed Area, a full-scale upgrading of SWHSTW may not be

necessary and cost effective. Details, however, shall be further developed in investigation stage after considering total flows within sewage catchment area of SWHSTW.

In view of the limited space available for the expansion/upgrade of STKSTW, it is recommended to adopt combined approach in the form of expansion/upgrade of STKSTW and package STP. The detailed scheme shall be developed in investigation stage after considering interfacing with other projects.

A summary of the proposed sewage treatment upgrade with their current Discharge Licence Standards (DLS) are described in **Tables 7.3.12**.

Table 7.3.12 Discharge licence standards of the STWs for this Study

Parameters	Sewage Flow m ³ /day	BOD (mg/L)	TSS (mg/L)	<i>E.Coli</i> (count/100ml)	NH ₃ -N (mg/L)	NO _x -N (mg/L)
SWHSTW	80,000	20	30	1,500	2	12
STKSTW	1,660	20	30	1,500	N/A	N/A

The technology described above, such as MBR, BAF, SBR, etc. are all space saving and compact advanced treatment technologies and could be used for upgrading the biological process of the SWHSTW. However, as for SWHSTW Upgrade, MBR, BAF and SBR may not be able to achieve the effluent reuse quality standard for toilet flushing and irrigation. Additional effluent polishing methods such as addition of MF/RO, sand filtration, dual media tertiary filter may be required. The feasibility of the effluent reuse processes and reuse purposes for SWHSTW is yet to be confirmed by the further pilot plant studies currently being undertaken by DSD.

As for STKSTW, the additional flow has exceeded the design capacity of STKSTW and so extensive upgrading works is needed. Owing to the space limitation of STKSTW, compact treatment processes like SBR, FMA, proprietary systems are recommended.

Regarding the new tertiary STW, treatment processes such as MBR/UV, BAF/UV and SBR/UV together with suitable effluent polishing methods such as sand filtration, dual media tertiary filter as well as the MF/RO is recommended.

(3) Emergency Operation of Pumping Stations

In order to prevent the uncontrolled discharge of untreated sewage effluent to surface waters there will be a need to minimise the risk of failure of the pumping stations.

The following measures should be implemented to reduce the risk of failure of the pumping stations, which could result in an emergency discharge of untreated sewage effluent.

Design Phase

- Twin rising mains are provided for backup and repairing purpose;
- The discharge point of the overflow bypass should be below the low water mark (i.e. location of minimum water level in stream in dry season);
- The discharge point of the overflow bypass should be away from sensitive receivers such as fish ponds, water gathering grounds, country parks, nature reserves, sites of special scientific interest, marine parks/marine reserves, streams with water for human consumption, etc.; and
- A contingency plan for emergency discharge shall be developed.

Operational Phase

- The overflow bypass should be operated only in an emergency, such as prolonged power failure. Overflow mechanism must not occur to facilitate routine maintenance on a regular basis;

- If the pumping station is unmanned, a telemetry system should be provided to the nearest manned station/plant so that swift actions could be taken in the case of malfunction of the unmanned facilities;
- Hand-cleaned screens should be provided at the overflow bypass to prevent the discharge of floating solids into receiving water bodies. The clear spacing of the bar screen should normally be about 25mm;
- Standby pump should be provided to facilitate maintenance and repairing of equipment; and
- Dual (back-up) power supply should be provided. Dual power supply could be in the format of ring main, or an automatic-operated emergency generator with sufficient capacity to cope with the demand loading of the essential plant equipment.

7.3.7 Conclusion

The existing water quality of the water systems within the Study Area has been reviewed. Potential water quality impacts of the landuse planning during construction and operational phase have been assessed.

During construction phase, water quality impacts could be avoided through implementation of adequate mitigation measures such as control measures on site runoff and drainage from the works areas to minimise construction run-off. Proper site management and good housekeeping practices are also required to ensure that construction wastewater would not enter WSRs and the public drainage system. Sewage effluent arising from the construction workforce would also be handled through provision of portable toilets.

Various upgrade options on sewerage infrastructure have been proposed in **Section 6.3**. The existing sewerage improvement works are not adequate for treating future sewage. A long term comprehensive sewerage scheme to upgrade and enhance the existing sewerage infrastructure works taking into account the latest land use intention in the area as a whole is considered necessary. This shall be coordinated and implemented by relevant government departments and implemented to ensure “No Net Increase in Pollution Loads” in Deep Bay. Reuse of effluent for landscape irrigation and flushing water, sewage treated by package STPs, SWHSTW Upgrade and new tertiary STW have been proposed. It is suggested that the feasibility of reusing the effluent from the proposed developments should be assessed together with the other concurrent projects, for cost effectiveness.

7.4 Hazards Assessment for Potentially Hazardous Installations

7.4.1 Introduction

This section presents the assessment of potential hazard impacts arising from Potentially Hazardous Installations (PHI) to the planned sensitive uses in areas from which developments are proposed under the landuse planning. It reviews the population increase within the Consultation Zone of the PHIs and evaluates the degree of potential risk associated with the concerned proposed developments. Proposals of risk mitigation measures required to meet the acceptable risk level have been recommended.

7.4.2 Overview of Potential Risk Implications of the Landuse Framework

The existing Sheung Shui Water Treatment Works (SSWTW) is the only PHI found within and in vicinity of the study area. **Figure 7.4.1** shows the location of the SSWTW. The SSWTW is located 700m to the north-west of the town of Sheung Shui. The site measures 290m by 250m and the chemical house, which contains the chlorine store, chlorinator and absorber, is located to the south of the site. The chlorination house stores liquid chlorine in an ultimate maximum of 56 drums. The drums, with a capacity of 1 tonne, are delivered by truck in batches of up to 6 to re-supply the works, which has an estimated ultimate usage of 1,095 tonnes per year. The SSWTW is classified as potentially hazardous installation (PHI)

with respect to its storage of liquid chlorine in more than the threshold quantity of 1 tonne drums.

From the drums, the liquid chlorine is drawn off and passed to the evaporators for conversion to the gaseous state. The gaseous chlorine is then passed through the chlorinators and dissolves in water at the ejectors to form a chlorinated water solution for dosing into the bulk water stream during the treatment process. The handling and storage of chlorine drums inside the SSWTW therefore pose hazard impact on the neighbouring areas.

In view of the current landuse proposal, the southeast portion of Planning Area 2 and southwest portion of Planning Area 3 fall within the PHI consultation zone of the SSWTW.

7.4.3 Environmental Legislation, Standards and Guidelines

HKPSG provides planning standards and guidelines on land uses located within the consultation zone of PHI. According to the definition of PHI in this guideline, a PHI is an installation which stores hazardous materials in quantities equal to or greater than a specified threshold quantity, which varies with different substances. The risk criteria and requirements for the hazard assessment, planning studies and action plans for existing and proposed PHI are given in this guideline.

The risk guidelines stipulated in the HKPSG and Annexes 4 of the TM-EIAO are given as follows:

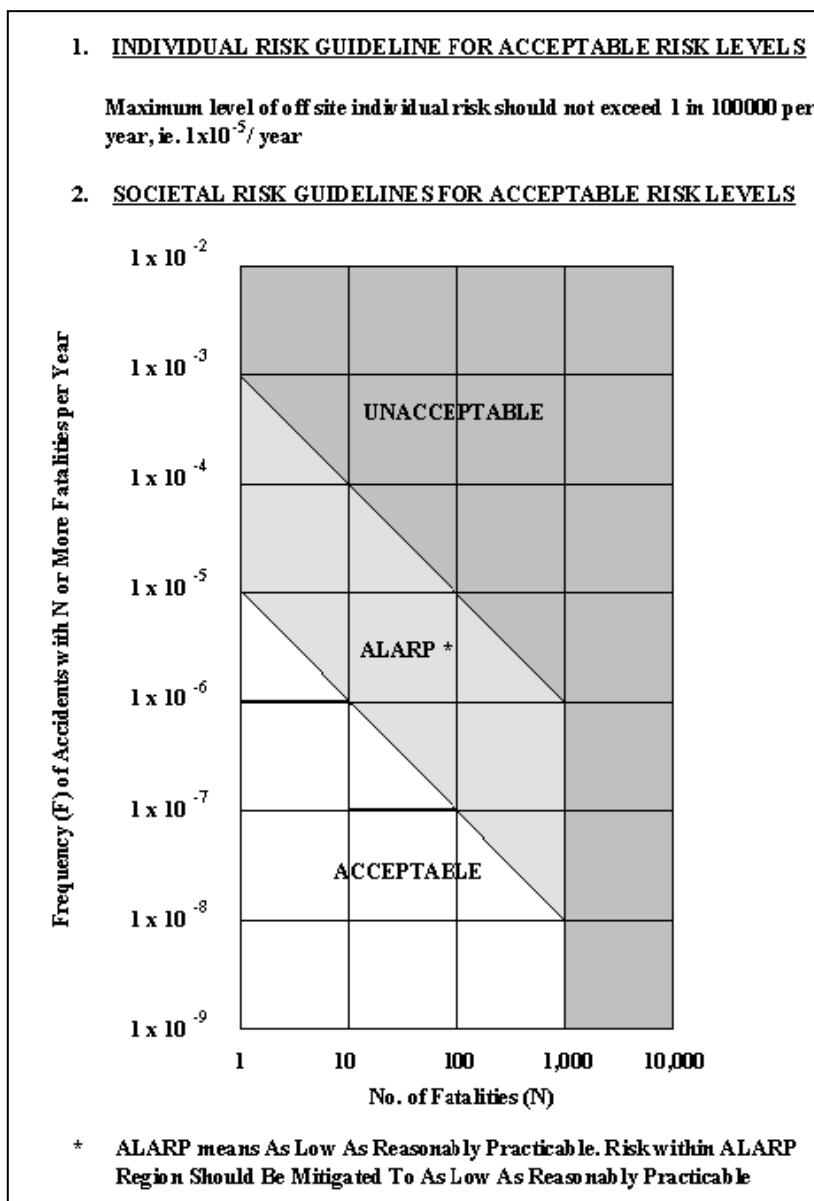
Individual risk

The Individual Risk guideline requires that the maximum level of off-site individual risk should not exceed 1 in 100,000 per year or 1×10^{-5} /year.

Societal Risk

The Societal Risk guideline is presented graphically in **Chart 7.4.1**. Should the total societal risk be in the As Low As Reasonably Practicable (ALARP) region, all practicable and cost-effective risk mitigation measures shall be considered.

Chart 7.4.1 Risk guidelines (sourced from HKPSG & TM-EIAO)



7.4.4 Evaluation of Potential Risk Impacts

7.4.4.1 Review of approved CCPHI paper

Reference has been made to the approved CCPHI paper for the reassessment of Chlorine Hazards for SSWTW which was undertaken to reassess the degree of risk levels as a result of upgrading the chlorine dosing facilities. Key findings of the hazards assessment in respect of the storage, handling and on-site transport of chlorine have been reviewed.

It is noted that the existing chlorination house of SSWTW is designed with safety systems, including the shutting down of the ventilation which will contain the release if the chlorine concentration exceeds 3ppm, and scrubbing which will absorb up to 1 tonne of chlorine via a packed tower with recirculating sodium hydroxide solution. With reference to the approved CCPHI paper, individual risk and societal risk levels within the 1km consultation zone of SSWTW are summarised below:

Risk Mitigation

In the approved CCPHI paper, a number of risk mitigation measures were recommended to reduce the risk. These measures include improvements to access road to reduce risk to as low as reasonably practicable. These measures include improvements to the access road

to reduce risk due to onsite transport of chlorine, provision of containment barrier at the northwest corner of the site to contain releases, provision of retaining brackets for cranes etc to reduce risk due to earthquakes, as well as improvement in truck unloading procedures, etc. to reduce risk due to drum rupture inside the chlorine store. Other measures such as improvements in safety management and staff quarters were also recommended. Recommendations arising from consideration of best practice or those required to comply with the ALARP principle were given in the Action Plan of the approved CCPhi paper.

Individual Risk (Mitigated Case)

The individual risk contours close to the site are significantly reduced from the Base Case and comply with the Hong Kong Risk Guidelines.

Societal Risk (Mitigated Case)

The corresponding FN-curves for the mitigated case based on 2006 population fall into the acceptable region. The total PLL value was calculated to be 2.97×10^{-5} per year, representing a 95% reduction on the Base Case.

Summary

It is concluded that individual and societal risks due to the delivery, storage and handling of chlorine at SSWTW after upgrading will comply with Government Risk Guidelines subject to implementation of the recommendations made in the Action Plan of the report.

7.4.4.2 Qualitative review of potential risk on proposed landuse framework

The southeast portion of Planning Area 2 and southwest portion of Planning Area 3 fall within the PHI consultation zone of the SSWTW. Planning area 2 within PHI consultation zone has been zoned as agriculture, green belt, conservation area and Government Institution or Community (i.e. the existing Lo Wu Correctional Centre). The proposed development area for Man Kam To Development Corridor will partially fall within the 1 km consultation zone of the Sheung Shui Water Treatment Works (SSWTW). The overall planning intention of the Man Kam To Development Corridor is to enhance the local environment and permit non-polluting uses within a clean high quality environment. This zoning is intended primarily for the preservation of the character of the rural area through the provision of complementary logistics and small scale commercial uses of retail, cafe and market facilities.

In formulation of the RDP, consideration has been given to development constraints arising from the PHI consultation zone for the Sheung Shui Water Treatment Works (SSWTW) which extends into the western portion of the proposed Man Kam To Development Corridor. In order to avoid the potential risk impacts, the RDP has specified the development requirements on future layout such that the final development strategy should limit population increase of the western portion of the planned Man Kam To Development Corridor falling within 1km consultation zone of the SSWTW. It should also be noted that the land within the consultation zone is currently used for workshop and vehicle parking. Any new developments such as retail, cafe, commercial and markets with population increase should therefore be located outside the consultation zone, while developments without population growth e.g. landscape buffer or beautification works on the environment of the existing workshops may only be permitted within consultation zone. In this regard, the potential cumulative adverse hazard impact is similar to the existing conditions, as the proposed landuse will not trigger increase in population.

7.4.4.3 Planning control

Appropriate approval conditions on development scale, layout, design, timing of population intake etc could be imposed so as to address any potential environmental impact.

The proposed Man Kam To Development Corridor is recommended to be included within a zone whereby the potential uses within the consultation zone of the SSWTW are contained

under Column 2 of the Statutory Notes such that any development may only be permitted with conditions subject to TPB approval(s) while only some less-intensive uses outside the consultation zone are recommended as Column 1. The explanatory statement and the Notes of the statutory town plans should specify that any net population increase within the consultation zone is subject to PHI hazard and is not desirable; and that a quantitative risk assessment would be conducted in planning application for any development that falls within the consultation zone with an aim to limiting population growth. All future uses in this area will require planning approval. The applicant shall submit the planning application with supporting technical assessments for the approval of TPB. Approval of the hazard assessment by the CCPHI should be obtained before submission of the planning application to TPB for any future development in case it will result in population increase within consultation zone.

Any new development within the proposed zonings of the Man Kam To Development Corridor with population increase shall be controlled by the statutory DPA/OZP uses, i.e. all development in the future statutory plan should require planning approval from the TPB where it is within the consultation zone for the SSWTW, which is considered as the best practicable means to minimise hazards from the PHI.

7.4.5 Conclusion

Qualitative assessment has been conducted to evaluate the potential hazard impact of the proposed landuse framework in the RDP. It is concluded that potential cumulative adverse hazard impact is similar to the existing conditions, as the proposed landuse will not trigger increase in population within the consultation zone of the SSWTW. The proposed Man Kam To Development Corridor is recommended to be included within a zone whereby the potential uses within the consultation zone of the SSWTW are contained under Column 2 of the Statutory Notes such that any development may only be permitted with conditions subject to TPB approval(s) while only some less-intensive uses outside the consultation zone are recommended as Column 1. Any new development uses within the adopted zoning and population increase shall be controlled by the statutory DPA/OZP, i.e. all development in the future statutory plan should require planning approval from the TPB where it is within the consultation zone for the SSWTW, which is considered as the best practicable means to minimise hazards from the PHI. It should also be noted that the quantitative risk assessment will be conducted in the future NDA study taking into account the potential population increase from the proposed development of Closed Area.

7.5 Landfill Gas

7.5.1 Introduction

This section presents the assessment of potential risk associated with landfill gas on proposed development under the landuse planning. The landfill gas hazard impact assessment has been conducted in accordance with the requirements in ProPECC PN 3/96 Landfill Gas Hazard Assessment for Developments adjacent to Landfills, EPD/TR8/97 Landfill Gas Hazard Assessment Guidance Note and Clause 4.22 of the SEA Study Brief of the Project. It reviews the potential hazards for landfill gas migration on adjacent proposed development, evaluates the degree of potential landfill gas hazard associated with the concerned proposed developments. Proposals of risk mitigation measures required have been recommended.

7.5.2 Overview of Potential Risk Implications of the Landuse Framework

Three landfill sites are located in vicinity of the Study Area, namely Ma Tso Lung Landfill Site, NENT Landfill and its Extension. **Figures 7.5.1** and **7.5.2** show the locations of these landfills.

7.5.2.1 Ma Tso Lung Restored Landfill

Ma Tso Lung Landfill ceased operation in 1979. It is about 2 ha in size, which received a total of 0.2 Mt waste. Restoration of landfill site has been completed in 2000 and the site is

currently used as a youth camp site. A LFG management system is in place. The Ma Tso Lung Landfill is located at more than 500 m away from the southwest of the study boundary.

No proposed development area falls within the 250m LFG Consultation Zone of Ma Tso Lung Landfill, and there is no distinct geological feature and fault line between the restored landfill site and Closed Area. Potential landfill gas hazard impact associated with Ma Tso Lung Restored Landfill on the proposed landuse planning framework is therefore not anticipated.

7.5.2.2 NENT Landfill and its Extension

The NENT Landfill is located near Ta Kwu Ling at the southern edge of Planning Area 4 of the RDP. The facility has a capacity of 35 Mm³ and occupying about 61ha of land, which is expected to be filled up by mid-2010s. An extension of the existing NENT Landfill immediately to its southeast has been proposed. The NENT Landfill Extension will have an estimated capacity of 21.4 Mm³, occupying about 63 ha of land. The topography around the extension is in concave form, bounded by Robin's Nest and Wo Keng Shan, which will be designed as a containment landfill with LFG collection and management systems that eliminate any off-site migration of LFG.

A LFG management system is/will be in place in both NENT Landfill and its Extension. The LFG management system collects and pumps LFG to a LFG utilization plant for generating electricity for on-site needs. LFG is also utilised as a heat source for leachate treatment, with surplus LFG treated and supplied to Hong Kong & China Gas Company's plant at Tai Po as fuel for production of town gas under the Landfill Gas Export Scheme. Flaring of surplus LFG shall be the last resort. The 250m LFG Consultation Zone of the NENT Landfill and its Extension partially falls within the Study Area. Localised inferred fault line running across the Study Area and outside the consultation zone has been identified (see **Figure 7.5.1**).

Under the current landuse planning framework, the village environs (VE) of all indigenous villages in Heung Yuen Wai & Ha Heung Yuen are recommended to be zoned "Village Type Development" (V) with its southern village boundary at the nearest 180m from the NENT Landfill site.

The proposed Heung Yuen Wai & Ha Heung Yuen village zone is expanded as a result of natural growth to meet the 10 years demand under the Small House Policy. The small houses will be constructed in accordance with the provisions of the Building Ordinance and are subject to their approval. The implementation and development scale will depend on the villager initiatives.

In order to avoid any LFG hazard, all proposed developments, including also proposed village zones, should be recommended outside the LFG Consultation Zone of the NENT Landfill and its Extension. Nonetheless, the existing village houses of Ha Heung Yuen and Heung Yuen Wai Villages are retained within the southern boundary of the proposed village zones which are within the 250m LFG Consultation Zone. Notwithstanding, should new developments be built in-between the existing village houses within the consultation zone, it would be subject to potential landfill gas hazard. Hence potential risks associated with the landfill gas have been reviewed.

7.5.3 Environmental Legislation, Standards and Guidelines

7.5.3.1 Relevant Ordinances, Legislation and Guidelines

The section has been conducted with relevant legislations and associated guidance notes that are applicable to landfill gas assessments. These include:

- EPD/TR8/97 Landfill Gas Hazard Assessment Guidance Note (LFGHA Guidance Note), specifying conditions and provide guidance for conducting assessments on LFG

- ProPECC PN 3/96 – Landfill Gas Hazard Assessment for Developments Adjacent to Landfills
- Annex 7 and 19 of the Technical Memorandum on EIAO (TM-EIAO)
- Hong Kong Planning Standards and Guidelines – Chapter 9 (Section 6.5 - Guidelines for Developments close to Landfills)

The LFGHA Guidance Note provides a risk assessment framework to be followed when evaluating potential hazards for landfill gas migration on adjacent development. Typically, if a development located within the 250m LFG Consultation Zone of a landfill site, a LFG hazard assessment is required. LFG hazard assessment is also required when the physical setting between a landfill and the proposed development is identified to have distinct geological features (e.g. fault lines and lineaments) or predominant artificial buried structures, which act as preferential pathways for gas migration.

7.5.4 Assessment Methodology

7.5.4.1 Approach

Qualitative assessment on the risk of LFG hazards at the receivers has been undertaken with reference to the approved EIA report for North East New Territories (NENT) Landfill Extension which was made in accordance with the method recommended in the LFGHA Guidance Note. This method is based on the “Source-Pathway-Receiver” model as described below:

- Source – location, nature and likely quantities/ concentrations of LFG which has the potential to affect the landfill extension.
- Pathway – the ground and groundwater conditions, through which LFG must pass in order to reach the landfill extension.
- Receiver – elements of the development that are sensitive to the effects of LFG.

The LFG sources, pathways and receivers are categorised for the hazard assessment. In accordance with the LFGHA Guidance Note, an assessment of the overall risk is made based on the risk category as summarised in **Table 7.5.1**.

For the purpose of categorising the landfill site, the category is based upon the highest level of risk determined for any of the potential impacts identified in **Table 7.5.1**, in which the general implications fall into different overall risk categories as shown in **Table 7.5.2**.

Table 7.5.1 Classification of risk category

Source	Pathway	Receiver Sensitivity	Risk Category
Major	Very Short/ Direct	High	Very high
		Medium	High
		Low	Medium
	Moderately Short/ Direct	High	High
		Medium	Medium
		Low	Low
	Long/ Indirect	High	High
		Medium	Medium
		Low	Low
Medium	Very Short/ Direct	High	High
		Medium	Medium
		Low	Low
	Moderately Short/ Direct	High	High
		Medium	Medium
		Low	Low
	Long/ Indirect	High	Medium
		Medium	Low
		Low	Very low

Source	Pathway	Receiver Sensitivity	Risk Category
Minor	Very Short/ Direct	High	High
		Medium	Medium
		Low	Low
	Moderately Short/ Direct	High	Medium
		Medium	Low
		Low	Very low
	Long/ Indirect	High	Medium
		Medium	Low
		Low	Very Low

Table 7.5.2 Summary of general categorisations of risk

Category	Level of Risk	Implication
A	Very high (undesirable)	The type of development being proposed is very undesirable and a less sensitive form of development should be considered. At the very least, extensive engineering measures, alarm systems and emergency action plans are likely to be required.
B	High	Significant engineering measures will be required to protect the planned development.
C	Medium	Engineering measures will be required to protect the proposed development.
D	Low	Some precautionary measures will be required to ensure that the planned development is safe.
E	Very low (insignificant)	The risk is so low that no precautionary measures are required.

7.5.4.2 Source

The classification of the Source (i.e. the landfill) should be undertaken as follows:

Minor

- Landfill sites at which installations of gas controls have been and proven to be effective by comprehensive monitoring which has demonstrated that there is no migration of gas beyond the boundary of the landfill site (or any specific measures) and at which control of gas does not solely rely on an active gas extraction system or any single measure with a failure vulnerability; or
- Old landfill sites where the maximum concentration of methane within the waste, as measured at several locations across the landfill and on at least four occasions over a period of at least 3 months (preferably longer), is less than 5% by volume (v/v).

Medium

- Landfill site at which some form of gas control installation are present (e.g. lined site or one where vents or barriers have been retrospectively installed) except where monitoring data are only limited in demonstrating its efficiency to prevent gas migration; or
- Landfill site where comprehensive monitoring has demonstrated that no migration of gas are observed beyond the landfill boundary except where the control of gas relies solely on an active gas extraction system or any other single control system which is vulnerable to failure.

Major

- Recently filled landfill site at which there is little or no control to prevent migration of gas or at which the efficacy of the gas control measures has not been assessed; or
- Any landfill site at which monitoring has demonstrated that there is significant migration of gas beyond the site boundary.

For guidance, assumptions are made on any concentration of methane or carbon dioxide exceeding 5% v/v above background levels in any monitoring well outside the landfill's boundary indicates significant migration. It may still be 'significant' if lower concentrations are observed in more than one monitoring well, on several occasions or in monitoring wells with separation of some distance from the site boundary.

In general, concentrations of greater than 1% v/v methane or 1.5% v/v carbon dioxide (above background levels in each case) indicate less than adequate control of the gas at source.

7.5.4.3 Pathway

The broad classification of the Pathway should be undertaken as follows:

Very short/Direct: Path length of less than 50m for unsaturated permeable strata and fissured rock or less than 100m for man-made conduits.

Moderately short/Direct: Path length of 50-100m for unsaturated permeable soil or fissured rock or 100-250m for man-made conduits.

Long/Indirect: Path length of 100-250m for unsaturated permeable soils and fissured rock.

In classifying the pathway, however, adjustment to the above general guidelines will often be required to take account of other factors which will affect the extent of gas migration including the following:

- particular permeability of the soils
- spacing, tightness and direction of the fissures/joints
- topography
- depth and thickness of the medium through which the gas may migrate (which may be affected by groundwater level)
- the nature of the strata over the potential pathway
- the number of different media involved; and
- depth to groundwater table and flow patterns

7.5.4.4 Target

Different types of target may be broadly classified by the following:

High sensitivity

- Buildings and structures with ground level or below ground rooms/voids or into which services enter directly from the ground and to which members of the general public have unrestricted access or which contain sources of ignition. This would include any developments where there is a possibility of additional structures being erected directly on the ground on an ad hoc basis and thereby without due regard to the potential risks.

Medium sensitivity

- Other buildings, structures or service voids where there is access only by authorised, well trained personnel, such as the staff of utility companies, who have been briefed on the potential hazards relating to landfill gas and the specific safety procedures to be followed;
- Deep excavations.

Low sensitivity

- Buildings/structures which are less prone to gas ingress by virtue of their design (such as those with a raised floor slab);
- Shallow excavations;

- Developments which involve essentially outdoor activities but where evolution of gas could pose potential problems.

7.5.5 Identification and Evaluation of Environmental Impacts

7.5.5.1 Sources

NENT Landfill

According to the NENT Landfill Extension EIA Report, the risk category of NENT Landfill is classified as **Medium**, with the following justifications:

- Active gas extraction system is an essential element of LFG protection measures at the NENT Landfill; and
- Gas control systems has been installed and proven to be effective by comprehensive monitoring which has demonstrated that there is no migration of gas beyond the landfill boundary.

7.5.5.2 Pathways

Natural pathways

The existing village houses in the southern boundary of Heung Yuen Wai & Ha Heung Yuen village fall within the LFG Consultation Zone at a separation of 180m from the NENT Landfill site. All faults lines passing through NENT Landfill and its Extension (see **Figure 7.5.1**) are far from the proposed development of Closed Area, and their separation distance are more than the distance from the existing villages to the NENT landfill (i.e. more than 180m). The soil between NENT Landfill and its Extension and the proposed village zone will be the primary natural pathway for LFG migration. The pathway is classified as “**Long/Indirect**”.

Man-made pathways

With reference to the approved NENT Landfill Extension EIA report, although there are man-made pathways in the vicinity of the landfill sites consisting of services routes, they are far from sensitive receivers and are classified as **Long/ Indirect** towards the planned Heung Yuen Wai and Ha Heung Yuen village zone.

7.5.5.3 Receivers

In order to avoid any LFG hazard, all proposed developments, including also proposed village zones, should be recommended outside the LFG Consultation Zone of the NENT Landfill and its Extension. Nonetheless, parts of the proposed village zones of Ha Heung Yuen and Heung Yuen Wai fall within the 250m LFG Consultation Zone to reflect the existing village houses. Landfill gas impacts may therefore occur in case new developments are built in-between the existing village houses within the consultation zone during both construction and operational phase.

Construction Phase

The construction works to be carried out within NENT Landfill Gas Consultation Zone include site formation and new village house development. Excavation for construction of house, trenches for utility installation, would be conducted at the village zone. Workers are potential sensitive receiver to LFG hazard associated with construction works. These receivers are categorised as **High Sensitivity** according to LFGHA Guidance Note.

Operational Phase

All existing and future new developments of Heung Yuen Wai and Ha Heung Yuen village, within the 250m LFG Consultation Zone, will be the potential targets prone to the risk of LFG migration. The village house development will be categorised under “**High Sensitivity**”. Building and structures with ground level or below ground rooms/ voids or into which services enter directly from the ground and to which members of the general public have

unrestricted access or which contain source of ignition” falls into this category, according to LFGHA Guidance Note.

7.5.5.4 Assessment of Landfill Gas Hazard

With all the information regarding the sources, pathways and receivers identified in the previous sections, a qualitative risk assessment of LFG hazards is summarised in **Table 7.5.3** based on the criteria stipulated in **Table 7.5.1**.

The overall risk level of LFG hazards to receivers at village zone for construction works within consultation zone is categorised as ‘**Medium**’ (Category C). Engineering measures will be required to protect the proposed development under **Medium** level of risk.

The overall risk level of LFG hazards to receivers at village zone within consultation zone during operational stage is categorised as ‘**Medium**’ (Category C). Adequate engineering measures will be required to protect the proposed development. The use of ‘semi-active’ or enhanced passive gas controls and detection system (in some situations) will be required for Category C risk level.

Table 7.5.3 Qualitative risk assessment of LFG hazards associated with NENT landfill

Source	Pathway	Receiver Sensitivity	Risk
Construction Phase			
From NENT Landfill: Medium	Natural (soil): Long/ Indirect	Construction workers: High	Medium
	Man-made (services routes): Long/ Indirect	Construction workers: High	Medium
Operational Phase			
From NENT Landfill : Medium	Natural (soil): Long/ Indirect	Adjacent residents: High	Medium
	Man-made (services routes): Long/ Indirect	Adjacent residents: High	Medium

The hazard to any new village development in-between the existing village houses in Heung Yuen Wai and Ha Heung Yuen which fall within the 250m LFG Consultation Zone of the NENT Landfill has been assessed to be **Medium** for construction and operational phases of the village.

7.5.6 Mitigation Measures

The hazard to any new village development in-between the existing village houses in Heung Yuen Wai and Ha Heung Yuen which fall within the 250m LFG Consultation Zone of the NENT Landfill have been assessed to be Medium, engineering measures will be required to protect the development, according to the LFGHA Guidance Note.

Notwithstanding, the village zone is expanded as a result of natural growth to meet the 10 years demand under the Small House Policy. The small houses will be constructed in accordance with the provisions of the Building Ordinance and are subject to their approval. The implementation and development scale will depend on the villager initiatives. To address potential risks associated with the landfill consultation zone, the mitigation measures should be forwarded to the Lands Department for consideration of future applications for small house grants. These provisions should also be implemented for any other structures within the consultation zone. The potential landfill gas risks associated with developments within the consultation zone should also be considered by relevant government authorities for licensing applications under column 1 uses where there is no planning control (e.g. eating places, schools on ground floor of NTEH).

7.5.6.1 Construction Phase

The construction works conducted at the village zones within the landfill gas consultation zone pose landfill gas risk to the construction workers. Precautionary measures to be adopted by the contractors/ workers are outlined in LFGHA Guidance Note. The following

guidance has been extracted to ensure a comprehensive set of measures is provided to protect workers.

General safety requirements

- Special precautions should be taken in all respects of works against the possible presence of LFG to the existing NENT Landfill. Potential hazards of exposure to LFG, e.g. ignition, explosion, asphyxiation, toxicity, etc. should be fully aware and alerted.
- Precautions should be clearly laid down and rigidly adhered to with respect to trenching and excavation; and creation of confined spaces at, near to or below ground level.
- All personnel who work on site and all visitors to the site should be made aware of the possibility of ignition gas in the vicinity of excavations. Safety notices should be posted warning of potential hazards.
- All staff and workers should receive appropriate training on working in areas susceptible to landfill gas, fire and explosion hazards.
- No workers should be allowed to work alone at any time in or near to any excavation. At least one other worker should be available to assist with a rescue if needed.
- Smoking, naked flames and all other sources of ignition should be prohibited within 15m of any excavation or ground-level confined spaces. 'No smoking' and 'No Naked Flames' notices should be posted prominently on the construction site.
- Welding, flaming-cutting or other hot works should be confined to open areas at least 15m from any trench or excavation.
- Ground level construction plant should be fitted with vertical exhaust at least 0.6m above ground level with spark arrestors.
- Any electrical equipment, such as motors and extension cords, should be intrinsically.
- Safe signs should be erected on-site where appropriate.
- During piping assembly or conduit construction, all valves/ seals should be closed immediately after installation. As construction progresses, all valves/ seals should be closed as installed to prevent the migration of gases through the pipeline/ conduit. All piping/ conduiting should be capped at the end of each working day.
- Mobile offices, equipment stores etc should be located on an area which has been proven to be gas free by survey with portable gas detectors and ongoing monitoring should be carried out to ensure that these areas remain gas free.
- Adequate fire extinguishing equipment, fire-resistant clothing and breathing apparatus set should be made available on site.

Monitoring Requirements

- The works area should be monitored for methane, carbon dioxide and oxygen using appropriately calibrated portable gas detection equipment in the following ranges.

Methane (CH ₄)	0-100% Lower Explosion Limit (LEL) and 0-100% v/v;
CO ₂	0-100%; and
O ₂	0-21%

- Routine monitoring should be carried out in all excavations, manholes, chambers and any other confined spaces that may have been created (e.g. temporary storage of building materials) on the site surface.

- LFG monitoring in excavations should be conducted at no more than 10mm from the exposed ground surface. The monitoring frequency and areas to be monitored should be set prior to commencement of ground-works by qualified person.
- For excavations deeper than 1m, measurements should be conducted:
 - ◆ At ground surface before excavation commences;
 - ◆ Immediately before any worker enters the excavation;
 - ◆ At the beginning of each working day for the entire period the excavation remains open; and
 - ◆ Periodically throughout the working day whilst workers are in the excavation.
- For excavations between 300mm and 1m, measurements should be conducted directly after the excavation has been completed; and periodically whilst the excavation remains open.
- For excavations less than 300mm, monitoring may be omitted at the discretion of qualified person.

Appropriate action should be taken in accordance with the action plan shown in **Table 7.5.4**.

Table 7.5.4 Action plan for LFG monitoring during construction phase

Parameter	Monitoring Result	Action
O ₂	<19%	Ventilate trench/ void to restore O ₂ level to >19%
	<18%	Stop works, evacuate personnel/ prohibit entry, and increase ventilation to restore O ₂ level to >19%
CH ₄	>10% LEL*	Prohibit hot works, and ventilate to attenuate CH ₄ level to <10% LEL
	>20% LEL	Stop works, evacuate personnel/ prohibit entry, and ventilate to attenuate CH ₄ level to <10% LEL
CO ₂	>0.5%	Ventilate to attenuate CO ₂ level to <0.5%
	>1.5%	Stop works, evacuate personnel/ prohibit entry, and ventilate to attenuate CO ₂ level to <0.5%

* LEL: Lower Explosion Limit

7.5.6.2 Operational Phase

Suitable building protection design measures should be provided for any new developments in Heung Yuen Wai and Ha Heung Yuen village zones which fall within the 250m LFG Consultation Zone of the NENT Landfill. Passive control measures could be used in low and medium risk situations where gas emissions are expected to be at relatively low rates and concentrations and venting to atmosphere is unlikely to cause a hazard or nuisance due to the low concentration or high dilution which will occur. The measures include:

- Gas-resistant polymeric membranes which can be incorporated into the floor or wall construction as a continuous sealed layer. Membranes should be able to demonstrate low gas permeability and resistant to possible chemical attack and may incorporate aluminium wafers to improve performance.
- Annulus around any service entry points shall be effectively blocked by means of sealant, collars or puddle flanges as appropriate.

The LFG mitigation measures would be advisory and its implementation shall be subject to village initiatives. It is recommended that the prevailing practice/measures for village house development within the LFG Consultation Zone of the NENT Landfill and its Extension adopted for small house applications and licensing applications for Column 1 uses of NTEH (e.g. the existing Wo Keng Shan Tsuen which is only at about 100m from the landfill site boundary according to the approved NENT landfill extension EIA) shall be followed. LandsD shall consider and seek advice from EPD during the process of NT village house application if any within the proposed Heung Yuen Wai & Ha Heung Yuen village zones which fall within the 250m LFG Consultation Zone of the NENT Landfill.

7.5.6.3 Conclusion

In order to avoid any LFG hazard, the current landuse proposal has recommended all areas designated for new village type development in Heung Yuen Wai and Ha Heung Yuen should be provided outside the NENT Landfill Gas Consultation Zone. Nonetheless, the existing village houses are also retained within the southern boundary of the proposed village zone which is within the 250m LFG Consultation Zone. Landfill gas impacts may therefore occur in case new developments are built in-between the existing village houses within the consultation zone.

The results of the qualitative risk assessment for LFG hazards associated with the NENT landfill and its extension indicate that the overall risk to any potential development uses in the proposed Heung Yuen Wai & Ha Heung Yuen village zone within the 250m LFG Consultation Zone is 'Medium'. Appropriate protective and precautionary measures have been proposed for construction and operational phase of the development.

7.6 Solid Waste Management Implications

7.6.1 Introduction

This section examines the implications of the proposed landuse in the RDP on the type and quantity of wastes arising from the construction and operation of the Project, and assesses the potential environmental impacts associated with waste reduction, collection, treatment and disposal measures for the existing, planned and proposed developments. The need for follow-up study to handle the solid wastes arising from the proposed developments and their mitigation measures for avoiding and minimising the potential impacts are presented.

7.6.2 Environmental Legislation, Standards and Guidelines

The relevant legislation applicable to the study for the assessment of waste management implications include:

- Waste Disposal Ordinance (Cap 354);
- Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap 354N);
- 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

7.6.2.1 Waste Disposal Ordinance (WDO)

The Waste Disposal Ordinance (WDO) prohibits the unauthorised disposal of wastes. Under WDO, animal waste means the manure of any animal; or any dead animal or any part of any dead animal not fit for, or not intended for, human consumption; or any bedding, straw, or other waste contaminated by manure or urine of any animal. The disposal of waste generated from the horse riding school, under worse case planning scenario, in the proposed Recreational Area near Pak Fu Shan in the landuse proposal is governed by this Ordinance.

7.6.2.2 Waste Disposal (Charges for Disposal of Construction Waste) Regulation

Under the Waste Disposal (Charges for Disposal of Construction Waste) Regulation, construction waste means any substance, matter or thing that is generated from construction work and abandoned, whether or not it has been processed or stockpiled before being abandoned, but does not include any sludge, screenings or matter removed in or generated from any desludging, desilting or dredging works. According to Schedule 6 of the Regulation, construction waste delivered to a landfill for disposal must not contain more than 50% by weight of inert material. Construction waste delivered to a sorting facility for disposal must contain more than 50% by weight of inert material, and construction waste delivered to a public fill reception facility for disposal must consist entirely of inert material.

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 \$1 million or above is required to open a billing account solely for the contract. Application should be made within 21 days after the contract is awarded.

For construction work under a contract with value less than \$1 million, such as minor construction or renovation work, any person such as the owner of the premises where the construction work takes place or his/her contractor can open a billing account; the account can also be used for contracts each with value less than \$1 million. The premises owner concerned may also engage a contractor with a valid billing account to make arrangement for disposal of construction waste.

Under the new construction waste charging 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, construction waste can be disposed at public fill, sorting facilities, landfills and outlying islands transfer facilities where different disposal cost would be applied. The scheme encourages reducing, reusing and sorting of construction waste such that the waste producer can minimise their disposal fee. **Table 7.6.1** presents a summary of the government construction waste disposal facilities, types of waste accepted and disposal cost.

Table 7.6.1 Government waste disposal facilities for construction waste

Government Waste Disposal Facilities	Type of Construction Waste Accepted	Charge Per Tonne ^[1]
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

Note: ^[1] Source from <http://www.epd.gov.hk/epd/misc/cdm/scheme.htm>

7.6.2.3 Waste Disposal (Chemical Waste) (General) Regulation

Chemical waste includes any scrap materials, or unwanted substances specified under Schedule 1 of this Regulation, if such a substance or chemical occurs in such a form, quantity or concentration that causes pollution or constitutes a danger to health or risk of pollution to the environment.

A person shall not produce, or cause to be produced, chemical wastes unless he is registered with EPD. Any person who contravenes this requirement commits an offence and is liable to a fine and/or imprisonment. Chemical wastes must be treated, utilising on-site plant licensed by EPD or have a licensed collector to transport the wastes to a licensed facility. For each consignment of wastes, the waste producer, collector and disposer of the wastes must sign all relevant parts of a computerised trip ticket. The system is designed to trace wastes from production to disposal.

This regulation also prescribes the storage facilities to be provided on site including labelling and warning sign. To minimise 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 storage of chemical wastes. The waste producer must also provide employees with training for such procedures.

Under the regulation of WDO, the Chemical Waste (General) Regulation 1992 provides regulations for chemical waste control, and administers the possession, storage, collection, transport and disposal of chemical wastes. The EPD has also issued a 'guideline'

document, the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992)*, which details how the Contractor should comply with the regulations on chemical wastes.

7.6.2.4 Land (Miscellaneous Provisions) Ordinance

The inert portion of Construction and Demolition (C&D) materials may be taken to public filling facilities including public filling area, public filling barging points and stockpiling areas. These facilities usually form part of land reclamation schemes and are operated by CEDD. The ordinance requires Dumping Licenses (to be issued by CEDD) to be obtained by individuals or companies, who deliver inert C&D materials to the public filling facilities.

Individual licenses and windscreen stickers are issued for each vehicle involved. Public filling areas will accept only inert building debris, soil, rock and broken concrete. There is no size limitation on the rock and broken concrete, and a small amount of timber mixed with inert material is permissible. The material should, however, be free from marine mud, household refuse, plastic, metal, individual and chemical wastes, animal and vegetable matters and any other materials considered unsuitable by the Filling Supervisor.

7.6.2.5 Public Cleansing and Prevention of Nuisances by-Laws

These by-laws provide further control on illegal tipping of wastes on unauthorised (unlicensed) sites. Illegal dumping of wastes can lead to a fine and imprisonment.

7.6.2.6 Other Relevant Guidelines

The following documents and guidelines also relate to waste management and disposal:-

Table 7.6.2 Other relevant documents and information

Bureau / Department	Documents / Guidelines / Technical Circulars
ex-Planning, Environmental and Lands Branch	<ul style="list-style-type: none"> • Waste Disposal Plan for Hong Kong (December 1989) • Waste Reduction Framework Plan, 1998 to 2008
ex-Environment, Transport and Works Bureau	<ul style="list-style-type: none"> • Works Branch Technical Circular (WBTC) No. 32/92, The Use of Tropical Hard Wood on Construction Site • WBTC No. 2/93, Public Dumps • WBTC No 2/93B, Public Filling Facilities • WBTC No. 16/96, Wet Soil in Public Dumps • WBTC Nos. 4/98 and 4/98A, Use of Public Fill in Reclamation and Earth Filling Project • WBTC Nos. 25/99, 25/99A and 25/99C, Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers • WBTC No. 12/2000, Fill Management • WBTC No. 19/2001, Metallic Site Hoardings and Signboards • WBTC No. 06/2002, Enhanced Specification for Site Cleanliness and Tidiness • WBTC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates • ETWBTC (Works) No. 31/2004, Trip-ticket System for Disposal of Construction and Demolition Material • Environment, Transport and Works Bureau Technical Circular (ETWBTC) (Works) No. 33/2002, Management of Construction and Demolition Material Including Rock • ETWBTC (Works) No. 34/2002, Management of Dredged / Excavated Sediment • ETWBTC (Works) No. 19/2005, Environmental Management on Construction Sites
EPD / CEDD	<ul style="list-style-type: none"> • New Disposal Arrangements for Construction Waste (1992)

Bureau / Department	Documents / Guidelines / Technical Circulars
EPD	<ul style="list-style-type: none"> • A Policy Framework for Management of Municipal Solid Waste (2005 -2014), (December 2005) • Code of Practice on the Packaging, Labeling and Storage of Chemical Wastes (1992) • Guidance Notes for Investigation and Remediation of Contaminated Sites of: Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops (1999) • Guidance Note for Contaminated Land Assessment and Remediation • Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management • ProPECC PN2/97 Handling of Asbestos Containing Materials in Buildings • Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste • Code of Practice on Asbestos Control: Asbestos Work Using Full Containment or Mini Containment Method • Code of Practices on Asbestos Control: Asbestos Work Using Glove Bag Method • Code of Practice on Asbestos Control: Safe Handling of Low Risk Asbestos Containing Material • Code of Practice on Asbestos Control: Preparation of Asbestos Investigation Report, Asbestos Management Plan and Asbestos Abatement Plan • A Guide to Livestock Waste Control Scheme • Guidelines for Dry Muck-out of Livestock Waste • Guidelines for Wet Muck-out and Hybrid Systems • Guidelines for Soakaway System • Guidelines for the Management of Livestock Waste Arising from Free Range Poultry Keeping • Guidelines on Litter Bedding Method for the Treatment of Livestock Waste
PlanD	<ul style="list-style-type: none"> • Hong Kong Planning Standards and Guidelines, Chapter 9 (Section 6 – Waste Management)

ETWBTC No. 15/2003, which supersedes “WBTC No. 5/98, On-site Sorting of Construction Waste on Demolition Sites” and “WBTC No. 29/2000, Waste Management Plan”, sets out the policy, procedures and requirements for contractors to prepare and implement an enhanced Waste Management Plan to encourage on-site sorting of C&D materials and to reduce C&D waste generation during construction.

7.6.3 Baseline Conditions

7.6.3.1 Classification of Solid Waste

Solid waste is classified into four main types by making reference to the sources of waste and the institutional arrangements for waste collection and disposal. These four types of solid waste are municipal solid waste, construction waste, chemical waste and special waste. The detailed interpretations of some commonly used terms are described below.

Municipal solid waste includes domestic waste, commercial waste and industrial waste.

- **Domestic waste** refers to household waste, waste generated from daily activities in institutional premises and refuse collected from public cleansing services. Public cleansing waste includes dirt and litter collected by the Food and Environmental Hygiene Department (FEHD), marine refuse collected by the Marine Department and waste from country parks collected by the Agriculture, Fisheries and Conservation Department.
- **Commercial waste** is waste arising from commercial activities taking place in shops, restaurants, hotels, offices, markets in private housing estates, etc. It is collected mainly

by private waste collectors. However, some commercial waste is mixed with domestic waste and collected by the FEHD.

- **Industrial waste** is waste arising from industrial activities and does not include construction waste and chemical waste. It is usually collected by private waste collectors. However, some industries may deliver their industrial waste directly to landfills for disposal. It should be noted that there are bulky items like furniture and domestic appliances which cannot be handled by conventional compactor type refuse collection vehicles. These items are regarded as bulky waste and are usually collected separately. They may come from residential premises, commercial and industrial activities.

Construction waste (previously known as construction & demolition waste) is a mixture of surplus materials arising from site clearance, excavation, construction, refurbishment, renovation, demolition and road works. Over 80% of construction wastes are inert, which include debris, rubble, earth and concrete, are suitable for land reclamation and site formation. When properly sorted, materials such as concrete and asphalt can be recycled for use in construction. The remaining non-inert substances in construction waste, which include bamboo, timber, vegetation, packaging waste and other organic materials, are not suitable for land reclamation and are disposed of at landfills.

Chemical waste is defined in the Waste Disposal (Chemical Waste) (General) Regulation under the Waste Disposal Ordinance (Cap. 354). Chemical waste can be any substance arising from any process or trade activity which contains chemical in such form, quantity or concentration that can cause pollution to the environment or become a risk to health.

Special waste is waste that requires special disposal arrangement. It includes abattoir waste, animal carcasses, asbestos, chemical waste, clinical waste, condemned goods, CWTC stabilized residue, dredged mud and excavated materials, sewage treatment and waterworks treatment sludge, grease trap waste, livestock waste, sewage works screenings, waste tyres, furnace bottom ash, pulverised fuel ash, etc.

7.6.3.2 Current Waste Problems in Hong Kong

The amount of municipal solid waste generated each year in Hong Kong is enormous, given that the city houses almost 7 million people and is a regional centre of commerce. In 2007 alone, 6.25 million tonnes were generated, of which 45% (EPD, 2008a) was recycled and the rest was disposed of at the three strategic landfills in Hong Kong, including the West New Territories (WENT) Landfill at Tuen Mun, the South East New Territories (SENT) Landfill at Tseung Kwan O, and the North East New Territories (NENT) Landfill at Ta Kwu Ling.

However, these landfill sites will be completely filled by the mid 2010s if the level of wastes continues to grow at the current levels. The Government published the "Policy Framework for the Management of Municipal Solid Waste in Hong Kong (2005-2014)" (Policy Framework) in 2005 to resolve targets for reducing waste and to ensure that local waste management can be sustainable, not only in the immediate future, but also in the long run.

In 2007, 45 per cent of municipal solid waste was recovered for the purpose of recycling or re-use. Domestic waste loads at landfills also fell by 4 per cent. However, waste generated from the commercial and industrial sectors increased due to the robust economic growth and strong tourism influx. This contributed to a 1.6 per cent increase in the total municipal solid waste disposed of at landfills in 2007.

7.6.3.3 Existing Waste Facilities

A summary of the locations of existing waste treatment facilities in Hong Kong is presented in **Figure 7.6.1**. Major current waste facilities serving the Study Area are shown in **Table 7.6.3**.

Table 7.6.3 Summary of existing waste facilities serving the Study Area

Waste Facilities	Date of Commission	Design Capacity	Operation Capacity in 2007	Utilization Rate(%) in 2007
Strategic Landfills				
NENT	1995	35 Mm ³	N/A	N/A
Refuse Transfer Stations				
North West New Territories (NWNTRTS) at Shun Tat Street, Tuen Mun (near Lam Tei)	2001	1,100 tpd	847 tpd	77
Public Fill Reception Facilities				
Temporary Tuen Mun Area 38 Fill Bank and sorting facilities	N/A	N/A	N/A	N/A
Special Waste Facilities				
Sha Ling Livestock Waste Composting Plant and livestock waste collection service	1991	20 tpd	N/A	N/A
Ngau Tam Mei Animal Waste Composting Plant	2008	20 tpd	N/A	N/A
Chemical Waste Treatment Centre	1993	100,000 tonnes per year	45,699 ^[1] tonnes per year	45.70

Note:

[1] Source from Environment Hong Kong 2007 (EPD, 2007a)

[2] Sha Ling Livestock Waste Composting Plant will be used for handling and storage of partially mature compost only by late 2010.

7.6.3.4 Future Waste Facilities and Waste Reduction Measures

To help ease this imminent waste problem, the Environmental Protection Department has placed a high priority on promoting waste reduction and recycling. The Government is planning waste management facilities that will reduce the size of bulk waste and promote resource recovery that are currently ignored. A summary of the locations of potential waste treatment facilities is presented in **Figure 7.6.2**. Key waste reduction measures and waste treatment facilities under planning are described as follows:

Landfill Extension

Feasibility and environmental impact assessment studies were completed on the North East New Territories Landfill Extension, South East New Territories Landfill Extension and West New Territories Landfill Extension in September 2007, May 2008 and November 2009 respectively. According to the “Environment Hong Kong 2008”, the target of the HKSAR is to commission the extensions in the early to mid-2010s, before the current sites run out of capacity.

Integrated Waste Management Facilities (IWMF)

According to the press release of EPD dated 29 Jan 2008, the Government has identified Tsang Tsui in Tuen Mun and Shek Kwu Chau to the south of Lantau Island as potential sites for the development of Integrated Waste Management Facilities (IWMF) Phase 1. The final choice of the site has not been made pending the completion of the detailed Engineering Investigation and Environmental Studies for both sites. The IWMF will employ incineration as the core technology to reduce waste volume and to recover energy. A demonstration-scale sorting and recycling facility will also be included. IWMF is also a Designated Project under the EIAO. The statutory EIAO process shall be followed.

Organic Waste Treatment Facility (OWTF)

As part of the multi-technology waste management strategy, the Government is also developing the OWTF at a separate location to treat source-separated organic waste from the commercial and industrial sectors. The first phase of the OWTF, with a design capacity

of 200 tonnes per day (tpd) is planned to be built in Siu Ho Wan of Lantau Island. The second phase will be of similar capacity to be built in Sha Ling of the North District (EPD, 2008b) subject to confirmation. OWTF is a Designated Project under the EIAO. The statutory EIAO process is required under the EIAO.

Sludge Treatment Facilities (STF)

Apart from the IWMF and OWTF, Environmental Permit was issued in March 2009 under the EIAO on the construction of Sludge Treatment Facilities (STF), adopting incineration technology, at the Ash Lagoon area at Tsang Tsui near Nim Wan, Tuen Mun for the disposal of dewatered sewage sludge. The STF will be designed to treat 2,000 wet tonne/day of the dewatered sludge generated from the sewage treatment process in the Stonecutters Island Sewage Treatment Works (STW) and 10 other regional sewage treatment works according to the EIA Report of Sludge Treatment Facilities (AEIAR-129/2009).

Waste Reduction, Recycle and Reuse

The Government's primary objective is to reduce waste production and promote increased recycling. In 2008, about 48% (3.14 million tonnes) of municipal solid waste has been recycled in Hong Kong, the needs for more are pursued. To build a future with less demand on needless waste disposal, various waste reduction measures are underway.

Environmental programmes for different sectors of society have been designed with the intention of changing life habits, especially in relation to segregation of municipal solid waste at the source and recycling. By March 2010, about 1445 housing estates/ buildings joined the Programme on Source Separation of Domestic Waste.

The Product Eco-responsibility Ordinance was enacted in July 2008. The Ordinance provides a legal basis for introducing producer responsibility schemes, with the environmental levy on plastic shopping bags as the first scheme under the Ordinance.

The environmental levy scheme on plastic shopping bags has been implemented since 7 July 2009, and a levy of 50 cents on each plastic shopping bags distributed by retailers is to be introduced by phases. Retailers covered by the scheme are no longer allowed to provide free plastic shopping bags and they must charge their customers an environmental levy for each plastic shopping bag they ask for. The scheme provides a direct economic incentive to discourage the indiscriminate use of plastic shopping bags. Chain or large supermarkets, convenience stores as well as personal health and beauty stores are covered in the first phase.

The Government is also developing an EcoPark, in which long term land is provided for establishment of recycling industries and environmentally friendly product manufacturing enterprises. In January 2010, EcoPark Phase 1 lots have been leased out for the recycling of waste plastics, used cooking oil, used computer equipment, waste plastics, waste metal and waste batteries. First batch of Phase 2 lots is expected to be available for disposal in mid-2010.

7.6.3.5 Waste Arisings from North District

The Study area falls within the North District. The development proposals will be implemented within 10 years from 2013 to 2023. Based on the 2006-based Territorial Population and Employment Data Matrices (TPEDM) land use data released and revised by Planning Department (PlanD) in May and July 2008 respectively, MSW arisings requiring disposal within the North District (Sheung Shui / Fanling and Sha Tau Kok, without taking considerations of this Project) in 2007 as well as the forecast arisings in 2021 and 2026 were approximately 539 (of which approximately 26% was derived from the commercial and industrial sources) in 2007, 520 (of which approximately 25% was derived from the commercial and industrial sources) in 2021 and 900 (of which approximately 17% was

derived from the commercial and industrial sources) tonnes per day (tpd) in 2026 respectively.

7.6.3.6 Existing Waste Arisings from the Study Areas

The existing solid waste arisings from within the Study Area include domestic waste from traditional village houses, agricultural waste from the existing farming, fisheries, livestock rearing (rare) and horticulture, commercial / industrial waste generated from open storage, small shops, and small scale car and electrical appliance repair, maintenance and dismantling workshops; and chemical waste from illegal petrol filling (if any), vehicle repair and dismantling operations.

7.6.4 Assessment Methodology

7.6.4.1 General

The assessment of environmental impacts from handling, storage, collection, transportation and disposal of solid waste materials generated by the landuse proposals have been undertaken in accordance with Annex 7 and 15 of the TM-EIAO and the SEA Study Brief.

The methodology for assessing potential impacts of the proposed developments on waste generation and management includes the following tasks:

- estimation of the types and quantities of wastes to be generated;
- evaluation of the opportunities for reducing, recycling and reusing of wastes;
- identification of disposal options for each type of waste; and
- assessment of impacts on the capacity of waste collection, transfer and disposal facilities.

It should also be noted that only preliminary information on the construction activities of the anticipated works is available at this planning stage. Hence, the types of wastes likely to be generated during the construction and operational stages of the Study should be examined in detail when the individual project is implementation in next stage.

7.6.5 Identification and Evaluation of Environmental Impacts

7.6.5.1 Construction and Reinstatement Phase

Wastes will be generated from various development proposals during construction phases, including Eco-lodge at Ma Tso Lung, Kong Nga Po Comprehensive Development Area, adaptive reuse of the existing villages/schools for holiday camps, museum/exhibition centre, eco-tourism, visitor centres, tourist facilities and other recreational/commercial uses, proposed Man Kam To Development Corridor, Hung Lung Hang Residential Area next to Kong Nga Po, proposed recreational area in Pak Fu Shan, Fung Wong Wu and Tong To Ping Tsuen, expansion of villages, road improvement work, heritage trail / hiking trail / bicycle track, etc.

The main activities which will potentially result in the generation of waste include:

- site clearance / site formation, excavation;
- construction of drain or road paving / alignment works; and
- construction of the proposed development and infrastructure.

A variety of wastes will be generated, which can be divided into the following distinct categories based on their compositions:

- C&D materials;
- chemical wastes; and
- general refuse

The nature and quantity of each of these waste types are described below.

(1) Construction and Demolition Materials

Construction and demolition (C&D) material consists of the following two portions:

- Inert portion (public fill) – e.g. excavated soil, rock, rubbles, concrete, etc. which can be used as fill material for reclamation and earth filling projects
- Non-inert portion (C&D waste) – e.g. timber, bamboo scaffoldings, etc. which can be recycled before disposal at landfills.

C&D material is mainly arising from construction activities such as site clearance, excavation works and new building construction.

Waste from Site Clearance

The proposed development areas will be partly located on hilly terrain and in remote rural areas. Some of them are currently covered with patchy vegetation. Site clearance waste of these proposed development sites would therefore generally consist of low graded natural vegetation such as scrub and grass.

Site clearance activities would be limited and the waste would be mainly composed of refuse, low grade vegetation and timber. They are non-inert wastes which shall be reused whenever possible and be disposed of at landfills as a last resort. It is considered that handling and disposal of these wastes would not be a key environmental issue.

Excavated Material / Imported Filling Material

Site formation to the required levels will be accomplished by cut and fill method. Excavated material is defined as inert virgin material removed from the ground and sub-surface which is generated during the site formation. Bulk import of inert fill material is required to raise site levels and to form the linear landscape areas. The majority of excavated materials will only be generated from the following activities:

- foundation work and basement structures for new development; and
- road alignment works.

According to the information provided by Engineer, approximately 284,880m³ of cut materials will be generated from the Road and Drain Improvement Works as well as 50,700m³ of cut material (subject to detail design by FEHD) of the proposed crematorium during the construction phase of the Study.

Design of the site formation should ensure a cut and fill balance as far as practical. The cut materials will consist of clean rock and soil, which could be reused on-site. In order to minimize the need for any off-site disposal of excavated materials, C&DM should be used for landscaping works in the proposed developments area as far as practicable. Surplus cut material will then be disposed off at public fill bank. A total of 335,580m³ of cut material will be produced, of which 66,372m³ will be used for backfilling and 225,582m³ will be disposed off at public fill and 43,625m³ will be disposed off at landfill. The excavated material shall be reused whenever possible and be disposed of at landfills as a last resort.

With careful planning for reusing excavated materials on-site, the secondary environmental impacts and potential impacts on waste handling capacity of excavated materials is expected to be minimal.

C&D Material from New Building Construction Works

C&D Material will be generated from the construction of the infrastructures (including road, drains and new buildings) for the landuse proposals. C&D materials generated from the construction works will mainly comprise unwanted materials, including:

- Existing abandoned structures (e.g. concrete, steel, glass, bricks, wood, plastics, etc.);

- Wood from formwork and falsework;
- Materials and equipment wrappings;
- Unusable/surplus concrete/grouting mixes; and
- Damaged construction materials.

The new development will be implemented in stages. The C&D materials will be generated in phases after the release of the closed area. Based on the information provided by Engineer, the estimated quantity is 124,723m³ (taking into account a safety factor of 1.2). In addition, the quantity of C&D materials generated by the village expansion is estimated to be 115,966m³. The total quantities of C&D material (including C&D Waste and public fill) to be generated from the construction of the proposed developments are 240,689m³.

The Contractor of the individual Project (the Contractor) will be responsible for sorting C&D material into inert and non-inert portions. Inert portion of C&D material should be reused on site as far as practicable. Surplus inert C&D material shall be transported to public filling areas depending on the percentage of inert content. Non-inert portion of C&D material shall be reused whenever possible and be disposed of at landfills as a last resort. It is estimated that around 87% (EPD, 2007b), i.e. 209,399m³ C&D material generated will be categorized as public fill (including on-site reuse) and the remaining 13%, i.e. 31,290m³ will be disposed of at landfills. It should be noted that at this planning stage, only preliminary information of the anticipated construction activities is available and all the recommended developments are subject to changes of conditions and policies in the future. Hence, the estimated quantities of wastes likely to be generated for the entire proposed developments in full operation are estimated with a safety factor of 1.2.

With reuse for the backfilling as well as reuse and recycling of the C&D waste, the surplus public fill and C&D waste requiring disposal is expected to be small and hence the extra loading on public filling areas and landfills will be minimized.

(2) Chemical Waste

The maintenance and servicing of construction plant and equipment may possibly generate some chemical wastes, for instance, cleaning fluids, solvents, lubrication oil and fuel.

Chemical waste arising during the construction phase of the proposed developments may pose the following potential environmental, health and safety hazards if not stored and disposed of appropriately as stipulated in the Waste Disposal (Chemical Waste) (General) Regulations:

- Toxic effects to workers;
- Adverse impacts on water quality from spills and associated adverse impacts on fresh water biota); and
- Fire hazards.

Materials classified as chemical wastes will require special handling and storage arrangements before removal for appropriate treatments at the Chemical Waste Treatment Facility at Tsing Yi. Wherever possible, opportunities for the reuse and recycling of materials will be taken.

In view of the smaller scale of the proposed developments under the landuse planning framework and the corresponding construction activities, it is anticipated that the quantities of chemical waste, such as lubricating oil and solvent produced from plant maintenance will be small. Given that the Code of Practices on the Packaging, Labelling and Storages of Chemical Wastes are followed, adverse environmental impacts are not expected.

Apart from the general chemical waste, asbestos containing materials (ACM) might arise from the refurbishment works for the holiday camps at Lung Kai Public School, Sam Wo

Public School, King Sau Public School and Kwan Ah Public School. Asbestos is widely used in the construction industry before the early 1980's for fireproofing, thermal and electrical insulation and in sound absorption materials. However, asbestos is currently recognised as hazardous materials, due to its etiological effects on the human respiratory system. As the proposed developments involve refurbishing works of buildings/ structures which were built before 1980's, ACM may be present in the building materials used for the construction of the buildings. Thus, ACM which may be disturbed during the refurbishing activities, should be removed and disposed of in a proper manner prior to the refurbishment works, so as to avoid the release of harmful asbestos fibres into the environment and minimise potential hazard.

All ACM if confirmed to be present within the existing schools must be removed and disposed of in accordance with *the Air pollution Control Ordinance* and the *Waste Disposal Ordinance* prior to the refurbishment work. A Registered Asbestos Consultant and Registered Asbestos Laboratory shall be engaged to conduct investigation for the presence of ACM. An Asbestos Investigation Report, an Asbestos Abatement Plan (AAP) (if required) and a notification of commencement of asbestos abatement works shall be submitted to EPD at least 28 days before the asbestos abatement works commences. Also, the removal of ACMs should be carried out by a Registered Asbestos Contractor according to the approved AAP under the supervision of a Registered Asbestos Consultant. The asbestos waste generated shall be disposed of by a licensed waste collector in compliance with the Waste Disposal Ordinance. Provided that handling and disposal of ACM are carried out in accordance with the EPD's *Code of Practice on Handling, Transportation and Disposal of Asbestos Waste* and *Practice Note for Professional Persons – Handling of ACM in Buildings*, it is not anticipated that the handling and disposal of ACM will cause adverse environmental impacts.

(3) General Refuse

Staff working at the construction site will generate general refuse requiring disposal during the construction works. General refuse will mainly consist of food wastes, aluminium cans, plastic bottles and waste paper. The storage of general refuse may give rise to adverse environmental impacts. These could include water quality (if waste enters nearby water bodies); odour, (if waste is not collected frequently) and visual impact; and in the form of windblown litter. The construction site may also attract pests and vermin if the storage areas are not well maintained and cleaned regularly. In addition, disposal of waste at sites other than approved waste transfer or disposal facilities can also have environmental impacts.

Given the minor scale of the proposed developments, the amount of general refuse generated by the site workers during construction and demolition activities will not be significant. If the refuse is stored and transported in accordance with relevant good practices and disposed of at licensed landfills, the potential environmental impacts will be minimal.

7.6.5.2 Operational Phase

The operational phase of the proposed developments will result in generation of a variety of wastes, which can be divided into the following distinct categories based on their compositions:

- municipal solid waste;
- stable waste;
- chemical waste and ash / non-combustible waste; and
- sludge.

The nature and quantity of each of these waste types arising from the operation of the proposed developments are described in the section below.

(1) Municipal Solid Waste

Domestic waste will arise from the proposed residential development and the storage and handling of domestic waste have the potential to give rise to adverse environmental impacts. These may include odour if waste is not collected frequently, litter, water quality impacts if waste enters storm water drains, visual impact and vermin problems if the waste storage area is not well maintained and cleaned regularly. In addition, disposal of waste at sites other than approved waste transfer or disposal facilities, can also lead to similar adverse impact at those sites.

It is estimated that a total of about 177 and 56 tonnes/day of municipal waste will be generated from the land use proposals in weekends / public holidays and normal days respectively. Recyclable materials such as plastic bottles, aluminum cans and paper will be collected by separate recycle bins and delivered to recyclers for recycling. The non-recyclable portion of waste generated will be collected and delivered to the designated refuse transfer station or landfill site for disposal by waste collector to be engaged by the FEHD / licensed collector.

As for the handling of waste, the North West New Territories Refuse Transfer Station (NWNTRTS) with a design capacity of 1,100tpd should be able to cater for the increased waste load from the proposed developments. Given the small amount of municipal solid waste produced daily and the surplus capacity of the NENT refuse transfer station (waste arising of 900tpd for North District in 2026 and 177tpd (taking into account of the safety factor of 1.2) for the landuse proposals, it is anticipated that the waste management implications due to the proposed landuse planning framework will be insignificant.

(2) Waste from Stable

For worst-case planning scenario, a horse riding school is proposed in the recreational area in Pak Fu Shan. Waste generation rate of 0.11tonne/horse/day is assumed with reference to EIA Report AEIAR-097/2006 Main Arena of the 2008 Olympic Equestrian Event.

Generally, stables waste mainly consists of bedding paper scraps, horse feed and horse excretion. The predicted daily waste amount produced by the 68 horses at the proposed horse riding school is approximately 9 tonnes. It should be noted that this figure is subject to variations depending on the seasonal factors, horse population and workload. The bedding materials for stables should be replaced more frequently in high humidity weather due to hygiene concerns and therefore a greater amount of stable waste is likely to be generated during these seasons.

All horse faeces will be collected and disposed of in accordance with the current practice of the other public horse riding schools. Waste from stables should be cleared and collected by licensed waste collector engaged by licensed collector daily or more frequent as necessary. Tracks and areas outside stables should also be cleaned regularly to ensure that they are free from waste or dust. The collected waste should be delivered to the landfill sites by refuse collection vehicles for final disposal, or alternatively be composted for reuse.

(3) Chemical Waste

During the operational phase of the proposed crematorium, three main types of wastes are expected.

- Ash and non-combustible residues generated from cremators during combustion;
- Chemical waste generated from the air pollution control system, machinery maintenance and servicing; and
- General refuse generated by visitors and staff during daily operation.

The maximum generation rate of bone ash and non-combustible residues per day are 39.6kg and 32.4kg respectively. The daily chemical waste arising associated with operation

of the air pollution control system of the new crematorium would be 18kg of used activated carbon and un-reacted lime and 28.5kg of collected particulate matter. Therefore, the estimated total generation of such chemical wastes would be about 46.5kg/day. A small amount of chemical waste in the form of cleaning fluids, solvents, lubrication oil and fuel would also be generated during regular maintenance and servicing of transformer, switch room and hydraulic lifts. The proposed crematorium is a Designated Project under EIAO and its potential environmental impacts are subject to the statutory Environmental Impact Assessment.

According to the operation of the existing crematorium, it is anticipated that the quantity of general refuse generated by visitors and staff during daily operation will not be substantial.

The proposed Man Kam To Development Corridor will be used as commercials, retails, warehouse and logistic type uses. Chemical waste is considered not compatible within this zoning and is not recommended. However, some trace amount of chemical waste would be generated during regular maintenance and servicing of the machinery. The amount of chemical waste generated during operation will depend on the type of plant/ equipment used and the maintenance schedule adopted. The quantity of chemical waste, however, is not considered to be significant. Chemical waste will be properly managed in accordance with the Waste Disposal (Chemical Waste) (General) Regulation and the Code of Practice on Packaging, Labelling and Storage of Chemical Wastes.

The proposed Man Kam To Development Corridor is recommended to be included within a zone whereby the potential uses within the consultation zone of the SSWTW (see **Section 7.4**) are contained under Column 2 of the Statutory Notes such that any development may only be permitted with conditions subject to TPB approval(s) while only some less-intensive uses outside the consultation zone are recommended as Column 1. Application system and approval conditions are to be proposed to ensure proper handling, storage and disposal of the chemical wastes.

(4) Sewage Sludge

The estimated average dry weather sewage flow arising from all the proposed developments is about 11,580m³/day. The major solid waste types produced from the increase of sewage in the Sewage Treatment Works (STW) will be grit and screenings from the Inlet Works and the digested sludge as well as the chemical waste associated with sewage treatment process.

With reference to the EIA report of Sha Tin Sewage Treatment Works, Stage 3 Extension (AEIAR-021/1999) and Study Brief of Expansion of Shek Wu Hui STW, the increase in sewage flow of around 11,580m³ arising from the proposed landuse planning would not produce significant quantity of screenings, grit, chemical wastes as well as the digested sludge. The quantity and nature of screenings, grit, the associated chemical waste and sludge are all process specific. For example, the nature of sludge generated from a STW will depend on the types of treatment processes employed. There are numerous sludge types, including primary sludge, sludge from chemical precipitation, activated sludge, trickling-filter sludge, aerobically / anaerobically digested sludge. Most digested sludges in Hong Kong are dewatered by filter press or centrifugation and set off-site for disposal at a strategic landfill. Assuming the sludge rate produced from the STW lies in the range of 5×10^{-4} to 10×10^{-4} m³ sludge/m³sewage/day, 5.79 – 11.58m³ sludge will be produced daily from the proposed landuse planning. Assuming the digested sludge has dried solids (ds) content of 30%, and the density of sludge is 1 t/m³, it is estimated that 1.74 – 3.47 tonnes dried sludge per day will require final disposal. The existing skip used for sludge transportation can hold approximately 10m³ of sludge. Thus, 1.74 – 3.47tpd sludge would only require less than one skip per day. It is therefore considered that the traffic impacts due to the expansion of Shek Wu Hui STW associated with off-site sludge disposal, if this disposal option is adopted, will be minimal.

The Sludge Treatment Facility Feasibility Study has proposed the Sludge Treatment Facility (STF) at Nim Wa for incineration of sludge generated from STW with the merits of low total costs, large reduction in volume of end product to be disposed at landfill, and reuse of energy from the incineration process. Construction of the STF is scheduled to commence in 2010 for completion in 2013. Prior to the operation of the STF, the sludge will be delivered to landfill for disposal.

7.6.6 Mitigation Measures

7.6.6.1 Construction Phase

(1) General

It is anticipated that the construction phase of the landuse proposals will only involve minor site formation works and construction of simple temporary structures, therefore significant amount of C&D material generation is not expected. However, the following good site practices are still recommended throughout the construction activities:

- nomination of an approved personnel, such as a site manager, to be responsible for the implementation of 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 site cleanliness, appropriate waste management procedures and concepts of waste reduction, reuse and recycling;
- provision of sufficient waste disposal points and regular collection for disposal;
- appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers;
- regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors;
- a waste management plan should be prepared by the contractor and submitted to the Engineer for approval.

Disposal to landfill should always be the last resort in waste management and the future Project Proponent should make their best effort in avoiding this option as far as practicable such as by on-site or off-site reusing of C&D materials.

(2) C&D Material

The future Project Proponent shall notify CEDD of the estimated spoil volumes to be generated, and liaise and agree with the Public Fill Committee for the disposal of surplus inert C&D materials including good quality rock during detailed design of the project. Wherever practicable, C&D materials should be segregated from other wastes to avoid contamination and ensure acceptability at public filling areas or reclamation sites. The following mitigation measures should be implemented in handling the waste:

- Maintain temporary stockpiles and reuse excavated fill material for backfilling and reinstatement;
- Carry out on-site sorting;
- Surplus artificial hard materials should be delivered to Tuen Mun Area 38 recycling plant or its successor for recycling into subsequent useful products;
- Make provisions in the Contract documents to allow and promote the use of recycled aggregates where appropriate;
- Implement a trip-ticket system for each works contract to ensure that the disposal of C&D materials are properly documented and verified; and

- Implement an enhanced Waste Management Plan to encourage on-site sorting of C&D materials and to minimize their generation during the course of construction.

(3) C&D Waste

Standard formwork should be used as far as practicable in order to minimise the arising of C&D waste. The use of more durable formwork or plastic facing for the construction works should be considered. Use of wooden hoardings should be avoided. Metal hoarding should be used to enhance the possibility of recycling. The purchasing of construction materials will be carefully planned in order to avoid over ordering and wastage.

The future Contractor should recycle as much of the C&D materials as possible on-site. Public fill and C&D waste should be segregated and stored in different containers or skips to enhance reuse or recycling of materials and their proper disposal. Where practicable, concrete and masonry can be crushed and used as fill. Steel reinforcing bar can be used by scrap steel mills. Different areas of the sites should be considered for such segregation and storage.

A charging policy for the disposal of waste to landfill implemented in December 2005 provides additional incentive to reduce the volume of waste generation and to ensure proper segregation of inert material for disposal to public filling areas.

(4) Chemical Waste

Chemical waste producers should be registered with EPD. The Contractor shall identify alternatives to eliminate the use of chemical, to reduce its generation quantities or to select a chemical type of less impact on environment, health and safety as far as practical.

Chemical waste should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes as follows. Containers used for 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 specification have been approved by EPD; and
- Display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations.

The storage area for chemical wastes should:

- Be clearly labelled and used solely for the storage of chemical wastes;
- 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 the area, whichever is 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 adequately separated.

Disposal of chemical waste should:

- Be via a licensed waste collector; and
- Be to a facility licensed to receive chemical waste, such as the CWTC which also offers a chemical waste collection service and can supply the necessary storage containers; or

- Be to a re-user of the waste, under approval from EPD.

(5) General Refuse

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

Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated and made easily accessible. Separately labelled bins for their deposit should be provided if possible.

Office wastes can be reduced through the recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered by the Contractor. In addition, waste separation facilities for paper, aluminium cans, plastic bottles etc., should be provided.

(6) Asbestos Containing Material (ACM)

ACM is classified as Part A waste under the Waste Disposal (Chemical Waste) (General) Regulation. An Asbestos Investigation Report (AIR) and Asbestos Abatement Plan (AAP) should be prepared by Registered Asbestos Consultants based on thorough site investigations under the Air Pollution Control Ordinance (APCO). All ACM shall be removed prior to commencement of demolition works. All asbestos waste shall be stored properly in a secure place isolated from other substances so as to prevent any possible release of asbestos fibres into the atmosphere and contamination of other substances. Type 1 asbestos waste shall not be stored together with Types 2 and 3 asbestos wastes so as to avoid damage to the plastic bags of Type 2 or 3 asbestos waste, unless the bags are packed in boxes or drums for additional protection. Bagged asbestos waste shall not be stacked more than 3 bags high in order to avoid damage to the bottom bag. The storage area shall be isolated from other working areas and bear warning panels to alert people of the presence of asbestos waste.

Disposal of asbestos wastes shall not commence before a designated notification has been given to EPD and confirmed. Before being transported for disposal, all the asbestos waste produced shall be stored in a temporary storage area which complies with the requirements of Section 7 of the *Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste*.

All asbestos wastes for disposal shall be transported by an asbestos waste collector - General Central Engineering Limited, licensed by EPD and in a designated barge equipped as stated in the Code of Practice and to be disposed of at the landfill site as designated by EPD.

7.6.6.2 Operational Phase

(1) Municipal Waste

The following measures should be implemented to enhance material recovery and recycling:

- Recycling bins should be provided at shops and food service locations to collect cardboard containers. Personnel in office should be provided with bins to recycle office paper.
- Aluminum can recycling bins should be placed at prominent locations for collection.
- Recycling bins for plastic bottle recovery should be set up at prominent places to facilitate visitors' participation in material recovery activities.

- The landscaping works will generate a certain amount of grass clippings, leaves, brush and tree trimmings. Should there be a market or facility which could process the green waste arising from the area, the establishment of a recycling programme for green waste should be considered.
- The venue operator should make arrangements with the laser printer toner cartridge suppliers to collect and recycle used toner cartridges for laser printers to avoid disposal of the cartridge at landfills as far as practicable.

(2) Waste from Stable

Waste from horse stables (mainly the horse manure) should be collected on a regular basis following sanitary practices of the other public horse riding school including the following:

- Stable waste should be stockpiled in properly enclosed containers;
- Stable waste should be collected by licensed waste collector on a regular basis;
- Collected waste should be delivered to the landfill sites by refuse collection vehicles for final disposal; and
- Briefings should be given to stable staff on the sanitary practices.

The current management control measures adopted by stables at the other public horse riding schools have been proven to be effective and sufficient in reducing nuisance and protecting the environment. These measures should be replicated for the waste management of the new stable area at the proposed site. Ngau Tam Mei Animal Waste Composting Plant may be possible options for treatment of the stable waste. However, the final waste management strategy is subject to further review in the development study.

Alternatively, an integrated new Animal Waste Composting Plant with the horse riding school development could be considered to handle the horse stable waste arising from the proposed horse riding school. This could gain environmental benefit by minimising the burden to the available landfill space, as well as promoting the recovery of the horse wastes into useful compost as consequently having an important contribution to the environmental commitment.

The new composting plant shall have capacity to treat about 10 tonnes of horse stable waste daily and turn it into useful organic compost suitable for landscaping, horticultural and agricultural uses for the Closed Area. The design could be made reference to the Animal Waste Composting plant at Ngau Tam Mei and adopt a rotary in-vessel composting technology to ensure effective elimination of all harmful pathogens as well as containment and treatment of potentially odorous emissions during the composting process. In-vessel composting enables the natural biological degradation of organic materials under controlled aerobic conditions.

Subject to detailed assessment for submission of the Section 16 planning application in the next stage, it is recommended that the composting plant should be at least 100m away from the sensitive uses to minimise the odour impacts. The strategic location of the composting plant will be determined after careful consideration of the source of waste arising, the routes of transport and future location of the disposal facility.

The horse riding school is only considered as the worst case planning scenario for the proposed recreational area in Pak Fu Shan and the animal waste composting plant is recommended as possible enhancement measure option for future consideration, should the horse riding school be actually proposed. The proposed animal waste composting plant is a Designated Project under Schedule 2, Part 1 G under EIAO and therefore a separate EIA study will be required by the respective project proponent in due course. The associated potential environmental impact and the buffer distance and any other environmental

mitigation measures recommended above would be subject to the statutory EIA under the EIAO.

(3) Ash and Non-combustible Residues

The disposal of bone ash and non-combustible residues generated from the operation of the new crematorium should be properly collected and handled to avoid dust emissions. In line with the current practices, the bone ash will be stored in covered containers for collection by the deceased's relatives within 2 months upon appointment while the non-combustible residues will be collected in sealed heavy-duty polyethene bags for disposal at landfill. Provided that these good practices are replicated, the potential secondary environmental impacts will be minimal. It should be noted that the proposed crematorium is a Designated Project under the EIAO. A statutory environmental impact assessment (EIA) is required to assess and confirm its potential environmental impact and recommended mitigation measures.

(4) Chemical Waste

The chemical wastes generated from the air pollution control system during the operation of the new crematorium would mainly include used activated carbon, un-reacted lime and collected particulate matter. The proposed Man Kam To Development Corridor may also generate some trace amount of chemical wastes. To prevent health hazards to operators, all such chemical wastes should be carefully collected and handled to avoid dust emissions.

Chemical waste producers should be registered with EPD. All the chemical wastes generated from the air pollution control system as well as from machinery maintenance and servicing should be dealt with according to the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes under the provisions of the Waste Disposal (Chemical Waste)(General) Regulation. The chemical wastes should be collected by drum-type containers and removed by a licensed chemical waste contractor.

Chemical waste should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes as follows. Containers used for 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 specification have been approved by EPD; and
- Display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations.

The storage area for chemical wastes should:

- Be clearly labelled and used solely for the storage of chemical wastes;
- 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 the area, whichever is 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 adequately separated.

Disposal of chemical waste should:

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

It should be noted that the proposed crematorium is a Designated Project under the EIAO. A statutory environmental impact assessment (EIA) is required to assess and confirm its potential environmental impact and recommended mitigation measures.

(5) Sludge

The containment, storage and delivery of the sewage sludge should be enclosed. Odour removal facilities should also be installed to minimise the potential air quality impacts to any sensitive receivers.

7.6.7 Conclusion

Assessment has been conducted to evaluate the solid waste management implication of the proposed landuse framework in the RDP. The quantity for the generation of waste during the construction phase has been estimated. Measures, including the opportunity for on-site sorting and reusing excavated fill materials (stored in stockpiles) are recommended to minimise the surplus disposal off-site. Recommendations should be made for the implementation by the future Contractor during the construction period to minimise the waste generation and any off-site disposal.

The types and quantities of waste that would be generated from the proposed development areas during the operational phase have been assessed. Only a limited amount of waste would be generated from the new stables and by the visitors and residents.

7.7 Ecological Impact

7.7.1 Introduction

This chapter presents the assessment of potential ecological impacts, including cumulative impacts, in areas in which developments are proposed under the landuse planning arising from both direct and indirect factors. It evaluates the potential ecological implications and the ecological acceptability of the proposed landuse framework via the identification and assessment of both direct and indirect impacts.

The primary ecological performance indicators are found in the Technical Memoranda on the Environmental Impact Assessment Process (<http://www.epd.gov.hk/eia/english/legis/index3.html>) and relevant annexes. Annex 8 provides criteria for evaluating ecological impact, including the significance of an ecological impact, the ecological value of a site and the species within a site or habitat. Annex 16 provides guidelines for ecological assessment, including general principles, the scope and content and the assessment methodology. The combination of assessment criteria and the quality and magnitude of impact provides the primary indicators against which ecological performance is generally measured in this Study. Proposals for mitigation measures required to reduce ecological impacts to insignificant levels are provided, and residual impacts are presented.

7.7.2 Overview of Potential Ecological Implications of the Landuse Framework

Changes to the boundary of the Closed Area will potentially open up some largely rural and relatively undisturbed land. Due to its current status, access to this area has been restricted, which has had the following ecological consequences. Firstly, habitat maturation of abandoned agriculture and grassland has occurred in widespread areas, which has created a mosaic of grassland, shrubland and woodland habitats. One notable feature is that forest linkages between Guangdong and the northeast New Territories have developed and strengthened. Secondly, low levels of human disturbance are likely to have been beneficial to the occurrence of fauna, and thirdly low levels of agriculture and other pollution sources

have allowed certain stream catchments in the area to maintain good water quality. Together with a lack of modification, this has meant a number of stream systems are of high ecological value. Finally, extensive areas of relatively fish pond wetlands of high ecological value are present at in the western part of the Study Area, as far east as the Ng Tung River. The relative lack of human disturbance has helped maintain the ecological value of these areas.

The Landuse proposals will have both direct and indirect ecological impacts. Direct impact comprises habitat loss, while indirect impacts range from disturbance and fragmentation impacts of both developments and supporting infrastructure to agricultural modification arising from the increased population of both residents and visitors. Quantification of direct effects can be estimated from the proposed maximum extent of the landuse zonings; however, no more than qualitative assessments can be made of indirect effects due to the lack of detailed project designs.

West of the Lok Ma Chau BCP no changes are proposed to the existing landuse framework, and thus no ecological impacts are predicted. To the east of the BCP impacts of low significance are predicted as a result of village and ecolodge development in the area.

West of the Lok Ma Chau BCP no changes are proposed to the existing landuse framework, and thus no ecological impacts are predicted. To the east of the BCP impacts of low significance are predicted as a result of village and ecolodge development in the area.

In the lowland areas between the Ng Tung River and Tsung Yuen Ha, in general residual impacts of low significance are predicted, largely due to the relatively low ecological value of much of this abandoned agricultural land and the feasibility of practical mitigation measures. In the Tsung Yuen Ha and Heung Yuen Wai areas, however, direct and indirect impacts of village expansion and infrastructure provision, and the impact of agricultural modification arising as an indirect impact of increased population and better infrastructure provision, could have significant ecological impacts on lowland grassland habitats and the stream network of the Heung Yuen Wai area. The latter, in particular, is susceptible to severe permanent adverse impacts under current proposals.

At Lin Ma Hang and the lowlands west of Sha Tau Kok, a similar situation pertains: direct and indirect impacts of village expansion and infrastructure provision, and the impact of agricultural modification arising as an indirect impact of increased population and better infrastructure provision both could have serious ecological impact on the streams at Lin Ma Hang, Tong To, Muk Min Tau and Sheung/Ha Tam Shui Hang.

The designation in this eastern part of the Study Area of a large area of land as Robin's Nest Country Park will afford a higher degree of protection to areas of closed-canopy shrubland, woodland and upland grassland.

7.7.3 Ecological Legislation, Standards and Guidelines

The western part of the Study Area constitutes an integral part of the Deep Bay wetland ecosystem. This includes a diversity of wetland habitats, including large areas of intertidal mudflats, mangroves, freshwater and brackish fishponds, gei wai, marsh and river channels, although that part within the Study Area comprises only fishponds, marsh and river channels. The wetlands are recognised as a site of international importance, supporting internationally-important populations of a number of bird species, including species that are both globally and regionally threatened. A number of other floral and faunal species of conservation importance are also present in significant numbers, including species that do not occur elsewhere within Hong Kong.

In recognition of the importance of the area, in September 1995 the Deep Bay mud flats, Mai Po Nature Reserve (MPNR) and some of the surrounding fishponds (with a total area of approximately 1500 ha) were declared a Wetland of International Importance under the Ramsar Convention (the Mai Po Inner Deep Bay Ramsar Site).

One of the methods for protection of the ecological value of the Ramsar Site has been the development of Town Planning Board Guideline 12B (TPB PG-No. 12B). This designates areas surrounding the Ramsar Site as Wetland Conservation Area (WCA) and Wetland Buffer Area (WBA). The intention of the WCA is 'to conserve the ecological value of the fish ponds which form an integral part of the wetland ecosystem in the Deep Bay Area'. This is further protected by the WBA, which aims to 'protect the ecological integrity of the fish ponds and wetland within the WCA and prevent development that would have a negative off-site disturbance impact on the ecological value of fish ponds'. The WCA and WBA provide significant limitations on permitted developments within these zones, in order to provide protection to the important wetland habitats of the area. Further, 12-month Ecological Impact Assessment is expected for proposed developments within these zones, and this requirement will affect developments proposed in this Study (e.g. Eco-lodges straddling Planning Areas 1 and 2). In this study the Ramsar Site will not be directly impacted by any proposed development plans, as areas west of the Lok Ma Chau remain largely unaffected by land use change or development area proposals.

Site of Special Scientific Interest (SSSI) status has been granted to two sites in the Study Area: Lin Ma Hang Stream (designated in July 2007) due to its high diversity of fish species, and Lin Ma Hang Lead Mines (designated in August 1994) due to its large, important bat colony. For both sites, the Register of SSSIs states that AFCD should be consulted on development proposals that may directly or indirectly affect the site. With regard to the Stream, it is stated that protection measures should comprise appropriate land use zoning to protect the riparian corridor and its vegetation as a buffer for the stream, and that activities that affect the quality and flow of water should be avoided.

With regard to natural streams/rivers, the Environment, Transport and Works Bureau Technical Circular (Works) No. 5/2005 (ETWB TCW No. 5/2005) provides an administrative framework for the protection of natural streams/rivers from adverse impacts arising from construction works associated with government projects and private developments. In addition, certain natural watercourses have been denoted "Ecologically Important Streams" by AFCD, and should be properly protected. In the Study Area, the only one included is Lin Ma Hang Stream.

7.7.4 Baseline Conditions

As noted above, relatively few ecological studies have previously been carried out in areas east of the Lo Wu Border Crossing, largely owing to the lack of access into the Closed Area, the relative lack of infrastructural development in the area and the lack of sites of known ecological importance. Nevertheless, a biodiversity study conducted by Kadoorie Farm and Botanic Garden (KFBG) found that, despite the proximity to heavily urbanised parts of Shenzhen, a high diversity of species occurs in parts of the area as a result of the lack of human disturbance (KFBG 2004).

There is a large contiguous area of fishponds in the western part of the Study Area, between Mai Po Inner Deep Bay Ramsar Site and the Ng Tung River, which forms part of the Deep Bay wetland ecosystem. These fishponds and associated wetlands are of high ecological value and form part of an extensive area of wetlands extending from Tsim Bei Tsui in the southwest to Hoo Hok Wai in the northeast (see **Figures 7.7.1 and 7.7.2**). This abundance of wetland habitats in the western part of the Study Area contrasts with the almost complete lack in the eastern half, while human disturbance in general declines from west to east, up to the lowlands just west of Sha Tau Kok.

Although most of the Study Area comprises anthropogenic or previously anthropogenic habitats, some of the areas not currently being utilized for human activities are in relatively advanced stages of succession to shrubland or forest. These habitat changes are overlain on the original pattern of agricultural and fishpond use around traditional New Territories villages, which are concentrated in the area east of the Ng Tung River. Ecological linkage between habitats is significant in the overall ecological value of the Study Area and

fragments of semi-natural habitat, and even superficially degraded areas, continue to support species of conservation importance. For many of these species the total area of habitat required for the maintenance of viable populations is unknown, even though the availability of a particular habitat of importance to the species may be quantifiable.

The most extensive areas of largely inactive agricultural land occur in the vicinity of Ta Kwu Ling and Heung Yuen Wai, with smaller areas at Lin Ma Hang and the lowland areas west of Starling Inlet (**Figures 7.7.3 to 7.7.6**). Although active and inactive dry agricultural land is generally considered to be of low or low to moderate ecological value, this area is subject to very low levels of disturbance and is part of an extensive block of similar habitat throughout the northeastern New Territories. Further, wet agricultural areas, which are generally of higher ecological value, are present near Sha Ling and at Chow Tin Tsuen.

There are a number of streams in the eastern part of the study area that are unmodified and are not polluted. The most studied of these is Lin Ma Hang Stream, which was declared an SSSI in July 2007. In addition, there are streams near the villages of Heung Yuen Wai, Sheung and Ha Tam Shui Hang, Muk Min Tau and Tong To that are of moderate to high ecological value. The good water quality, relative lack of modification and the resultant diverse riparian flora and fauna of these streams appear to have not been reported previously.

Botanically rich grassland supports a globally-threatened species of bird, Large Grass Warbler, for which Hong Kong is one of only two places the south China subspecies has been seen in modern times. The grassland at Robin's Nest is of this type, while it has also been recorded once at Tsung Yuen Ha.

There is a large area of undisturbed secondary woodland and closed-canopy shrubland at Lin Ma Hang and Robin's Nest that is around 30-40 years old. This woodland is closely linked to the adjacent Wutongshan Forest Park, Shenzhen (KFBG 2004). The narrow river between Lin Ma Hang and Sha Tau Kok that forms the boundary is relatively undisturbed, and there is forest on both sides. Although a road runs along this section on the Guangdong side, it is on viaduct for some of the length, allowing for passage of fauna below. In any event, the road would not prove a barrier to vagile fauna such as birds, butterflies and strong-flying insects. In this respect, this woodland provides an important ecological linkage between Hong Kong and Guangdong, and provides an important corridor for recolonisation of Hong Kong by more vagile forest species, especially mammals and birds. This woodland is further linked, albeit not so closely, to undisturbed woodland and closed-canopy shrubland at Pat Sin Leng and the northeast New Territories (see **Figures 7.7.5 and 7.7.6**).

Larger *fung shui* woodlands comprising mature trees with a relatively diverse floral community are found adjacent to the villages of Heung Yuen Wai, Muk Min Tau, Sheung Tam Shui, Lin Ma Hang, Tsung Yuen Ha and Shan Tsui, while other blocks of woodland are also located close to Ha Heung Yuen, Kan Tau Wai and Chuk Yuen (see **Figures 7.7.4, 7.7.5 and 7.7.6**). Due to the presence of a number of other small woodland patches in the area, these larger blocks are reasonably well connected to each other and to woodlands at Lin Ma Hang, and ultimately to Wu Tong Shan National Forest Park in Shenzhen (KFBG 2004), and support a woodland-associated fauna and flora.

Although not inside the Study Area, Starling Inlet is an ecologically important wetland on which impacts may occur as a result of development in the Closed Area. It covers an area of approximately 500 ha and lies immediately to the east of the Study Area (see **Figure 7.7.6**). The Inlet is tidal, and a small area of mangrove lies adjacent to the Study Area near Sha Tau Kok, while there are two fishponds adjacent to Sha Tau Kok within the Study Area.

This section presents the baseline conditions as currently understood, based on literature review and field surveys carried out for this Study. As a first step in this analysis, a baseline study was achieved through a desk-based review of existing literature for the area and broad assessments of the habitats according to recent aerial photographs, supplemented by

ground-truthing and selective habitat assessment where necessary. Supplementary faunal surveys were carried out to fill in gaps associated with projected development areas based on the habitats present, but inventory assessments were not carried out for the Closed Area as a whole.

The methodologies adopted for and the data collected during field surveys are presented in **Appendix G**, which provide lists of all species recorded for non-avian fauna, and lists of species of conservation significance or wetland-dependant species in the case of birds. In addition, a summary of the bird community at each site is provided.

Mammals are notoriously difficult to survey due to their secretive nature and low densities. As a result, no dedicated mammal surveys were conducted, although any observations made during other surveys (including signs of mammal activity, for example tracks, droppings or burrows) were noted. Difficulties in assigning foraging bats to species level mean that only general comments about their occurrence in the area are possible.

The following descriptions of the baseline conditions of each Planning Area concentrate on identifying the elements of the fauna that are distinctive or of conservation-significance.

7.7.4.1 Planning Area 1

Since no development areas were identified in areas to the west of the Lok Ma Chau BCP, no ecological surveys were carried out, and the description of baseline conditions is based on literature review only. This area, however, is well understood in terms of its ecological significance due to previous studies, both professional and amateur. With regard to areas to the east of the Lok Ma Chau BCP, between there and the Ng Tung River, surveys were carried out in the hills between Chau Tau and Ma Tso Lung Village to fill information gaps, and at Hoo Hok Wai to determine its ecological value.

Fishpond Wetland Areas

Birds

The fishpond wetland areas (including fishpond, reedbed and marshy habitats) that comprise much of Planning Area 1 are of particular importance for wetland birds due to a combination of suitable habitat and a relative lack of both fragmentation and disturbance. Of particular note are breeding, passage and wintering populations of large waterbirds, including egrets, herons, duck and spoonbills. Significant numbers of globally-threatened Black-faced Spoonbills *Platalea minor* occur at the Lok Ma Chau Station and Spur Line Wetland Compensation Area. Significant linkages exist with the intertidal areas of Inner Deep Bay, as confirmed by radio-telemetry studies of Black-faced Spoonbills and colour-marking of ducks, and with Mai Po Nature Reserve and other parts of the Mai Po Inner Deep Bay Ramsar Site. The eastern part of the Ramsar Site extends into the westernmost portion of the Study Area.

In terms of the Study Area, this linkage is most clearly expressed in the form of a flight line corridor followed by large waterbirds commuting between the wetland areas at Hoo Hok Wai and those west of the BCP, as far as Mai Po Nature Reserve and beyond. Hoo Hok Wai, although a large wetland area, is smaller in area than the wetland area to the west of the Lok Ma Chau BCP, and consequently its current ecological value is dependent on a continued link with the larger area. Should the link not exist, only wetland-dependent fauna for which the Hoo Hok Wai area provided all their needs would remain. In addition, the foraging areas at Hoo Hok Wai available to waterbirds that roost elsewhere, such as at Mai Po Nature Reserve, would not be accessible. Together, these impacts would reduce the number of waterbirds in the Deep Bay area and at Hoo Hok Wai in particular.

The flight line link was first identified in winter 2000-01, and was surveyed again in 2004-05, although in both years Great Cormorant was the focus of the surveys. As part of the later study, up to 23% of the Deep Bay wintering population of Great Cormorants were recorded flying through this corridor to forage in fishponds at Hoo Hok Wai (Anon. 2005). Other large

waterbirds such as Great and Little Egrets and Grey Heron were also observed utilising this corridor between the two wetland areas.

It is also possible that these ponds, situated as they are between the border fence and the old channel of the Shenzhen River, provides a corridor for mammalian fauna moving between the two wetland areas either side of the Lok Ma Chau BCP. The issue of the need to maintain connectivity between the wetlands at and around Mai Po with those to the east of Lok Ma Chau was faced when the Lok Ma Chau Spur Line project was amended to incorporate a Public Transport Interchange, which required upgrading of the access road at the Lok Ma Chau Station. This road upgrading had the potential to prevent terrestrial fauna from crossing under the Lok Ma Chau Boundary Crossing Bridge, hence blocking ground level linkages between the west and east sides of the Boundary Crossing Road. In order to mitigate for this potential significant fragmentation impact, the road and bridge design was amended to incorporate an underpass suitable for terrestrial fauna.

Although the exact boundary of the flight line corridor and the number of birds and other fauna using it is not clear, it is certainly the case that the fish ponds within the Study Area to the south and southeast of Loop are an important constituent. The ecological impact arising from the development of LMC Loop is being assessed under the EIA of the Planning and Engineering Study on Development of the Lok Ma Chau Loop, conducted by PlanD and CEDD.

Some egrets and herons from breeding colonies situated outside the Closed Area at Mai Po Village, Mai Po Lung and Tam Kon Chau forage within the Study Area, though primarily, if not exclusively, within areas to the west of the Lok Ma Chau BCP, which are not proposed for development.

Imperial *Aquila heliaca* and Greater Spotted Eagles *Aquila clanga*, both listed as globally threatened species by BirdLife International, occur regularly in Hong Kong only in the Deep Bay wetlands, and range throughout this part of the Study Area.

Herpetofauna

Fish ponds and adjacent areas within the Deep Bay area are known to support a number of conservation-significant reptile species, including Chinese Soft-shelled Turtle *Pelodiscus sinensis*, Burmese Python *Python molurus*, Common Rat Snake *Ptyas mucosus*, Indo-chinese Rat Snake *Ptyas korros*, Copperhead Racer *Elaphe radiata*, Banded Krait *Bungarus fasciatus*, Many-banded Krait *Bungarus multicinctus* and Chinese Cobra *Naja atra* (Anon. 1995, Karsen *et al.* 1998).

Four common and widespread amphibian species (Asian Common Toad *Bufo melanostictus*, Günther's Frog *Rana guentheri*, Paddy Frog *Fejervarya limnocharis* and Brown Tree Frog *Polypedates megacephalus*) generally occur in commercial fishpond areas, as well as the conservation-significant Chinese Bullfrog *Hoplobatrachus chinensis* and Narrow-mouthed Frog *Kalophrynus interlineatus* (Karsen *et al.* 1998, Chan *et al.* 2005).

Dragonflies and butterflies

Wilson (1995) noted that up to 30 species of dragonfly may be encountered at or adjacent to fish pond areas in the northwest New Territories. Species that are common in such habitats tend, however, to be widespread and have little or no conservation significance. A total of 28 species have been recorded at the Lok Ma Chau Station and Spur Line Wetland Compensation Area (AEC 2008), but only *Anaciaeschna jaspidea* and *Macrodiplox cora* are regarded by Wilson (2004) as 'uncommon' in Hong Kong.

This section of the Study Area is dominated by managed fish ponds, river channels with rank grass along the banks, waste land, and developed land. Such habitats are generally poor for butterflies, and results from a number of years of fieldwork at the Lok Ma Chau Station and Spur Line Wetland Compensation Area supports this.

Mammals

Several mammal species are known to occur in the Deep Bay area, and these include the Eurasian Otter *Lutra lutra*, which is of conservation significance ('Near Threatened', IUCN; 'Vulnerable', China Red Data Book). The Hong Kong distribution of this protected species appears to be confined to the northwest New Territories (Shek 2006), and the core area of its distribution appears to comprise the area from LMC Station and Spur Line Wetland Mitigation Area (WMA) to Hoo Hok Wai, including LMC Meander. At the Lok Ma Chau Station and Spur Line WMA, Small Indian Civet *Viverricula indica*, Small Asian Mongoose *Herpestes javanicus* and Leopard Cat *Prionailurus bengalensis* have also been recorded.

Hoo Hok Wai

Hoo Hok Wai is an area of fishponds located east of Lok Ma Chau Loop, stretching to the Ng Tung River. The faunal and floral characteristics of Hoo Hok Wai are very similar to fishpond wetland areas further west in the Deep Bay area. Provided here is a summary of the detailed assessment of its ecological significance carried out for this Study, after the area was included in the Study Area.

Fishponds and freshwater marsh or reedbed are the dominant habitat types. Wetland habitats, comprising ponds, marsh/reedbed, major streams/drainage channel, seasonally wet grassland and inactive wet agricultural land constitute 267.29ha, or 87.6% of the area.

Hoo Hok Wai provides an important foraging area for egrets and herons during both the breeding and non-breeding seasons. Previously, the area was known to be an important foraging area for Chinese Pond Herons breeding at the Ho Sheung Heung egretty (Aspinwall 1997), although its significance in this respect has declined in recent years.

Since December 1998 the number of waterbirds recorded at Hoo Hok Wai has averaged 15.8% of the total for all fishponds surveyed in the Deep Bay area as part of the Mai Po Inner Deep Bay Ramsar Site Waterbird Monitoring Programme (WMP). The number of fishponds surveyed at Hoo Hok Wai comprises 19.25% of the 399 ponds surveyed as part of the WMP. As might be expected given the higher levels of disturbance and smaller pond size, the fishponds lying alongside the Lok Ma Chau Loop support a proportionately lower (by approximately 40%) number of waterbirds than the ponds in the core area of Hoo Hok Wai itself, where disturbance levels are lower and habitat diversity is greater. Still, though, a total of 35 species of waterbird have been recorded in the WMP in the fishponds from Lok Ma Chau BCP up to and including the strip of ponds adjacent to the Loop.

In terms of species of conservation concern recorded at Hoo Hok Wai, Table 3 lists those considered to be globally threatened by BirdLife International as of April 2009 or of Regional or Global concern by or Fellowes *et al.* (2002).

Table 7.7.1 Species of birds recorded at Hoo Hok Wai (HHW) listed by BirdLife International or listed as of Global or Regional Concern by Fellowes *et al.* (2002). RC = Regional Concern, GC = Global Concern, PGC = Potential Global Concern. WMP = Waterbird Monitoring Programme

Species	BirdLife International	Fellowes <i>et al.</i>	Status at Hoo Hok Wai (HK primary status in brackets)
Species recorded at HHW as part of WMP			
Great Egret <i>Egretta alba</i>		RC	Common all year (1)
Little Egret <i>E. garzetta</i>		RC	Common all year (1)
Chinese Pond Heron <i>Ardeola bacchus</i>		RC	Common all year (1)
Falcatid Duck <i>Anas falcata</i>	Near-threatened	RC	Rare (4)
Chinese Spotbill <i>A. zonorhyncha</i>		RC	Rare (4)
Northern Pintail <i>Anas acuta</i>		RC	Scarce (2)
Northern Shoveler <i>A. clypeata</i>		RC	Scarce (2)
Eurasian Coot <i>Fulica atra</i>		RC	Small numbers in winter (4)
Black-winged Stilt <i>Himantopus himantopus</i>		RC	Regular in winter and on passage (3)

Species	BirdLife International	Fellowes <i>et al.</i>	Status at Hoo Hok Wai (HK primary status in brackets)
Pied Avocet <i>Recurvirostra avosetta</i>		RC	Rare in winter (2)
Kentish Plover <i>Charadrius alexandrinus</i>		RC	Rare on passage (2)
Marsh Sandpiper <i>Tringa stagnatilis</i>		RC	Rare on passage (3)
Dunlin <i>Calidris alpina</i>		RC	Rare on passage (2)
Collared Crow <i>Corvus torquatus</i>	Near-threatened		Common all year (1)
Other species recorded at HHW but not as part of WMP			
Black-faced Spoonbill <i>Platalea minor</i>	Endangered	PGC	Occasional winter records (2)
Greater Spotted Eagle <i>Aquila clanga</i>	Vulnerable	GC	Previously regular, now rare (4)
Imperial Eagle <i>A. heliaca</i>	Vulnerable	GC	Previously regular, now rare (4)
Styan's Grasshopper Warbler <i>Locustella pleskei</i>	Vulnerable	GC	One record (Aspinwall 1997) (4)
Chinese Penduline Tit <i>Remiz consobrinus</i>		RC	Regular in winter (2)
Yellow-breasted Bunting <i>Emberiza aureola</i>	Vulnerable	RC	Regular in winter and on passage (3)
Red-billed Starling <i>Sturnus sericeus</i>		GC	Common in winter (2)
White-cheeked Starling <i>S. cineraceus</i>		PRC	Common in winter (2)

RC = Regional Concern, GC = Global Concern, PGC = Potential Global Concern. WMP = Waterbird Monitoring Programme.
* indicates change in taxonomic treatment since Carey *et al.* (2001).

Key to Hong Kong status: 1: common wetland species present all year; 2: common winter visitor to Deep Bay area; 3: common winter visitor and passage migrant; 4: scarce winter visitor to Deep Bay area.

The Hoo Hok Wai area is also an important foraging ground for the Hong Kong wintering population of Great Cormorants. The most recent data available concern winter 2004-05, when up to 1728 birds or 23% of the wintering population was recorded flying to forage in fishponds at Hoo Hok Wai (Anon. 2005.). The area of LMC Meander and adjacent fish ponds forms part of an important flight line corridor linking wetlands to the west of LMC with those at Hoo Hok Wai.

In terms of the non-bird fauna, the ecological significance of Hoo Hok Wai is, overall, much lower than it is for birds; such a difference is normal for fishpond wetland areas in the Deep Bay area. Two-striped Grass Frog was the only uncommon species found at Hoo Hok Wai during surveys carried out for this Study. This species is regarded as being of Local Concern (Fellowes *et al.* 2002), and its distribution is considered to be restricted in Hong Kong (Chan *et al.* 2005). It is possible that other species of conservation significance such as Burmese Python, Chinese Bullfrog, Chinese Soft-shelled Turtle, Common Rat Snake and Reeves' Terrapin *Chinemys reevesii* occur, as they do in other fishpond wetland areas.

The floristic structure is simple and the floristic composition shows a typical transitional pattern from abandoned ponds or inactive agricultural land via the natural successional process, i.e. initially invaded with herbaceous vegetation and gradually by isolated woody species establishment. Freshwater wetlands support a wider variety of flora (including submerged macrophytes, emergent wetland species and aquatic floating plants), fauna and aquatic insects than brackish wetlands (Dudgeon and Chan 1996).

Wetland Mitigation Areas

There are two wetland mitigation areas present, with the primary one being that for Lok Ma Chau Station and Spur Line. This comprises a managed wetland of diverse habitats in former fish ponds dedicated to meeting ecological targets set out in the Environmental Permit for the project. The second is that associated with the San Tin East Main Drainage Channel, which lies between the drainage channel and the access road to LMC BCP. Low

numbers of a suite of freshwater-associated waterbirds occur, including Greater Painted-Snipe.

Hills between Chau Tau and Ma Tso Lung, and Tai Shek Mo

This area, which lies immediately to the south of Hoo Hok Wai, comprises degraded, fire-retarded upland grassland, with better quality grassland and a grassland-shrubland mix in damper, valley areas, where there also exist a very small number of human use areas. The rather frequent burning and lack of streams means it supports a relatively impoverished fauna, though in terms of birds it is a rather distinctive one. Due to the distinct habitat and topographical differences from Hoo Hok Wai, there are few ecological linkages, though there are hydrological linkages from the streams that drain the southern north-facing slopes.

Although not recorded in surveys for the current study, Eurasian Eagle Owl *Bubo bubo* is known to occur in the grassy hills near Chau Tau Village (Carey *et al.* 2001), and probably also in similar areas of habitat northeast to Ma Tso Lung Village. This species is listed by Fellowes *et al.* (2002) as of Regional Concern, and is a Category II protected species in China (Wang 1998). It is presumed to breed in the area as it occurs in suitable habitat at the appropriate time of year. Another bird of prey of restricted range in Hong Kong is Bonelli's Eagle *Hieraaetus fasciatus*, which, while not listed as a species of conservation concern, is a scarce breeding species in Hong Kong. The bird community of this area also comprises grassland specialists such as Savanna Nightjar *Caprimulgus affinis* and the locally-breeding form of Richard's Pipit *Anthus richardi sinensis*, as well as species of grassland-shrubland mix, such as Chinese Francolin *Francolinus pintadeanus*, Lesser Coucal *Centropus bengalensis* and Sooty-headed Bulbul *Pycnonotus aurigaster*. While individually none of these are species of conservation concern, the community they form is distinctive.

The only herpetofauna species of concern recorded during surveys was Chinese Cobra, which was observed once in the hillside shrub. This species is considered to be of Potential Regional Concern (Fellowes *et al.* 2002). It is also considered to be vulnerable in China (Zhao 1998).

The seasonal streams in the area, which were dry as late as May, are considered to be of low conservation value, although they remain in a natural state. No fish were recorded in these, however, as no water was present.

Lok Ma Chau Village and Ha Wan Tsuen

Ha Wan Tsuen is located immediately south of Lok Ma Chau Loop, to the east of Lok Ma Chau BCP. This area is partially built-up (i.e. village houses, viaduct, roads, artificial channel). Reinstated ponds and a very small active fishpond are also present, as well as plantation woodland.

Lok Ma Chau Village is located adjacent to fish ponds south of Lok Ma Chau Loop and is backed by the hills near Lok Ma Chau Lookout. It mainly comprises village area and active and inactive agricultural land. Shrubland, secondary woodland, seasonal streams and an abandoned pond can be found on the hillside.

This area includes a small area of active wet and dry agricultural land in front of Lok Ma Chau Village. In terms of birds, although such areas support freshwater wetland species, the small size of this area and the relatively high level of disturbance mean that the numbers present here are low, and this was reflected in the surveys. Of the species recorded, Wood Sandpiper and White-shouldered Starling are listed by Fellowes *et al.* (2002) as of Local and Potential Local Concern respectively. White-shouldered Starlings *Sturnus sinensis* were recorded in the village area. Otherwise, the bird community was typical of village and village edge habitats, and did not comprise any species of conservation significance.

In terms of non-bird fauna, at Ha Wan Tsuen, all species recorded are regarded as common and widespread in Hong Kong or, in the case of fish, are exotic species.

In the area of Lok Ma Chau Village a total of 11 amphibian species was found, mostly in the active and abandoned agricultural land. Chinese Bullfrog, which is listed as a Class II protected species in China (Chan *et al.* 2005) and considered to be of potential regional concern by Fellowes *et al.* (2002) was very abundant in the active agricultural land. Two-striped Grass Frog, which is considered to be uncommon in the territory (Chan *et al.* 2005) and of Local Concern (Fellowes *et al.* 2002), was very abundant in an abandoned hillside fish pond. During the LMC Loop Study, this species was also found in a pond alongside the Boundary Fence Road, to the south of the Loop. Amphibian diversity and abundance in the agricultural land were high, and nearly all Hong Kong's lowland species were recorded, making this an area of moderate ecological value to amphibians.

The only native fish species recorded were Common Carp, Edible Goldfish and Spotted Snakehead, but these are of low conservation value. No fish were recorded in the seasonal streams. During the LMC Loop Study, however, Paradise Fish *Macropodus opercularis* was found in a stream to the south of the Loop, alongside the Boundary Fence Road. Although this species is considered to be common (Lee *et al.* 2004), it appears to be more vulnerable than its congener, Hong Kong Paradise Fish *M. hongkongensis*, in Hong Kong, as suitable habitat (lowland marshes and streams) are degrading. Indeed, Chan (2001) considered the local status of Paradise Fish to be "conservation dependent". The streams to the south of the Loop, along the Boundary Fence Road, are all considered to be potential habitats for this species. In addition, a freshwater crab species, *Somanniathelphusa zanklon*, considered endangered by IUCN and endemic to Hong Kong, was also observed in one of these streams during the LMC Loop Study.

A total of 18 odonate species were recorded, most of which (14 species) were at the hillside pond. A species of Local Concern (Fellowes *et al.* 2002), Sapphire Flutterer, was abundant at this pond. Although regarded as common in the territory (Wilson 2004), it was only found at three isolated sites in the present study. Although another species of Local Concern, Scarlet Basker, was also found in the pond, this was more widespread in the Study Area and is considered as common in the territory by Wilson (2004). Other odonate species recorded are common in Hong Kong (Wilson 2004).

Butterfly diversity in the area around Lok Ma Chau village was moderately high, with a total of 34 species recorded in the area. Very few butterflies were recorded around the wet agricultural land in front of the village, and those present comprised common and widespread species. Diversity was moderately high, however, in hillside shrubland to the east of the village and around the Lychee trees adjacent to the village; these included several species typically associated with woodland habitats. Most species recorded in the area are common in Hong Kong, and no species were recorded that are listed by Fellowes *et al.* (2002) as of conservation importance.

7.7.4.2 Planning Area 2

This area includes a large area of fishponds and wetlands at Hoo Hok Wai. The ecological value of these wetlands is described under Planning Area 1, as the habitat characteristics are the same. The other ecologically significant site in this Planning Area is Ho Sheung Heung Egretty. Otherwise, village land at Liu Pok and Ma Tso Lung and the grassy hillsides of Tai Shek Mo comprise much of the area; the latter is included in Planning Area 1 with the hills between Chau Tau and Ma Tso Lung, as the habitat is very similar.

Ma Tso Lung Village

The area of Ma Tso Lung Village mainly consists of abandoned agricultural land that has turned to seasonal wet grassland and permanently wet freshwater marsh, village area, shrubland, channels and streams, secondary woodland and active agricultural land.

Bird species present are typical of village and village edge areas with nearby seasonally wet grassland occupying former agricultural areas. Only three wetland-dependant species were recorded, Chinese Pond Heron, White-breasted Waterhen and Green Sandpiper, all of

which are common and widespread in suitable habitat in Hong Kong. Of most interest was a record of a nest of White-shouldered Starling, a sparsely distributed breeding species whose breeding population in Hong Kong is estimated at less than 50 pairs (Carey *et al.* 2001).

Nine species of frog were observed, including Chinese Bullfrog, which is quite abundant in this area, especially at a small piece of active farmland on the hillside. A Class II Protected animal in China, it is considered to be of Potential Regional Concern owing to depletion of wild populations for the food trade (Fellowes *et al.* 2002; Chan *et al.* 2005). In addition, four reptile species were found, including two snake species of conservation concern – Common Rat Snake and Many-banded Krait (Zhao 1998; Fellowes *et al.* 2002). These two species were observed near village areas.

Streams in this area are partially channelized, and only two species of conservation value were recorded, a Three-banded Box Terrapin and the freshwater crab species *Somaniathelphusa zanklon*, which were sighted as part of surveys carried out for the NENT NDA Planning Study. A total of 18 odonate species were recorded in the stream system and two very small ponds. One dead individual of Ruby Darter, a species of Local Concern (Fellowes *et al.* 2002), was found in the stream. All odonate species recorded, including Ruby Darter, are regarded as common in Hong Kong (Wilson 2004). Although the streams are partially modified, their bottoms still comprise sand and gravel, while certain sections are also rich in both riparian and submergent vegetation, which can support habitats for native fish and odonate species.

Dudgeon and Chan (1996) stated that the water quality of the seasonal marsh (the abandoned farmland) at Ma Tso Lung was very bad due to domestic sewage intrusion. Although domestic sewage discharge to the abandoned farmland was still occurring during the present study, it would appear that the water quality has improved somewhat. This marsh and the active farmlands nearby act as seasonal wetlands, providing habitats for wetland-dependent species, such as Chinese Bullfrog. Given the location of Ma Tso Lung, it is likely that these habitats connect ecologically to the wetland system at Hoo Hok Wai.

A relatively high diversity of butterflies was recorded from the site (48 species), mostly from shrubland and village edge. Most species are common in Hong Kong, although Pale Palm Dart *Telicota colon* is considered by Fellowes *et al.* (2002) to be of Local Concern.

Bat abundance and diversity at this site was very low, with only a few individuals of one species recorded.

Liu Pok

Liu Pok consists of a large piece of abandoned agricultural land and a village area. An artificial water channel is also present, though this was dry in May.

Bird species recorded were typical of village and village edge areas with nearby seasonally wet grassland occupying former agricultural areas. Only two wetland-dependant species were recorded, Chinese Pond Heron and White-breasted Waterhen, both of which are common and widespread in suitable habitat in Hong Kong.

A total of six frog species was found within the abandoned farmland, with Spotted Narrow-mouthed Frog the most abundant, and a Common Rat Snake was also observed in the same area. The three species of fish observed in this area are exotic. Eleven common odonate species were observed in the channel.

A total of 38 butterfly species were recorded from Liu Pok, mostly associated with village edge and adjacent woodland/shrubland habitats. Butterfly abundance and diversity in the marsh was generally rather low, as would be expected in this habitat, although high densities of Bush Hopper *Ampittia dioscorides*, a wetland-dependent species, were recorded in June and July.

The abandoned farmland functions as a seasonal wetland. Although Dudgeon and Chan (1996) found that its water quality was poor, no sign of heavy pollution could be observed in this marsh during the present study.

Bat abundance and diversity at this site were also relatively low; two species were recorded around the village and nearby marsh.

Tak Yuet Lau

This area lies just west of the confluence of the Shenzhen and Ng Tung Rivers. It comprises two areas of woodland, the northernmost of which is planted, separated by an area of wasteland. The isolation of the northernmost area of woodland and its relatively young age means that it is of relatively low ecological value, while the linkage of the southern area with shrubland on the eastern slopes of Crest Hill affords it a higher rating. Neither area is of significance to species of conservation importance. The area of wasteland is of negligible ecological value.

Ho Sheung Heung area

This area comprises reinstated fish ponds alongside the Ng Tung River, surrounding shrubland and nearby agricultural land and a mixed village and light industrial area interspersed with bamboos that are occupied by breeding egrets and Chinese Pond Herons, forming the Ho Sheung Heung Egretty. The reinstated fish ponds alongside the Ng Tung River appear not to be managed. Next to the Lo Wu Correctional Institute is a pond considered to be actively managed, but this is small. Adjacent to this, there is a larger pond and adjoining farmland mosaic, which lie outside the Study Area, at the edge of Long Valley.

The primary interest of this area in terms of birds is the Ho Sheung Heung Egretty, which occupies roadside and village edge bamboos along Fai King Road. The Egretty was discovered in 1994, though its size at the time (65 breeding pairs) ranked it among the top three in Hong Kong and suggested it had been extant for some years. It is now one of the largest and longest-lived egrettries in Hong Kong, and the number of breeding birds approximately doubled between 1994 and 2007. The egretty is occupied by Chinese Pond Herons, Little Egrets and Cattle Egrets, and supports one of the largest colonies of Chinese Pond Herons in the SAR (Anon. 2007). In terms of the Hong Kong breeding population of ardeids, Ho Sheung Heung has supported a mean of 11.8% since 2000, while fieldwork carried out for this Study in 2008 it supported 13.0%; a total of 86 ardeid nests were counted, 42 of which were of Chinese Pond Heron. At least part of the reason for its longevity and size presumably derives from its location within the Closed Area, where disturbance is much reduced compared to other areas. The egretty is of high conservation value.

Fieldwork carried out in the 2008 breeding season indicates that the egretty, which lies along a stretch of road northeast of Ho Sheung Heung village, straddles the FCA boundary, with about half lying within the Study Area and half outside. Currently, the area outside the FCA in which the egretty lies is not included in any Outline Zoning Plan, but is being considered as part of the North East New Territories New Development Area Study.

Aspinwall (1997) carried out a study of flight lines in summer 1995 that revealed the primary foraging areas for these birds were the commercial fishponds at Hoo Hok Wai and, when drained, the reinstated fishponds very near to the egretty, immediately adjacent to the Ng Tung River. However, over the years this appears to have changed such that in 2008 about 80% of ardeids were recorded flying toward Long Valley for foraging, while approximately 10% flew toward Ma Tso Lung and a similar number flew toward the area of active and inactive wet agriculture lying the other side of the river and railway line.

Apart from the egretty and the reinstated fish ponds, which provide foraging grounds for Chinese Pond Herons breeding at the egretty and a small number of large waterbirds primarily in the non-breeding season, the bird community of this area comprises species

typical of village edge and open-canopy shrubland, with none of conservation significance having been recorded.

Ten frog species were recorded in this area, with the uncommon Two-striped Grass Frog in the northernmost reinstated pond, although its abundance was low. Other frog species recorded are common in the territory. No other fauna of conservation-significance were recorded.

The roadside plantations supported low vegetation diversity, and consequently the butterfly diversity here was very low, albeit with high abundances of a limited number of common species. Shrubland habitats, on the other hand, supported a moderate diversity of butterflies; a total of 32 species was recorded in this area, most of which are common or very common in Hong Kong. No species of conservation importance were recorded.

Surveys of the shrubland edge in this area revealed two foraging bat species, both of which were moderately abundant in the area.

7.7.4.3 Planning Area 3

The western section of this area is dominated by the grassy hillsides of Sandy Ridge cemetery, with an adjacent area of ecologically significant wet agriculture and inactive fish ponds immediately to the south. Further east is a mosaic of village areas, largely abandoned agricultural land and disturbed areas of grassland and shrubland. At the easternmost extent lies an area of wet agriculture at Chow Tin Tsuen next to channelised sections of the Ping Yuen River.

Sandy Ridge area

This area consists of active and abandoned agricultural land, fish ponds, reinstated pond, streams, village area, shrubland, secondary woodland, railway station and cemetery. Some stream sections in this area have been channelized (those inside farmland), but some remain in their natural condition (those next to the cemetery). To the north of the cemetery are located mitigation areas for the Shenzhen River Regulation Project Stage III. These comprise reinstated fish pond and planted woodland of approximately three years age.

The area to the southwest of Sandy Ridge, bounded to the west by the Ng Tung River and rail line and to the south by the Man Kam To Road, comprises active and inactive agricultural land, both wet and dry, and inactive fish ponds. This combination of habitats is generally attractive to birds, and this area is no exception. Twenty wetland-dependant species were recorded in the five surveys carried out as part of this study, including the rare Greater Painted-snipe. Although breeding was not actually proven, its occurrence throughout the year, the presence of calling birds in May and the presence of both inactive and wet agricultural areas suggests very strongly that breeding occurs.

The area lies close to Long Valley, and there are ecological linkages with this area, as shown by the occurrence of similar wetland dependent species, in particular, Cattle Egret, Common Teal, Greater Painted-snipe, Black-winged Stilt, Little Ringed Plover, Common Snipe and sandpipers *Tringa*, which are typical species at Long Valley but not in other, nearby wetland habitats.

The area also provides foraging grounds for Chinese Pond Herons nesting at the nearby Ho Sheung Heung Egret, which lies across the Ng Tung River. These birds were seen flying directly from the egret to the area during surveys.

A total of 11 frog species was found in this area. Nine of these, including Chinese Bullfrog, were present in the active farmland and active fish ponds to the southwest of Sandy Ridge. Two-striped Grass Frog was very abundant in a reinstated mitigation pond to the north of Sandy Ridge. The only reptile species of conservation significance recorded was Many-banded Krait.

A total of 11 fish species were recorded in this area. The only species of conservation significance was Small Snakehead, considered as uncommon in the wild locally (Lee *et al.* 2004) and of Local Concern (Fellowes *et al.* 2002), which was found in the active farmland and associated watercourses on the southern side of Sandy Ridge. It was, however, only recorded once, in May. A stream to the east of Sandy Ridge is mainly natural, with the bottom largely untouched, comprising sand and gravel. During the study conducted by Chan (2001), a species considered to be of local concern by Fellowes *et al.* (2002), Topmouth Gudgeon *Pseudorasbora parva*, was recorded in this stream.

A total of 32 odonate species was recorded in the reinstated pond, fish ponds and the streams and channels in this area. Three species of local concern, including Emerald Dwarf, Ruby Darter and Sapphire Flutterer, were found in the reinstated mitigation pond. Emerald Dwarf is also regarded as an uncommon species locally (Wilson 2004).

Amphibian diversity and abundance in the agricultural land and fish ponds to the southwest of Sandy Ridge were high. Chinese Bullfrog was found in the active agricultural land throughout the survey period, while odonate diversity observed in those ponds was also relatively high.

The reinstated pond on the northern side of Sandy Ridge seems to support a large population of Two-striped Grass Frog, and odonates of conservation concern can also be found. Most streams in this area, except that on the eastern side of Sandy Ridge, are either channelized or heavily disturbed by human activities (e.g. disposal of rubbish, introduction of exotic species such as Guppy). Although Small Snakehead was found in a channel and nearby farmland, this species was only recorded once. Channelized streams are generally not considered to be suitable habitats for fish.

Despite the diversity of habitats in the lowlying agricultural and adjacent areas, butterfly diversity was relatively low, with just 25 species recorded. All species are common and widespread throughout Hong Kong.

A single Eurasian Otter was recorded in one of the inactive fish ponds in the wet agricultural area to the southwest of Sha Ling in January 2009. This is the only record of the species in this area of Hong Kong east of the Ng Tung River. Of conservation significance ('Near Threatened', IUCN; 'Vulnerable', China Red Data Book), the Hong Kong distribution of this protected species appears to be confined to the northwest New Territories (Shek 2006). The area provides potentially suitable breeding habitat, although equally the record could have involved an opportunistic individual temporarily present after dispersing from the much larger wetland area of Hoo Hok Wai (assuming suitable passage exists across the railway and fenced river).

Only two species were recorded during surveys for foraging bats, both in relatively low numbers compared to other lowland wetland habitats.

Man Kam To (San Uk Ling and Muk Wu)

This area is located east of the Man Kam To BCP. Habitats in this area include secondary woodland, shrubland, orchard, streams, village areas, inactive fish ponds and active and abandoned agricultural land.

In terms of birds a very small number of four wetland-dependant species were recorded, in addition to Black Kite. These data, in addition to the lack of extensive wet agriculture areas and the presence of typical village and village edge habitats, mean that the area is not of high ecological value to birds.

Ten species of frog were recorded. Chinese Bullfrog was recorded in the area, and its tadpoles were abundant in the active agricultural land in the Muk Wu area. Two-striped Grass Frog was recorded in the pond on the hillside. Other species recorded are common in the territory.

Only 12 species of odonate were recorded at San Uk Ling, mostly common stream species, while at Man Kam To 22 odonate species were recorded. Sapphire Flutterer was found at a hillside pond in this area.

In total, nine fish species were recorded but only four are not exotic species, and all are of low conservation concern. Five species were recorded in the upper reaches of the stream near San Uk Ling. This section is partially channelized, but the bottom remains largely untouched, comprising sand and gravel. The lower stream section next to Man Kam To BCP, however, is completely channelized, and only Mosquito Fish was found in this section.

Butterfly surveys in this area covered the agricultural land (mostly dry, although including some wet fields) and secondary woodland close to Muk Wu village. Butterfly diversity in this area was found to be relatively low, comprising 21 species, all of which are common and widespread in Hong Kong. This low diversity is typical of agricultural land in Hong Kong.

Surveys for foraging bats covered shrubland and fishpond habitats at San Uk Ling. A moderate diversity of species was encountered (four species recorded) and bat abundance was also moderate. A survey conducted in farmland to the east of the Man Kam To Boundary Crossing Point found bat abundance and diversity to be relatively low, with few individuals of two species recorded.

Kong Nga Po

Kong Nga Po is highly disturbed by human activities. Open storage, container yards, active pig farms, abandoned fish ponds, streams, shrubland and secondary woodland dominate in this area.

The high level of disturbance, the lack of extensive wet agriculture areas and the presence of typical village and village edge habitats, means that the area is not of high ecological value to birds. Only four species of conservation significance were recorded, all in low numbers.

Nine frog species were found, of which the only one of significance was Chinese Bullfrog, which was found throughout the survey period in an abandoned pond heavily polluted by pig farm sewage. Although the streams in this area remain largely natural, they are heavily disturbed by human activities (e.g. domestic sewage input and runoff from pig farms). Only two fish species (Chinese Barb *Nicholsicypris normalis* and Edible Goldfish) were found in streams in this area. A total of 18 common odonate species were recorded.

Despite the high levels of disturbance, the Kong Nga Po-Hung Lung Hang area was found to support a moderate diversity of butterflies, with 41 species recorded, although this did not include any species considered to be of conservation importance. Nearby, west of Kong Nga Po, butterfly diversity was moderate, comprising 30 species. This included Danaid Egg-fly *Hypolimnas misippus*, which is listed by Fellowes *et al.* (2002) as of Local Concern; however, the population of this species seems to have increased in recent years and it is now widespread in Hong Kong (Lo and Hui 2004).

A moderate abundance of foraging bats was recorded, including individuals of three widespread species.

Chow Tin Tsuen

Chow Tin Tsuen mainly consists of active and abandoned agricultural lands, secondary woodland and shrubland. There is a moderately-sized area of wet agricultural land for farming Water Spinach.

A total of 11 wetland-dependant bird species were recorded in the area of wet agricultural land, a habitat that is generally of some ecological significance to birds in Hong Kong. These included Greater Painted-snipe, which was present in both May and June, suggesting that a breeding population is present in the area.

The bird community present in these agricultural areas, characterised by species such as Chinese Francolin, Asian Barred Owlet *Glaucidium cuculoides*, Indian Cuckoo *Cuculus micropterus*, Plaintive Cuckoo *Cacomantis merulinus*, Lesser Coucal and Sooty-headed Bulbul *Pycnonotus aurigaster*, is rather distinctive. It is also unusual in a Hong Kong context in that most lowland areas of the territory are too disturbed or cultivated to allow the presence of the francolin and the coucal.

Ten frog species were recorded in this area, including Chinese Bullfrog. A dead Burmese Python was observed in abandoned farmland; this species is regarded as a critically endangered species in China (Zhao 1998). The only fish species found in this area was Mosquito Fish.

Agricultural land typically supports a rather low diversity of butterfly species, which was the case during the butterfly surveys in 2008. There are small patches of remnant woodland, however, and these were found to support woodland-associated butterfly species, including Quaker *Neopithecops zalmora*, Yellow Orange-tip *Ixias pyrene* and Large Faun *Faunis eumeus*. Other species were associated with fruiting trees (especially *Litchi chinensis*) present in the villages. In total, 35 species of butterfly were recorded at this site, none of which are considered to be of conservation importance in Hong Kong.

Five species were recorded during night-time surveys, all in moderate to high abundance. A large bat seen during the night-time surveys was thought to have been a Short-nosed Fruit Bat *Cynopterus sphinx*, which is very common and widespread in Hong Kong (Shek 2006).

7.7.4.4 Planning Area 4

This area is dominated by agricultural land, largely abandoned, with associated village areas in the west and north. The eastern part holds areas of shrubland and upland grassland.

Ta Kwu Ling (Tong Fong, Kan Tau Wai, Kaw Liu)

This area mainly comprises agricultural land and village areas, and the eastern midstream and upstream sections of the Ping Yuen River. The midstream section is channelized and the upstream section is largely undisturbed. An abandoned, polluted pond can be found on the hillside.

In terms of birds, the main interest in this area is concentrated in two small relatively isolated areas, comprising an area of abandoned agriculture and a heavily polluted pond. A number of wetland species were recorded here, but numbers were not high. These did include Greater Painted-snipe, however, a single individual of which was recorded at an area of seasonally wet grassland. Otherwise, the suite of species recorded was of relatively low ecological significance due to the presence of large dryland agricultural areas, both active and inactive.

The only frog species of significance recorded in the agricultural land was Chinese Bullfrog, which was quite common in the area and tadpoles of which could be found in the water storage ponds in the farmland. A juvenile was also observed on the bank of the upstream section of Ping Yuen River. Amphibian diversity (nine species) and abundance in the hillside pond were also high, including Chinese Bullfrog, although the water was heavily polluted. Of the three reptile species recorded, only Indo-Chinese Rat Snake is of conservation significance (Zhao 1998).

All fish species found are of low conservation value, while only two were native (Chinese Barb and Swampy Eel), which were found in the upstream areas. The bottom of these upstream areas, however, remains largely untouched, comprising sand and gravel, potentially providing habitats for species of conservation concern (i.e. nursery for odonates, see below).

Although odonate diversity in this area was not as high as other places in the Study Area, a species of regional concern, Tawny Hooktail *Paragomphus carpicornis*, was recorded in the upstream section of Ping Yuen River. In Hong Kong, this species has been found breeding in gently-flowing streams with a sandy bottom (Wilson 2004), which matches the characteristics of the upstream section of Ping Yuen River.

Butterfly surveys at Ta Kwu Ling covered a variety of habitats, mostly abandoned agricultural land and young shrubland. The butterfly community was reasonably diverse, with 48 species recorded during summer 2008. This diversity is likely to result from the relatively diverse habitats present in the area. Two species of Local Concern (Fellowes *et al.* 2002) were recorded in low densities in hillside shrubland: Small Grass Yellow *Eurema brigitta* and Danaid Egg-fly *Hypolimnys misippus*.

A high abundance of bats was present at Ta Kwu Ling, especially in the lowland farmland habitats close to Ping Yuen River. Diversity at this site was also relatively high, with at least six species recorded. Himalayan Roundleaf Bat *Hipposideros armiger* was recorded in hillside shrubland in this area; this species is considered to be very common in Hong Kong (Shek and Chan 2005, Shek 2006).

Tsung Yuen Ha and Heung Yuen Wai

This area mainly comprises village areas, abandoned and active agricultural lands, natural streams, channelized watercourses and shrubland. Most of the active farmland is dry.

The distinctive bird community present in these agricultural areas, characterised by species such as Chinese Francolin, Asian Barred Owlet, Indian Cuckoo, Plaintive Cuckoo *Cacomantis merulinus*, Lesser Coucal and Sooty-headed Bulbul, is rather distinctive. It is also unusual in a Hong Kong context in that most lowland areas of the territory are too disturbed or cultivated to allow the presence of the francolin and the coucal. The grassland-specialist and highly-localised Bright-capped Cisticola *Cisticola exilis* was recorded in winter.

Ten frog species were recorded in the agricultural lands, including adult and tadpole Chinese Bullfrog. Other species of interest recorded were Common Rat Snake and a Porcupine.

The streams in Heung Yuen Wai, including an upstream section next to Lin Ma Hang Road, are largely natural. Six native fish species, including Chinese Barb, Oriental Weatherfish, Paradise Fish, Small Snakehead and Whitespotted Clarias, were recorded in the stream sections near Heung Yuen Wai village. Juveniles of these species were also found, indicating that these sections serve as nursery habitats for these fishes. Remarkably, no exotic species were observed, which is highly unusual in Hong Kong streams (Chan 2001). Small Snakehead is considered uncommon in the wild locally (Lee *et al.* 2004) and is of Local Concern (Fellowes *et al.* 2002), and Paradise Fish is considered to be conservation dependent (Chan 2001). The endangered crab species *Somanniathelphusa zanklon* was also observed in these streams. The upstream section next to Lin Ma Hang Road is of very good quality. *N. normalis* was abundant in this section, while other fish species recorded included Chinese Barb, Oriental Weatherfish and Paradise Fish. Again, no exotic fish species were observed in this section. In contrast, the stream at Tsung Yuen Ha is completely channelized, and is of low ecological value.

A total of 17 odonate species was recorded in the streams next to Lin Ma Hang Road and near Heung Yuen Wai village. One Chinese Greenwing was observed in the section next to Lin Ma Hang Road. Although common in Hong Kong, it only appears in clean woodland streams (Wilson 2004), indicating that the stream section next to Lin Ma Hang Road is not polluted. Only three odonate species were observed in the channel at Tsung Yuen Ha.

At Tsung Yuen Ha two butterfly species listed by Fellowes *et al.* (2002) as of Local Concern were recorded: Spotted Angle *Caprona alida* and Small Three-ring *Ypthima norma*. Both are

species of open grassland habitats and were recorded on the grassy hillside above the Tsung Yuen Ha *fung shui* woodland. The *fung shui* woodland supports a few woodland-dependent species, including Quaker and Forest Hopper *Astictopterus jama*, while the wet grassland and abandoned paddies are home to wetland-associated species such as Bush Hopper and Grass Demon.

At Heung Yuen Wai the butterfly community was moderately diverse, with 42 species recorded during surveys in 2008. A variety of habitats are present, including shrubland and mature *fung shui* woodland, both of which are known to be attractive for butterflies. Despite the moderate diversity of butterflies present, no species are listed by Fellowes *et al.* (2002) as being of conservation concern.

The abundance of bats recorded at Tsung Yuen Ha was very high, especially along the drainage channel adjacent to the village. Activity of bats along this drainage channel was almost constant during the surveys, with many individuals continuously present. The diversity of foraging bats was low, however, with only two species recorded. The high abundance present may suggest that a significant roost is present in or close to the village.

A moderate abundance of insectivorous bats was recorded at Heung Yuen Wai. The diversity of species present was reasonable, with a total of five species recorded during the survey. Himalayan Leaf-nosed Bat was recorded in the *fung shui* woodland behind the village.

7.7.4.5 Planning Area 5

This area is dominated by Lin Ma Hang village, associated abandoned agricultural land and the surrounding wooded slopes of the northern part of Robin's Nest. The woodland is of high ecological value, while two Sites of Special Scientific Interest (SSSI) are found near the village: Lin Ma Hang Stream and Lin Ma Hang Lead Mines. Ecological surveys in this area focused on the lowland village land areas that are scheduled for development.

Lin Ma Hang

Abandoned agricultural land, village area and hillside secondary woodland and closed-canopy shrubland are present in this area, in addition to Lin Ma Hang Stream SSSI, a stream of high ecological value, and Lin Ma Hang Lead Mines SSSI, which hosts a large bat colony.

The bird community of the stream is limited, comprising such very small numbers of such widespread wetland-dependant species as Little Egret, Chinese Pond Heron, Common Kingfisher and Grey Wagtail, in addition to Eurasian Woodcock. All of these species are widespread in Hong Kong in suitable habitat. In the abandoned agricultural areas, such species as White-breasted Waterhen and Cattle Egret are present for much of the year, while the localised grassland-specialist species Bright-capped Cisticola occurs in the non-breeding season.

The mature shrubland and woodland areas appear to host most of the typical native forest avifauna found in Hong Kong, as well as locally-distributed species such as Slaty-legged Crake, Black-naped Oriole, Hodgson's Hawk Cuckoo, Orange-headed Thrush (KFBG 2004), Lesser Shortwing and Hainan Blue Flycatcher.

At Robin's Nest, which overlooks the Lin Ma Hang valley, the habitat comprises a mixture of grassland and shrubland or woodland. Of greatest ecological significance here is a breeding population of Large Grass Warbler *Graminicola bengalensis* in the rich grassland areas. This globally-endangered species is listed by BirdLife International as Near-Threatened, and Robin's Nest has the highest-known breeding density in Hong Kong. In addition, this area supports a bird community typical of upland grassland areas in Hong Kong (including Upland and Richard's Pipits, and Lesser Coucal), as well as the rare and localised Bright-capped Cisticola, which is of Local Concern (Fellowes *et al.* 2002), in the winter months.

Eight frog species, including Chinese Bullfrog, were found in the Lin Ma Hang area, with seven present in the abandoned agricultural land. A juvenile Bamboo Pit Viper was observed in the village area.

The Lin Ma Hang Stream SSSI was declared in July 2007 on the basis of the extremely diverse lowland fish community present in the stream, including the largest natural population in the territory of the rare Chinese Rasbora *Rasbora steineri*, as well as the only confirmed location of Spiny Eel *Mastacembelus armatus* in Hong Kong. A total of 11 fish species were recorded in the stream, nine of which are native to Hong Kong, with Chinese Rasbora and Predaceous Chub very abundant. The former is a locally rare species (Lee *et al.* 2004) and is considered to be of Global Concern (Fellowes *et al.* 2002). The second is common in Hong Kong (Lee *et al.* 2004), but is considered to be vulnerable in China (Yue and Chen 1998). Chinese Barb was also very abundant in the stream. One Paradise Fish was also recorded.

19 odonate species were recorded, including a species of conservation concern, Emerald Dwarf, which was observed once in the lower stream section.

A total of 61 butterfly species were recorded at Lin Ma Hang during surveys in summer 2008. This can be accounted for by the relatively high diversity of habitats present (including woodland, shrubland and grassland) and low levels of human disturbance in these habitats. Despite this high diversity of species, no species of conservation importance were recorded during the surveys in 2008.

A survey conducted by KFBG in July 2003 recorded a total of 30 butterfly species at Lin Ma Hang, including eight species not recorded during 2008 (Rare Swift *Parnara ganga*, Glassy Bluebottle *Graphium cloanthus*, Tailed Jay *Graphium agamemnon*, Red-base Jezebel *Delias pasithoe*, Small Grass Yellow *Eurema brigitta*, Green Flash *Artipe eryx*, Ceylon Blue Glassy Tiger *Ideopsis similis* and Blue spotted Crow *Euploea midamus*). Two of these (Glassy Bluebottle and Small Grass Yellow) are considered to be of Local Concern in Hong Kong (Fellowes *et al.* 2002). Combined with the 2008 findings, it is clear that Lin Ma Hang supports a highly diverse butterfly community.

A night-time survey was conducted around Lin Ma Hang village and adjacent marshland and shrubland. Despite the presence of large numbers of bats in the roost at the Lin Ma Hang Lead Mines SSSI, relatively few individuals (of three species) were recorded around the village

7.7.4.6 Planning Area 6

This area is dominated by the wooded eastern slopes of Robin's Nest, which are contiguous with and of an ecological value equivalent to the woodland areas in Planning Area 5; these are described in that section. In the lowland areas are large areas of mainly abandoned agricultural land and associated village areas. The Sha Tau Kok Road runs along the western side of Starling Inlet, which is an intertidal wetland with small areas of mangrove that is of high ecological value to waterbirds. The Inlet lies outside the Study Area.

Lowland areas near Sha Tau Kok

The Sha Tau Kok area mainly consists of abandoned agricultural land, streams, secondary woodland, shrubland, fish ponds and village area. A small piece of mangrove can be found next to Sha Tau Kok Road. There are three streams in this area, next to Tong To, Muk Min Tau and the Tam Shui Hang villages. Although all these streams are partially modified, their upper sections remain largely undisturbed. In addition, though the lower section of the Tam Shui Hang stream is channelized, its bottom is still covered with sand and gravel and both emergent and submergent vegetation are rich.

The bird community of the lowland areas is typical of abandoned agriculture, shrubland and village or village-edge habitats. Typical grassland specialists such as Lesser Coucal and Chinese Francolin are present year-round, while the localised Bright-capped Cisticola is

present in the winter months. Open-country species such as Sooty-headed Bulbul and Plaintive Cuckoo are present year-round, while shrubland/woodland-edge species such as Hair-crested Drongo and Black-naped Oriole were recorded in the breeding season. The relatively high degree of habitat diversity means that the bird community is relatively diverse, including a small number of wetland species such as Great Egret and White-throated Kingfisher attracted to the natural streams in the area. In the dry season both grassland and seasonally wet grassland provided suitable foraging for granivorous species such as buntings, including the globally-threatened Yellow-breasted Bunting. The lack of open water areas and the uniformity of vegetation type means that the seasonally wet grassland does not provide suitable habitats for wetland species.

The fishponds located adjacent to Starling Inlet provide suitable foraging for very small numbers of large waterbirds. Their isolation and small size mean they are not of high conservation value. The mangrove areas do not appear large enough to support Slaty-breasted Rail, the only mangrove-dependent bird species in Hong Kong.

Ten frog species were recorded, but not in the abandoned agricultural land. Although a Chinese Bullfrog was observed in Tam Shui Hang Stream, it appeared to be ex-captive, while the only reptile species of conservation significance recorded was Common Rat Snake, which was found in abandoned farmland on the hillside.

Five fish species (Chameleon Goby, Chinese Barb, *Liza* sp., Mosquito Fish and Nile Tilapia) were observed in the lower section of Tong To Stream during the survey. One mature Paradise Fish was observed in this section during the site visit. Although no fish were observed in the upper section during diurnal fish surveys, three native fish species (Chinese Barb, Oriental Weatherfish and Vietnam Catfish) were found in this section during nocturnal surveys for amphibians, making a total of eight.

No fish were recorded in the lower reaches of Muk Min Tau Stream. However, Chinese Barb, Mosquito Fish and Oriental Weatherfish were observed in the upper reaches. Only three fish species were recorded in the fish ponds. Mozambique Tilapia and four common estuarine fish species were observed in the mangrove area during high tide periods.

Ten fish species (Barcheek Goby, Chameleon Goby, Chinese Barb, Glass Perch, Eastern Keelback Mullet, Mosquito Fish, Predaceous Chub, *Rhinogobius duospilus*, Swampy Eel and Variable Platyfish) were recorded in Tam Shui Hang Stream. Most of these were found in the channelized lower section only. Predaceous Chub and *R. duospilus* were found in both upper and lower stream sections. In August, local villagers reported that two Giant Mottled Eels *Anguilla marmorata* were taken from the lower section of this stream. This species is regarded as a Class II protected animal in China (Lee *et al.* 2004).

Vietnam Catfish only appear in clean, natural streams (Lee *et al.* 2004), and its presence in the upper section of Tong To Stream indicates good water quality. The presence of estuarine species (Chameleon Goby and *Liza* spp.) in the lower reaches of Tong To and Tam Shui Hang Streams indicates that these streams may provide migration pathways and function as habitats for diadromous species (e.g. Giant Mottled Eel and *Stiphodon* spp.). *Stiphodon* spp. are considered to be of Global Concern (Fellowes *et al.* 2002), and they are found other freshwater systems around Starling Inlet (KFBG,2004; Lee *et al.* 2004). Both these streams are connected to the intertidal mangrove area of this inlet, and modification of these sections would completely block the migration pathways for diadromous species. The lower section of Muk Min Tau Stream has been largely modified and its ecological function as a habitat for diadromous fish species is believed to be totally lost.

Only two uncommon odonate species, Blue Sprite and Ferruginous-faced Sprite, were present in these streams, and these were both recorded in the lower section of Tam Shui Hang Stream. According to Wilson (2004), Ferruginous-faced Sprite has only been recorded at one site in Hong Kong (not within the FCA) and is regarded as rare locally.

The upper sections of Tam Shui Hang and Muk Min Tau Streams remain natural. Although animal diversities recorded were not high, these sections retain the potential to develop into good habitat for wetland fauna (e.g. stream amphibians and odonates).

Animal diversity in the lower reaches of Tong To Stream was not very high, as this section has also been partially modified. However, its bottom is still covered with sand and gravel, and both riparian and submergent vegetation are present. The presence of estuarine species also indicates that this section provides suitable habitat for diadromous species.

Predaceous Chub was very abundant in both upper and lower sections of Tam Shui Hang Stream. The lower section also provides suitable habitats for Ferruginous-faced Sprite and diadromous fish species (e.g. *Stiphodon* spp.). Vegetation within and along the stream, especially the diverse flora in the lower section, should also be properly protected. In contrast, the lower section of Muk Min Tau Stream is completely channelized and is of low conservation value.

The abandoned farmland functions as a seasonal wetland for non-bird fauna. The small area of mangrove in the adjacent part of Starling Inlet is nearly completely isolated, although it still provides habitat for intertidal species such as certain fiddler crabs and gastropods. The fish ponds in this appear not to support any non-bird fauna of conservation significance.

Butterfly diversity in the Tong To/Muk Min Tau area was high, with a total of 54 species recorded. This included three species considered by Fellowes *et al.* (2002) to be of Local Concern: Great Swift *Pelopidas assamensis*, Centaur Oak Blue *Arhopala pseudocentaurus* and Baron *Euthalia aconthea*. The first of these was recorded in woodland behind Tong To village, while the latter two were found in a small area of mature trees alongside a stream south of Tong To village. Other woodland-associated species were also recorded around Tong To (for example Common Gull *Cepora nerissa*, Rustic *Cupha erymanthis* and Common Mapwing *Cyrestis thyodamas*), suggesting the woodland in this area may support a reasonably diverse butterfly community.

The high quality *fung shui* woodland at Muk Min Tau has previously been proposed for SSSI status because lowland forest such as this is a very restricted habitat in Hong Kong (Chu 1998). Although this woodland was not covered by regular surveys in summer 2008, a site visit in September 2008 revealed a moderate diversity of butterflies within the woodland (all of which had previously been recorded on surveys in the area). This included a high density of Quaker, a woodland-dependent species with localised distribution in Hong Kong.

Habitats surveyed at Tam Shui Hang included lowland areas around the village as well as abandoned paddies, shrubland and secondary woodland on the hillside above the village. The butterfly community was reasonably diverse, with 41 species recorded, most of which were associated with the shrubland and secondary woodland. Only one species recorded is listed by Fellowes *et al.* (2002) as a species of conservation concern: Danaid Egg-fly *Hypolimnas misippus*, which was considered to be of Local Concern, but has increased in Hong Kong in recent years (Lo & Hui 2004).

Four species were recorded in the Tong To/Muk Min Tau area, one of which was moderately abundant although the other three were present in small numbers. Pomona Leaf-nosed Bat *Hipposideros pomona* was recorded at this site; this species is common in Hong Kong (Shek and Chan 2005, Shek 2006).

Despite the presence of woodland and shrubland habitats along the survey route, most foraging bats were located close to Tam Shui Hang village. Four species were recorded in low to moderate abundance.

7.7.5 Habitat Evaluations

The areas of each habitat are presented in **Table 7.7.2**, while evaluations of the main habitats in each planning area are provided below.

Table 7.7.2 Area of each habitat present in the six Planning Areas (PA)

Habitat	Area (ha)						
	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Total
Active Dry Agriculture	-	-	13.14	6.66	0.03	0.62	20.45
Active Wet Agriculture	2.11	-	1.71	0.17	-	-	3.99
Developed Land	15.98	34.37	69.05	24.31	5.32	15.25	164.28
Drainage Channel	5.16	13.41	7.57	0.58	-	-	26.72
Fishpond	231.90	170.43	13.29	0.84	-	1.91	418.37
Grassland/ Shrubland	-	-	17.21	90.40	4.48	1.25	113.34
Inactive Dry Agriculture	-	0.04	5.11	2.28	0.00	0.05	7.49
Inactive Wet Agriculture	1.55	0.81	9.34	-	-	0.07	11.76
Lowland Grassland	0.37	4.73	18.42	47.33	17.10	3.94	91.90
Mangrove	0.07	-	-	-	-	0.17	0.24
Marsh	4.95	71.57	-	-	-	-	76.52
Mitigation Wetland	2.60	-	-	-	-	-	2.60
Orchard	-	7.96	3.42	4.37	-	-	15.75
Plantation	-	15.81	5.78	3.06	0.70	1.98	27.33
Reedbed	4.88	3.50	-	-	-	-	8.38
Sea	-	-	-	-	-	0.02	0.02
Seasonally Wet Grassland	-	13.56	19.75	9.92	1.30	28.64	73.18
Shrubland	35.06	89.37	95.74	54.85	110.89	256.17	642.07
Stream	4.36	3.99	0.16	1.37	0.72	0.60	11.20
Upland Grassland	44.12	109.15	139.56	155.73	76.27	137.72	662.54
Wasteland	1.97	3.14	2.52	-	-	-	7.64
Woodland	7.50	25.70	79.03	24.64	106.60	65.96	309.44
Total	362.57	567.56	500.82	426.51	323.41	514.35	2695.22

7.7.5.1 Planning Area 1

This comprises the westernmost part of the Study Area, and is dominated by fishpond wetlands. These wetlands occupy the western section up to the Lok Ma Chau BCP, which provides a significant ecological barrier to all but the most mobile fauna. To the east of this the area largely comprises fishpond wetlands, upland grassland and village areas, and is bounded to the north by the Lok Ma Chau Loop. As no development or land zoning changes are proposed for areas to the west of Lok Ma Chau BCP, neither habitat nor mitigation assessments are provided.

The changes planned for this planning area are restricted to areas east of the Lok Ma Chau BCP, and include expanded village development at Lok Ma Chau and the siting of eco-lodges in the hills between Lok Ma Chau and Ma Tso Lung. The latter covers the easternmost part of Planning Area 1 and the westernmost section of Planning Area 2, but is dealt with in assessments for Planning Area 1.

Drainage Channels

Drainage channels are those watercourses in which human activity for drainage improvement has created an artificial base and/or banks to the watercourse, and there is little scope for colonisation by natural riparian vegetation. The Shenzhen River is the largest example in this area.

Table 7.7.3 Habitat evaluation for Planning Area 1: Drainage channels

Criteria	Shenzhen River and small drainage channels	San Tin Eastern Main Drainage Channel
Naturalness	Significant man-made elements of but with natural tidal flow.	Man-made habitat but with natural tidal flow.
Size	Shenzhen River is a large river in HK context; other drainage channels small.	Small.
Diversity	Very low diversity of species and microhabitats.	Limited diversity of habitats and species.
Rarity	Common in Hong Kong.	Common in Hong Kong.
Re-creatability	Easily recreated.	Easily recreated.

Criteria	Shenzhen River and small drainage channels	San Tin Eastern Main Drainage Channel
Fragmentation	Little fragmentation.	Little fragmentation.
Ecological linkage	Strong ecological linkage to the Deep Bay wetland ecosystem downstream.	Strong ecological linkage to the Deep Bay wetland ecosystem downstream.
Potential value	Limited potential for increase in value due to constraints imposed by artificial banks and management regime, and currently highly polluted nature of Shenzhen River.	Limited potential for increase due to constraints imposed by artificial banks. Management regime could be amended to achieve some increase.
Nursery/ breeding ground	Not known as a significant nursery or breeding ground.	Not known as a significant nursery or breeding ground.
Age	Approximately 10-15 years in current (channelised) form.	Approximately 5 years.
Abundance/ Richness of wildlife	Low diversity of fauna.	Low to moderate faunal diversity.
Ecological value	Low.	Low to Moderate

Natural Stream Channels

Natural stream channels occur in the hills between Lok Ma Chau and Ma Tso Lung Villages. They are highly seasonal in this area, and appear to contain water during very limited periods of time as they were dry during survey work for this Study. This is probably related to lack of substantial vegetation on the slopes as a result of fire-retardation. Should the incidence of fire decrease and succession occurs on the hillsides, then it is likely that water flow in the streams will become more prolonged and regular.

Lowland natural stream channels comprise the current and old (Lok Ma Chau Meander/Bend) courses of the Shenzhen River. The highly eutrophic and polluted nature of the current course of the river means it is of low ecological value; however, the LMC Meander is of high ecological value as it comprises an important element of the ecological corridor linking wetlands to the west of LMC BCP with those at Hoo Hok Wai and it supports Eurasian Otter.

Table 7.7.4 Habitat evaluation for Planning Area 1: Natural stream channel

Criteria	Natural Streams on hillsides	LMC Meander
Naturalness	The banks are natural, but nearby areas are often fire-retarded.	Current course: man-made banks, natural bottom. LMC Meander: entirely natural.
Size	Small in width and length.	Moderate to large
Diversity	Low floral and faunal diversity.	Low floral and faunal diversity
Rarity	Similar hillside streams are fairly common in Hong Kong, but lowland ones are not. Paradise Fish and <i>Somanniathelphusa zanklon</i> were recorded.	Such sizeable natural streams are not common in Hong Kong. Eurasian Otter was recorded (in NENT NDA Study).
Re-creatability	Not readily re-creatable.	Not readily recreated.
Fragmentation	Linked to lowland areas surrounding Lok Ma Chau Loop, and ultimately to Deep Bay.	Little fragmentation, though limited hydrological linkage between two.
Ecological linkage	Few linkages with adjacent habitats, though vegetation used by fauna in area.	Close linkage with Deep Bay, and functional linkages with adjacent wetland habitats. LMC Meander forms important element of ecological corridor linking wetlands west of LMC with those at Hoo Hok Wai. Shenzhen River would provide corridor for Eurasian Otter.

Criteria	Natural Streams on hillsides	LMC Meander
Potential value	Limited due to small size and lack of significant water flow under current conditions, though vegetation succession in future would increase water flow.	Shenzhen River has limited potential value without significant improvements in water quality. LMC Meander has some potential for increased ecological value via management.
Nursery/ breeding ground	No significant nursery or breeding ground known.	Probably a significant nursery or breeding ground for Eurasian Otter..
Age	Unknown.	The new section of the Shenzhen River channel is approximately 15 years old..
Abundance/ Richness of wildlife	Low diversity and abundance of wetland-dependent and associated fauna.	Very low for Shenzhen River proper. Moderate for LMC Meander.
Ecological value	Moderate.	Low to Moderate for Shenzhen River. High for LMC Meander.

Abandoned Fish Pond

A single abandoned fishpond lies in the hills behind Lok Ma Chau village, and this supports three species of conservation concern.

Table 7.7.5 Habitat evaluation for Planning Area 1: Abandoned fish pond

Criteria	Hillside Fishpond
Naturalness	Man-made.
Size	Small in size.
Diversity	Low diversity of flora, low to moderate diversity of fauna, in particular odonata.
Rarity	Similar ponds are not uncommon in the northern New Territories.
Re-creatability	Fairly readily re-creatable.
Fragmentation	Not fragmented.
Ecological linkage	Some linkages to other ponds due to mobility of fauna.
Potential value	Moderate improvements could occur through habitat management.
Nursery/ breeding ground	Supports a breeding population of Two-striped Grass Frog, as well as two odonate species of concern: Sapphire Flutterer and Scarlet Basker.
Age	Unknown.
Abundance/ Richness of wildlife	Low to moderate.
Ecological value	Moderate due to current faunal use and potential for enhancement.

Active and Inactive Wet Agricultural Land

An area of active and inactive agriculture lies in front of Lok Ma Chau Village, adjacent to the Border Fence Road. Present are flooded or seasonally wet agriculture for crops such as *Ipomoea aquatica* and *Nasturtium officinale*. Regular human disturbance and vegetation control ensure that little natural vegetation occurs around the active fields, and that this is dominated by a limited number of weedy species.

Table 7.7.6 Habitat evaluation for Planning Area 1: Active wet agricultural land

Criteria	Active Wet Agricultural Land
Naturalness	Entirely anthropogenic habitat.
Size	Small in size, 1.85 ha.
Diversity	Low floral and faunal diversity due to small size and disturbance.
Rarity	Widespread, but localised and declining habitat in northern New Territories.
Re-creatability	Readily re-creatable.
Fragmentation	Not fragmented.
Ecological linkage	Close linkage with adjacent inactive wet agricultural land. Some linkages presumably exist with nearby agricultural areas such as at Chau Tau Village.
Potential value	Limited scope for enhancement under current active use.
Nursery/ breeding ground	A breeding population of Chinese Bullfrog is present.
Age	Unknown, but regular human activity maintains early successional stage.

Criteria	Active Wet Agricultural Land
Abundance/ Richness of wildlife	High abundance and richness of amphibians.
Ecological value	Low to Moderate

Table 7.7.7 Habitat evaluation for Planning Area 1: Inactive wet agricultural land and marsh

Criteria	Inactive Wet Agricultural Land and Marsh
Naturalness	Semi-natural habitats derived from abandonment of land previously used for active cultivation.
Size	Small, 0.97 ha.
Diversity	Moderately diverse floral community but low faunal diversity.
Rarity	Relatively uncommon habitats in Hong Kong but widespread. Declining as a result of development of lowland habitats.
Re-creatability	Readily recreated where soil and hydrology are suitable.
Fragmentation	Mostly concentrated in a single small block.
Ecological linkage	Shows good linkage to adjacent active wet agriculture.
Potential value	Ecological value could be increased from appropriate management of vegetation and water levels.
Nursery/ breeding ground	Presence of Greater Painted-snipe suggests species probably breeds locally. Used for foraging by ardeids breeding in Ho Sheung Heung egretty.
Age	Derived from relatively recent abandonment of agricultural land.
Abundance/ Richness of wildlife	Moderate in terms of common dragonflies and amphibians.
Ecological value	Low to Moderate because of small size and relatively few species recorded using this habitat.

Upland Grassland

Upland grassland in the area between Lok Ma Chau and Ma Tso Lung is a fire-arrested habitat of dry hilly areas, and as a result species diversity is low. The reduction in the incidence of fire that would presumably result should part of the area be developed would improve habitat quality, but ultimately would result in succession to shrubland. A further example of this habitat is located to the east of Ma Tso Lung in Planning Area 2.

Table 7.7.8 Habitat evaluation for Planning Area 1: Upland grassland

Criteria	Upland Grassland
Naturalness	Fire-retarded habitat, probably as a result of human activity at burial grounds.
Size	Moderate, 44.12ha in planning area, but approximately 150 ha in area (including area in Planning Area 2).
Diversity	Low floral and faunal diversity.
Rarity	Widespread and common habitat in Hong Kong, though probably declining as result of succession to shrubland.
Re-creatability	Fairly readily re-creatable.
Fragmentation	Fragmented into two blocks, west and east of Ma Tso Lung Village.
Ecological linkage	No significant linkages exist with habitats of ecological significance.
Potential value	Some scope for enhancement via reduction of fire occurrence, though resultant succession would, ultimately, cause the habitat to disappear.
Nursery/ breeding ground	Breeding bird community of upland/grassland specialists present, including Eurasian Eagle Owl.
Age	Unknown age in its present state.
Abundance/ Richness of wildlife	Low abundance but Low to Moderate richness of wildlife, as bird community is distinctive in a Hong Kong context.
Ecological value	Low to Moderate (higher rating due to presence of Eurasian Eagle Owl).

Shrubland

In the damper valleys of the hills and in the area near Lok Ma Chau village, areas of closed- and open-canopy shrubland are present. However, these are rather isolated from larger blocks of mature shrubland.

Table 7.7.9 Habitat evaluation for Planning Area 1: Shrubland

Criteria	Shrubland
Naturalness	Semi-natural habitat arising from succession on grassy habitats.
Size	Small in area, approximately 35ha
Diversity	Moderate floral and faunal diversity.
Rarity	Widespread habitat in Hong Kong.
Re-creatability	Readily re-creatable given time.
Fragmentation	Rather fragmented.
Ecological linkage	No significant linkages exist with habitats of ecological significance.
Potential value	Limited scope for enhancement.
Nursery/ breeding ground	No significant nursery or breeding ground known.
Age	Probably no more than 30 years at oldest.
Abundance/ Richness of wildlife	Low abundance and richness of wildlife.
Ecological value	Low

Developed Land and Wasteland

In this area developed land largely comprises village land and roads.

Table 7.7.10 Habitat Evaluation for Planning Area 1: Developed Land and Wasteland

Criteria	Developed land and Wasteland
Naturalness	Entirely anthropogenic habitat.
Size	Small in size, approx 18ha.
Diversity	Low floral and faunal diversity.
Rarity	Widespread and common habitat in Hong Kong.
Re-creatability	Readily re-creatable.
Fragmentation	Not fragmented.
Ecological linkage	No significant linkages exist with habitats of ecological significance.
Potential value	Limited scope for enhancement under current conditions.
Nursery/ breeding ground	A breeding population of White-shouldered Starlings may be present.
Age	Variable.
Abundance/ Richness of wildlife	Low abundance and richness of wildlife.
Ecological value	Low

7.7.5.2 Planning Area 2

Planning Area 2 comprises a large area of fishponds and marshy areas of high ecological value at Hoo Hok Wai, located outside the current border fence. Inside the border fence are located a mosaic of village and village-edge habitats, including seasonally wet grassland and freshwater marsh, in the Ma Tso Lung area, as well as areas of upland grassland and shrubland around Crest Hill (Tai Shek Mo). Along the eastern edge lie three reinstated fishponds along the Ng Tung River, and adjacent to these is Ho Sheung Heung Egret, one of the largest in Hong Kong.

Active and inactive fishponds from Lok Ma Chau to Hoo Hok Wai

The fishpond and pond habitats in this part of the Study Area are nearly contiguous with other wetlands within the Deep Bay Area and are considered to have high ecological value because of their existing value to avifauna, large waterbirds in particular, and their potential for enhancement. A Working Paper assessing the ecological value of the HHW area has been prepared separately, and presented in **Appendix I**. Based on this WP, the area supports a significant proportion of the total number of waterbirds frequenting fish pond areas in the Deep Bay area at densities comparable to those occurring in fish pond areas west of the LMC BCP, as well as a number of threatened species or species of regional concern. The Study on the Ecological Value of Fish Ponds in the Deep Bay Area (Aspinwall 1997) confirmed the unique international and regional importance of the fish pond

ecosystem, especially for herons and egrets. The provision by fish pond areas of food supply and roosting areas is critical to the continued presence of these birds in significant numbers in the Deep Bay area.

Fishponds are a key wetland habitat for certain wetland-associated wildlife, although the ecological functions they perform are highly influenced by farming practices. Fishponds are used asymmetrically in that concentrations of birds occur at particular ponds at certain stages of the production cycle. Usually, the highest concentrations occur during draindown. Aspinwall (1997) observed greater bird usage at ponds that are contiguous with other ponds, and ponds that form part of a larger more continuous area rather than fragmented and isolated ponds. Hoo Hok Wai is just such a large area of contiguous ponds; moreover, its location in the FCA also means it is relatively undisturbed.

Although the avifauna is the primary focus of ecological interest, the Hoo Hok Wai area is also known to lie at the heart of the distribution of the Hong Kong population of Eurasian Otter, a globally-threatened mammal species that is rare and of restricted distribution in Hong Kong. Diversity of other fauna appears to be typical of fishpond areas in Hong Kong, which are generally of limited significance in terms of dragonfly, butterfly and herpetofauna species of conservation significance.

Certain areas of HHW can be considered of lesser ecological value, which would render the area suitable for a comprehensive development approach that included wetland enhancement. Broadly speaking, the area northeast of LMC Police Operational Base at Ngau Kok Shan that lies adjacent to the Boundary Fence Road might be more suitable for development. The area lies at the edge of the wetland habitats, is located alongside a road, includes marsh habitats of relatively moderate ecological value and terrestrial habitats such as shrubland and woodland that are of lower ecological value than the wetland, and includes fishponds that have long been inactive. The remaining area of fishponds at HHW would need to be preserved in the current unfragmented and largely managed condition in order to maintain the ecological value of the area.

The area from the Shenzhen River to the hills between Lok Ma Chau and Ma Tso Lung villages constitutes an ecological corridor connecting wetland areas at Hoo Hok Wai with those to the west of LMC BCP and, ultimately, Tsim Bei Tsui and intertidal areas of Deep Bay, which form part of the Inner Deep Bay Mai Po Ramsar Site. This corridor has three elements, a flight line element for birds, an aquatic element for Eurasian Otter and a terrestrial element for mammals.

In respect of flight lines, the core part of this corridor over which most flight lines appear to pass is LMC Meander and adjacent fishponds. Consequently, the narrow strip of fishponds adjacent to the southern boundary of Lok Ma Chau Loop forms a crucial part of the ecological corridor and invests them with high ecological value.

Hoo Hok Wai, although a large wetland area, is smaller in area than the wetland area to the west of the Lok Ma Chau BCP, and consequently its current ecological value is dependent on a continued link with the larger area. Should the link not exist, the only wetland-dependent fauna that would survive would be those for which the Hoo Hok Wai area provided all their needs. In addition, the foraging areas at Hoo Hok Wai available to waterbirds that roost elsewhere, such as at Mai Po Nature Reserve, would not be accessible. Together, these impacts would reduce the number of waterbirds in the Deep Bay area and at Hoo Hok Wai in particular. Adverse impacts on this link are location-specific. In other words, they cannot be mitigated for via compensatory enhancement of nearby wetland areas as would normally be the case when peripheral areas of the Deep Bay wetland ecosystem are developed. Thus, the principle of avoidance of impact needs to be adopted.

Retention of these fishponds in their current semi-natural state is regarded as critical to the maintenance of the flight line linkage. Further, given the likely future development of LMC

Loop, which may deter some birds from flying over that area, the importance of these fishponds in this respect can only increase.

This strip of fish ponds between the border fence and the old course of the Shenzhen River, is also likely to be a movement corridor for terrestrial fauna such as mammals, providing passage between Hoo Hok Wai and areas to the west of the BCP. There are records of Leopard Cat from the area, a species that ranges throughout the Deep Bay area; thus it is likely that animals use this area as a movement corridor, as the LMC Meander probably provides a significant geographical limitation on movement of terrestrial mammals through the area.

Table 7.7.11 Habitat evaluation for Planning Area 2: Fishponds from Lok Ma Chau to Hoo Hok Wai

Criteria	Fishponds from Lok Ma Chau to Hoo Hok Wai
Naturalness	Anthropogenic habitat in which succession is prevented by active management.
Size	Large area of fishponds, nearly contiguous with a very large area of fishponds around Deep Bay, separated only by roads leading to the Lok Ma Chau Border Crossing Point.
Diversity	Poor plant species diversity and structural complexity, high faunal diversity in respect of birds.
Rarity	Locally abundant, in that ponds are a major habitat on the south side of Inner Deep Bay. However, the extensive area of ponds at Hoo Hok Wai is part of an ecosystem that is unique in Hong Kong and the international importance of at least part of which is recognised by the Ramsar Site designation.
Re-creatability	Readily re-creatable and overgrown ponds could readily be restored.
Fragmentation	Very little fragmentation within the Planning Area.
Ecological linkage	Functionally linked to surrounding fishpond areas and the nearby Ramsar Site, primarily via flight lines of large waterbirds to and from foraging and roosting areas.
Potential value	Even higher potential value.
Nursery/ breeding ground	Used as a breeding ground by a few widespread wetland-dependent bird species, as well as amphibians, reptiles and dragonflies. Fishponds within Study Area are used for foraging by egrets breeding in nearby colonies. It is also possible that Eurasian Otter breeds at Hoo Hok Wai.
Age	N/A.
Abundance/ Richness of wildlife	Faunal diversity typical of fishponds in the Deep Bay area, including moderately large numbers of some ardeid and stalling species. Moderate to highly rich avifauna, but only moderately rich non-bird fauna.
Ecological value	Hoo Hok Wai is part of the Deep Bay wetland ecosystem, part of which has been designated as a wetland of international importance under the Ramsar Convention. Ecological value is High.

Freshwater Marsh at Ma Tso Lung and Liu Pok

The freshwater marsh in these areas is a semi-natural habitat occupying former agricultural land. Due to the lack of microhabitat diversity, in particular areas of open, shallow water, and relatively poor water quality, faunal diversity is low.

Table 7.7.12 Habitat evaluation for Planning Area 2: Freshwater marsh at Ma Tso Lung and Liu Pok

Criteria	Freshwater Marsh at Ma Tso Lung	Freshwater Marsh at Liu Pok
Naturalness	Semi-natural wetland habitat maintained by natural freshwater inflow.	Semi-natural wetland habitat maintained by natural freshwater inflow.
Size	Relatively small.	Relatively small.
Diversity	Low to moderate floral and faunal diversity.	Low to moderate floral and faunal diversity.
Rarity	Lowland freshwater marsh is a relatively scarce and declining habitat in Hong Kong.	Lowland freshwater marsh is a relatively scarce and declining habitat in Hong Kong.
Re-creatability	Readily recreated.	Readily recreated.

Criteria	Freshwater Marsh at Ma Tso Lung	Freshwater Marsh at Liu Pok
Fragmentation	Somewhat fragmented by adjacent woodland and developed area.	Somewhat fragmented by adjacent woodland and developed area.
Ecological linkage	Hydrological linkages with streams and some functional linkage with adjacent seasonally wet grassland.	Hydrological linkages with streams and some functional linkage with adjacent seasonally wet grassland.
Potential value	Good scope for enhancement with appropriate management, but potential value constrained by small size unless incorporated with adjacent wet grassland.	Good scope for enhancement with appropriate management.
Nursery/ breeding ground	None of significance known.	None of significance known.
Age	Unknown.	Unknown.
Abundance/ Richness of wildlife	Low to moderate.	Low to Moderate.
Ecological value	Low to Moderate in view of connection with nearby wetland areas and potential for enhancement.	Low to Moderate in view of connection with nearby wetland areas and potential for enhancement.

Seasonally Wet Grassland at Ma Tso Lung

Areas of seasonally wet grassland are concentrated in abandoned agricultural areas near Ma Tso Lung Village. The lack of open water areas and the tall dense vegetation with limited floral diversity restricts the current ecological value of this habitat.

Table 7.7.13 Habitat evaluation for Planning Area 2: Seasonally wet grassland at Ma Tso Lung

Criteria	Seasonally Wet Grassland
Naturalness	Anthropogenic habitat derived from abandonment of agricultural land with subsequent colonisation by natural vegetation.
Size	Moderate area, approximately 10ha
Diversity	Low vegetation and microhabitat diversity, and thus low floral diversity; low faunal diversity.
Rarity	Widespread in Hong Kong.
Re-creatability	Readily recreated, as this is the default successional habitat on much filled agricultural land.
Fragmentation	Somewhat fragmented by village development and woodland.
Ecological linkage	Possibly some linkages to nearby areas of wetland, including at Hoo Hok Wai, and with natural stream running through it.
Potential value	Considerable scope for restoration and enhancement with appropriate management.
Nursery/ breeding ground	None of significance.
Age	Unknown.
Abundance/ Richness of wildlife	Low.
Ecological value	Low to Moderate due to presence of Chinese Bullfrog and connectivity with other wetlands.

Natural Stream at Ma Tso Lung

This is a narrow, partially-channelised stream that appears to provide suitable habitat for fish and odonates, though its ecological value is, ultimately, constrained by the modification that has occurred.

Table 7.7.14 Habitat evaluation for Planning Area 2: Natural stream at Ma Tso Lung

Criteria	Natural Stream at Ma Tso Lung
Naturalness	Semi-natural with some channelisation.
Size	Relatively short.
Diversity	Certain sections with diverse riparian and submergent vegetation' faunal diversity low.
Rarity	<i>Not uncommon in Hong Kong. Somaniathelphusa zanklon and Three-banded Box Terrapin were recorded in other studies.</i>
Re-creatability	Not readily recreated.
Fragmentation	Some fragmentation due to channelisation.
Ecological linkage	Hydrological linkages with Hoo Hok Wai area and some functional linkage with adjacent seasonally wet grassland.
Potential value	Some scope for enhancement with appropriate management, but potential value constrained by existing channelisation.
Nursery/ breeding ground	Three-banded Box Terrapin may breed. Native fish and odonate species possible.
Age	Unknown.
Abundance/ Richness of wildlife	Low to moderate.
Ecological value	Moderate to High due to habitat suitable for native fish and odonate species and single record of Three-banded Box Terrapin.

Secondary Woodland/Plantation

Rather fragmented areas of secondary woodland/plantation are located around Ma Tso Lung Village, behind Liu Pok Village and further east along the Ng Tung and Shenzhen Rivers. These are only moderately disturbed, and some linkage exists with shrubland on Crest Hill (Tai Shek Mo).

Table 7.7.15 Habitat evaluation for Planning Area 2: Secondary woodland/plantation

Criteria	Secondary Woodland/Plantation
Naturalness	Semi-natural climax habitat.
Size	Individual areas not large, totally approx 40ha.
Diversity	Moderate floral diversity and structural complexity.
Rarity	Common habitat in Hong Kong, but the riparian plantation along Ma Tso Lung Stream would provide habitats for Three-banded Box Terrapin.
Re-creatability	Possible, but significant time required to reach maturity.
Fragmentation	Significant fragmentation of blocks in west around Ma Tso Lung Village, while shrubland on Tai Shek Mo provides linkage for blocks in eastern part.
Ecological linkage	Linkages with shrubland on Tai Shek Mo, though limited linkages with other woodland areas.
Potential value	Limited potential for direct increase in habitat value as woodland is mature and area constrained.
Nursery/ breeding ground	None of significance.
Age	Unknown.
Abundance/ Richness of wildlife	Low to Moderate.
Ecological value	Individual woodland blocks of Low ecological value, though eastern blocks of Low to Moderate value due to linkage provided by shrubland areas.

Upland Grassland

Upland grassland in the area between Lok Ma Chau and Ma Tso Lung is a fire-arrested habitat of dry hilly areas. Species diversity is low.

Table 7.7.16 Habitat evaluation for Planning Area 2: Upland grassland

Criteria	Upland grassland
Naturalness	Fire-retarded habitat, probably as a result of human activity at burial grounds.
Size	Moderate area, of approximately 154 ha (including area in Planning Area 1).
Diversity	Low floral and faunal diversity.
Rarity	Widespread and common habitat in Hong Kong, though probably declining as result of succession to shrubland.
Re-creatability	Fairly readily re-creatable.
Fragmentation	Significant fragmentation from same habitat west of Ma Tso Lung village.
Ecological linkage	No significant linkages exist with habitats of ecological significance.
Potential value	Some scope for enhancement via reduction of fire occurrence, though resultant succession would, ultimately, cause the habitat to disappear.
Nursery/ breeding ground	Breeding bird community of upland/grassland specialists present, though areas in Planning Area 2 appear to have less species diversity in this respect.
Age	Unknown age in its present state.
Abundance/ Richness of wildlife	Low abundance and richness of wildlife, although bird community distinctive; numbers of the latter appear lower than areas to west, however.
Ecological value	Low

Shrubland

Shrubland occurs as a moderately-sized area centred on Crest Hill (Tai Shek Mo), and in fragmented blocks around Ma Tso Lung and Liu Pok Villages. Both appear to be relatively little-disturbed.

Table 7.7.17 Habitat evaluation for Planning Area 2: Shrubland

Criteria	Shrubland at Crest Hill	Shrubland at Ma Tso Lung/Liu Pok
Naturalness	Semi-natural to natural habitat	Semi-natural to natural habitat
Size	Moderate area, of approximately 80 ha.	Small patches
Diversity	Moderate floral and faunal diversity.	Moderate foral and faunal diversity.
Rarity	Widespread and common habitat in Hong Kong, though somewhat less abundant in northern New Territories.	Widespread and common habitat in Hong Kong, though somewhat less abundant in northern New Territories.
Re-creatability	Can be recreated but requires time to mature.	Can be recreated but requires time to mature.
Fragmentation	Little fragmentation.	Significant fragmentation by natural and non-natural habitats.
Ecological linkage	Linkage exists with adjacent areas of woodland.	Some linkages with nearby areas of woodland/plantation, and with Tai Shek Mo.
Potential value	Some scope for enhancement though only via succession on adjacent areas of upland grassland.	Some scope for enhancement though only via succession on adjacent areas of upland grassland.
Nursery/ breeding ground	None of significance known.	None of significance known.
Age	Unknown age in its present state.	Unknown age in its present state.
Abundance/ Richness of wildlife	Moderate.	Low to moderate.
Ecological value	Low to Moderate	Low

Bamboo near Ho Sheung Heung

At Ho Sheung Heung clumps of bamboo along Fai King Road support an important colony of breeding herons and egrets.

Table 7.7.18 Habitat evaluation for Planning Area 2: Bamboo near Ho Sheung Heung

Criteria	Bamboo near Ho Sheung Heung
Naturalness	Largely anthropogenic habitat.
Size	A number of clumps, though small in total area.
Diversity	Comprises one species, <i>Bambusa eutuldoides</i> . Low floral and faunal diversity.
Rarity	Widespread though localised habitat in northern New Territories.
Re-creatability	Fairly readily recreated, though issues exist regarding successful establishment.
Fragmentation	Somewhat fragmented by village-type development and road.
Ecological linkage	No habitat linkages with similar areas, but significant linkages exist with wetland habitats of ecological significance due to the presence of the colony of breeding ardeids.
Potential value	Some scope for enhancement via planting of bamboo.
Nursery/ breeding ground	One of Hong Kong's largest breeding colonies of ardeids known to be present here since mid 1990s.
Age	Variable, more mature stands probably in region of 25 years old.
Abundance/ Richness of wildlife	Low abundance of wildlife but large number of breeding ardeids means moderate richness.
Ecological value	High due to presence of egretty.

Reinstated fishponds

Three reinstated fishponds are present alongside the Ng Tung River and immediately east of the egretty at Ho Sheung Heung.

Table 7.7.19 Habitat evaluation for Planning Area 2: Reinstated fishponds

Criteria	Reinstated fishponds
Naturalness	Entirely anthropogenic habitat created at time of channelisation of Ng Tung River. Large areas of invasive exotic Water Hyacinth.
Size	Small in area.
Diversity	Low to moderate floral and faunal diversity.
Rarity	Localised habitat in Hong Kong.
Re-creatability	Readily re-created.
Fragmentation	None.
Ecological linkage	Significant linkage exists with Ho Sheung Heung egretty, as some birds breeding at the site forage at these ponds. Also functional linkage with area of inactive fishponds and wet agriculture lying to the east of the Ng Tung River, near Sha Ling.
Potential value	Significant scope for enhancement via appropriate management. Value to waterbirds and herpetofauna could be increased greatly.
Nursery/ breeding ground	Breeding Two-striped Grass Frogs present in the northernmost pond.
Age	Approximately 15 years.
Abundance/ Richness of wildlife	Low to moderate abundance and richness of wildlife.
Ecological value	Moderate in view of presence of Two-striped Grass Frog and potential for enhancement.

Wasteland

An isolated patch of wasteland is present at the confluence of the Ng Tung and Shenzhen Rivers.

Table 7.7.20 Habitat evaluation for Planning Area 2: Wasteland

Criteria	Wasteland
Naturalness	Derived from abandonment of man-made habitats or filling of fishponds.
Size	A relatively small area of 3.14ha.
Diversity	Poor species diversity and structural complexity, very low faunal diversity.
Rarity	A common habitat in the New Territories and on the edge of the Deep Bay wetlands.
Re-creatability	Readily re-created.

Criteria	Wasteland
Fragmentation	Not fragmented.
Ecological linkage	Not functionally linked to any valued habitat in close proximity.
Potential value	Limited potential value; not feasible for restoration to high value wetland or wetland-related habitat due to isolation.
Nursery/ breeding ground	None of significance known.
Age	Unknown, but perhaps linked to regulation of Shenzhen River.
Abundance/ Richness of wildlife	Low.
Ecological value	Low

Developed Land

In this area developed land largely comprises village land and roads at Ma Tso Lung, Liu Pok and Ho Sheung Heung.

Table 7.7.21 Habitat evaluation for Planning Area 2: Developed Land

Criteria	Developed land
Naturalness	Entirely anthropogenic habitat.
Size	Relatively small in area at 34.37ha.
Diversity	Low floral and faunal diversity.
Rarity	Widespread and common habitat in Hong Kong.
Re-creatability	Readily re-creatable.
Fragmentation	Significantly fragmented.
Ecological linkage	No significant linkages exist with habitats of ecological significance.
Potential value	Limited scope for enhancement under current conditions.
Nursery/ breeding ground	Breeding White-shouldered Starlings are present at Ma Tso Lung.
Age	Variable.
Abundance/ Richness of wildlife	Low.
Ecological value	Low

7.7.5.3 Planning Area 3

Much of Planning Area 3 comprises areas of grassland and grassland-shrubland in abandoned agricultural areas. Dominating the western part are the grassy hills constituting Sandy Ridge Cemetery, with the largest remaining area of wet agricultural land in the Study Area lying between the cemetery area and the Ng Tung River. This latter area appears to have significant ecological linkages with both Hoo Hok Wai and Long Valley. The Man Kam To Road and associated Border Crossing Point provides a significant ecological barrier between the western and eastern portions. The eastern portion is dominated by the grassy hills of Lo Shue Ling, with lowland areas of largely abandoned agriculture to the east.

Pond area

This comprises inactive ponds located near the Ng Tung River as part of the area of wet agricultural land south of Sandy Ridge cemetery, a reinstated pond to the north of Sandy Ridge as a component of the mitigation works for the Shenzhen River Regulation Stage III project and a small number of scattered ponds artificially created for irrigation or fish culture. The total area is small, at 13.29ha.

Table 7.7.22 Habitat evaluation for Planning Area 3: Pond areas

Criteria	Ponds southwest of Sandy Ridge	Pond north of Sandy Ridge	Other ponds in planning area 3
Naturalness	Artificial habitat derived from abandoned fish ponds.	Artificially created but undisturbed and conditions now fairly natural.	Ponds artificially created for irrigation or fish culture. Some ponds highly polluted.
Size	Area relatively small compared to nearby Deep Bay pond areas.	Single relatively large pond, but total area small compared to other parts of Hong Kong.	Several small ponds contributing to a small total area.
Diversity	Low vegetation diversity is typical of fish pond habitats. Faunal diversity limited due to small size.	Habitat diversity fairly low but moderate diversity of amphibians and dragonflies.	Moderate diversity of habitats due to differing hydrology affecting each pond.
Rarity	Fish pond habitats are common in northwest New Territories. Eurasian Otter is rare in Hong Kong. Chinese Bullfrog is of Local Concern.	Ponds are fairly common in this part of Hong Kong but conditions here (at base of hill) are different from most other ponds. Some species present are uncommon or rare (Two-striped Grass Frog and three dragonfly species).	Similar ponds are common in Hong Kong. Two-striped Grass Frog and Sapphire Flutterer occur in pond south of Muk Wu.
Re-creatability	Readily re-created where suitable land available.	Readily re-created if suitable conditions exist.	Readily recreated in suitable conditions with suitable hydrology.
Fragmentation	A single block of habitat in this area but fragmented from other pond habitats.	A single pond isolated from similar habitat.	Highly fragmented as small, individual ponds.
Ecological linkage	Ecologically linked to adjacent wet agricultural land. Some ecological linkage (birds) to Long Valley and Hoo Hok Wai (Otter).	Limited ecological linkage to Deep Bay due to differences in conditions available.	Generally show very little ecological linkage to nearby habitats.
Potential value	Management of fish ponds for wildlife could lead to significant increase in ecological value.	Possibly room for further enhancement through appropriate management.	Some potential for enhancement but limited by small size and isolated nature of ponds involved.
Nursery/ breeding ground	Breeding ground for common amphibians. Foraging area for Chinese Pond Herons breeding at Ho Sheung Heung.	Breeding ground for Two-striped Grass Frog and a diverse community of dragonflies.	Small hillside pond near Muk Wu supports populations of Two-striped Grass Frog and Sapphire Flutterer. A polluted pond at Kong Nga Po supports Chinese Bullfrog.
Age	Not known but probably fairly recently created.	Fairly young, created as mitigation for Shenzhen River Regulation.	Variable in age, most probably present for a number of years.
Abundance/ Richness of wildlife	Fairly high abundance of amphibians and dragonflies.	High diversity and abundance of amphibians and dragonflies including uncommon species.	Overall a moderate richness of dragonflies and amphibians supported by the various different ponds.
Ecological value	Moderate to High , although mostly common species, value is enhanced by presence of Eurasian Otter.	Moderate to High due to semi-natural conditions, low levels of disturbance and high abundance and diversity of some faunal groups.	Low despite the importance of fish ponds in other parts of Hong Kong, because these ponds are small and fragmented and do not support significant wetland faunal communities.

Drainage Channel

The relatively large, channelised Ping Yuen River is located in the east of the Planning Area. While the banks of this channel are lined with concrete, limiting vegetation growth, the base of the channel contains grasscrete which is, at times, colonised by various plant species. Nevertheless, riparian vegetation along the channel is poorly developed and there is little variation in stream conditions. This part of the river does not appear to support stream-dependent fauna, however. The channel is sometimes used by small numbers of wetland-dependent birds, although the habitat provision and levels of human disturbance are not conducive to regular use by significant numbers.

Table 7.7.23 Habitat evaluation for Planning Area 3: Drainage channel

Criteria	Channelised Ping Yuen River
Naturalness	An artificially channelised stream in which semi-natural riparian vegetation has been allowed to colonise and develop in diversity.
Size	A relatively large (7.57ha) and wide channel, although water flow is low for much of the year.
Diversity	Vegetation diversity relatively low in the channel; faunal diversity low to moderate.
Rarity	Channelised streams are common in Hong Kong.
Re-creatability	Readily recreated.
Fragmentation	Habitat not fragmented.
Ecological linkage	Ecological linkage to upstream Ping Yuen River and some linkage to nearby wet agricultural land and seasonally wet grassland.
Potential value	May be possible to enhance value by improvements to riparian vegetation.
Nursery/ breeding ground	Not known to be a significant breeding ground.
Age	Recently channelised (approximately 5-10 years).
Abundance/ Richness of wildlife	Low, comprising mostly common and widespread wetland species.
Ecological value	Low to moderate because river is relatively large but conditions after channelisation are unsuitable for many species.

Natural Streams

A number of streams are located in Planning Area 3, all of which are small and narrow. Most have natural substrate and riparian vegetation, although some have been channelised, especially in lowland areas, and should be preserved with a view to future recolonisation by aquatic fauna and flora. There are moderate levels of human disturbance to most streams; this includes pollution by effluent from nearby pig farms, especially at Kong Nga Po. Fish and dragonfly communities are relatively impoverished.

Table 7.7.24 Habitat evaluation for Planning Area 3: Natural streams

Criteria	Natural Streams
Naturalness	Most are channelised to some extent, especially in lowland areas, and tend to be highly disturbed by human activity. However, the stream flowing along the eastern side of Sandy Ridge is unmodified.
Size	All streams are small in size and length.
Diversity	Some diversity in conditions surrounding different streams but faunal diversity low.
Rarity	Streams are common in Hong Kong, and conditions found in these streams are not unusual.
Re-creatability	Natural streams not easily re-created.
Fragmentation	Several small streams in the area which are relatively fragmented.
Ecological linkage	Some ecological linkage to riparian habitats but little functional linkage between streams.
Potential value	Some streams may have potential for enhancement if riparian vegetation is improved and sources of pollution removed.
Nursery/ breeding ground	No significant breeding grounds known but most support populations of common dragonflies.
Age	Most streams probably fairly old.

Criteria	Natural Streams
Abundance/ Richness of wildlife	Streams in this area do not support abundant or diverse faunal communities.
Ecological value	Low to Moderate

Active Wet Agricultural Land

Two discrete patches of active wet agricultural land are present: one to the southwest of Sandy Ridge (east of the Ng Tung River) and the other at Chow Tin Tsuen. These fields are flooded and are used for the cultivation of wetland crops, especially Water Cress. Other vegetation is managed and is thus highly impoverished, comprising a few common annual species. High numbers of dragonflies and amphibians can sometimes be present, but the species involved are mostly common and not of conservation importance. Chinese Bullfrog, a species of Local Concern, was recorded in this habitat, however. Wetland bird species are also present at times; this is particularly the case for the wet agriculture south-west of Sandy Ridge, which supports a similar bird community to that present nearby at Long Valley, albeit in smaller numbers. Greater Painted-snipe was recorded in both areas of wet agricultural land and probably breeds locally.

Table 7.7.25 Habitat evaluation for Planning Area 3: Active Wet agricultural land

Criteria	Active Wet Agricultural Land south-west of Sandy Ridge	Active Wet Agricultural Land at Chow Tin Tsuen
Naturalness	Highly artificial habitat subject to regular impacts from agricultural practices.	Highly artificial habitat subject to regular impacts from agricultural practices.
Size	Area under active agriculture is small.	Area under active agriculture is small.
Diversity	Low diversity of vegetation structure and species. Fairly low faunal diversity but abundance of some species relatively high.	Very low diversity of vegetation structure and species. Low faunal diversity but abundance of some species relatively high.
Rarity	A fairly common habitat in lowland Hong Kong but declining with changing farming practices and development of lowlands.	A fairly common habitat in lowland Hong Kong but declining with changing farming practices and development of lowlands.
Re-creatability	Readily recreated where suitable soil and hydrology is present.	Readily recreated where suitable soil and hydrology is present.
Fragmentation	A small area separated from other active wet agricultural land.	A fairly small area fragmented from other wet agriculture.
Ecological linkage	Ecologically linked to adjacent pond areas and inactive agricultural land. Some linkage (mostly birds) to active wet agriculture at Long Valley.	Ecologically linked to adjacent inactive agriculture and wet grassland. Probably some linkage (mostly birds) to active wet agriculture to the south (outside the Study Area).
Potential value	Suitable management of crops, vegetation and water levels could enhance ecological value.	Suitable management of crops, vegetation and water levels could enhance ecological value.
Nursery/ breeding ground	Chinese Bullfrog and Greater Painted-snipe both present and probably breeding. Used as a foraging ground by egrets breeding at Ho Sheung Heung.	Apparently used by breeding Chinese Bullfrog and probably Greater Painted-snipe.
Age	Agriculture in some form probably relatively old but maintained at early seral stage by regular agricultural practices.	Agriculture in some form probably relatively old but maintained at early seral stage but regular agricultural practices.
Abundance/ Richness of wildlife	Moderate richness and abundance of wetland-dependent bird species. Dragonflies present in high abundance but low diversity.	Low to moderate abundance of a few wetland-dependent bird species. Moderate richness and sometimes high abundance of dragonflies.
Ecological value	Moderate to high given importance as foraging site for breeding herons, use by wetland bird species, including Greater Painted-snipe.	Moderate because diversity is generally lower than at Sandy Ridge (especially birds) but still supports diverse dragonfly community and population of Greater Painted-snipe.

Inactive Wet Agricultural Land

Many abandoned agricultural fields continue to flood during the wet season, permitting the colonisation of wetland plants to create a marsh-like habitat. A relatively large area of this inactive wet agricultural land is located to the south-west of Sandy Ridge, with a smaller area at Chow Tin Tsuen. Both are part of a larger wetland area including active wet agricultural land, and also at Sandy Ridge fishponds. The vegetation structure and lower levels of disturbance in the abandoned agricultural fields make these favoured areas for some species typical of marsh habitats, including Greater Painted-snipe and various amphibians.

Table 7.7.26 Habitat evaluation for Planning Area 3: Inactive wet agricultural land

Criteria	Inactive Wet Agricultural Land
Naturalness	Semi-natural habitat derived from abandonment of land previously used for active cultivation.
Size	Total area within the planning area relatively small.
Diversity	Moderately diverse floral community but low faunal diversity.
Rarity	A relatively uncommon habitat in Hong Kong but widespread. Declining as a result of development of lowland habitats. Greater Painted-snipe is of Local Concern.
Re-creatability	Readily recreated where soil and hydrology are suitable.
Fragmentation	Mostly concentrated in a single block, but also some small isolated patches scattered elsewhere.
Ecological linkage	Shows good linkage to adjacent active agriculture and fishponds.
Potential value	Ecological value could be increased from appropriate management of vegetation and water levels.
Nursery/ breeding ground	Presence of Greater Painted-snipe suggests species probably breeds locally. Used for foraging by ardeids breeding in Ho Sheung Heung egretry.
Age	Derived from relatively recent abandonment of agricultural land.
Abundance/ Richness of wildlife	Moderate richness of common dragonflies and amphibians.
Ecological value	Low to Moderate because, despite presence of Greater Painted-snipe, relatively few species recorded using this habitat.

Active Dry Agricultural Land

A few small patches of active dry agricultural land are present, mostly along Man Kam To Road and around the Man Kam To Boundary Crossing. Regular activity related to crop cultivation prevents establishment of vegetation, resulting in a very low diversity of wild plant species. Regular disturbance of the fields, as well as the low diversity of habitat structure, makes this habitat unsuitable to most wildlife and results in a low ecological value.

Table 7.7.27 Habitat evaluation for Planning Area 3: Active dry agricultural land

Criteria	Active Dry Agricultural Land
Naturalness	Artificial habitat maintained by regular human activity.
Size	A small total area of 13.14ha.
Diversity	Low floral and faunal diversity.
Rarity	A common habitat type in lowland Hong Kong.
Re-creatability	Readily recreated in lowland areas.
Fragmentation	Small habitat patches are highly fragmented.
Ecological linkage	Some ecological linkage with nearby habitats, especially other agricultural land.
Potential value	Could be enhanced by management of vegetation and water levels.
Nursery/ breeding ground	Not known to be a significant breeding ground.
Age	Constant disturbance maintains an early successional stage.
Abundance/ Richness of wildlife	Low.
Ecological value	Low

Inactive Dry Agricultural Land

Areas of inactive dry agricultural land are located within the lowland area to the east of the Ng Tung River. These are continuous with areas of both dry and wet active agriculture, and with a relatively large area of inactive wet agricultural land. The existing value of the inactive dry fields is relatively low, but surrounding habitats are of relatively high ecological value and there is scope for enhancement of these fields if the vegetation and water levels were managed in a suitable manner, to extend the area of wetland present.

Table 7.7.27 Habitat evaluation for Planning Area 3: Inactive dry agricultural land

Criteria	Inactive Dry Agricultural Land
Naturalness	Semi-natural habitat derived from recent abandonment of agricultural land.
Size	A small area present (5.11ha).
Diversity	Low diversity of vegetative structure and species.
Rarity	A common habitat in lowland Hong Kong.
Re-creatability	Readily recreated by abandonment of agriculture.
Fragmentation	Reasonably fragmented in this area.
Ecological linkage	Ecological linkages to nearby agricultural land and grassland/shrubland.
Potential value	Could be enhanced by suitable management of vegetation and/or water levels.
Nursery/ breeding ground	No significant breeding grounds known.
Age	Evolved recently from abandonment of agricultural land.
Abundance/ Richness of wildlife	Relatively low.
Ecological value	Low

Fung Shui Woodland

There are two *fung shui* woodlands in this Planning Area, at Muk Wu and Chow Tin Tsuen.

Table 7.7.28 Habitat evaluation for Planning Area 3: Fung shui woodlands at Muk Wu and Kan Tau Wai

Criteria	Fung shui woodlands at Muk Wu	Fung shui woodland at Chow Tin Tsuen
Naturalness	Semi-natural habitat with low structural complexity. Low number of exotic plantation species around fringe and high human disturbance.	Semi-natural habitat with low structural complexity and high levels of human disturbance.
Size	Moderate in a Hong Kong context.	Very small in a Hong Kong context, 0.2ha.
Diversity	Low plant diversity and poor structural integrity. Faunal diversity low to moderate, as size small.	Low plant diversity, with only 34 species identified by Chu (1998).
Rarity	Semi-natural <i>fung shui</i> woodland with high human disturbance very common in Hong Kong. Woodland comprises species common and widespread in lowland forest and <i>fung shui</i> woodlands in Hong Kong. Woodland fringe heavily disturbed by surrounding environ and weedy or exotic species common.	Semi-natural <i>fung shui</i> woodlands with high human disturbance are very common in Hong Kong. This woodland is dominated by several large trees <i>Cinnamomum camphora</i> , <i>Sterculia lanceolata</i> and <i>Dimocarpus longan</i> in its canopy, with poor understorey development.
Re-creatability	Fairly readily recreated due to low complexity of floristic structure, although trees need time to grow to achieve their full functions.	Fairly readily recreated due to low complexity of floristic structure, although trees need time to grow to achieve their full functions.
Fragmentation	Little fragmentation by the village.	Moderately fragmented by village and agricultural land.
Ecological linkage	Some ecological linkage with woodland nearby and adjacent grassland and agricultural fields.	Some ecological linkage with adjoining seasonally wet grassland and woodlands.
Potential value	Ecological value will increase slowly with time if undisturbed.	Ecological value will increase slowly with time if undisturbed, but value is limited by small size of woodland and low plant diversity.

Criteria	<i>Fung shui</i> woodlands at Muk Wu	<i>Fung shui</i> woodland at Chow Tin Tsuen
Nursery/ breeding ground	None of significance known. Unlikely due to low structural complexity and high level of disturbance.	None of significance known. Unlikely due to low structural complexity and high level of disturbance.
Age	Unknown, but presumably at least 50 years old.	Unknown, but presumably at least 50 years old.
Abundance/ Richness of wildlife	Low	Low.
Ecological value	Low to Moderate	Low to Moderate

Seasonally Wet Grassland

This habitat is formed on areas that are flooded for prolonged periods during the wet season. This prevents the colonisation of shrubs and trees but favours the presence of certain wetland-associated grass and small herb species, which form a dense sward of low-growing vegetation. These habitats typically have lower diversity in vegetation structure than inactive wet agricultural land. Such habitats are located mostly around Chow Tin and to the east of the Man Kam To Boundary Crossing. Faunal species diversity is often relatively low but a few species of conservation concern were recorded, including Greater Painted-snipe. A single dead Burmese Python was observed on a road passing through this habitat near Chow Tin. Tawny Hooktail, a dragonfly of Local Concern, was observed during 2008 on the edge of an area of seasonally wet grassland near Chow Tin. This species is typically associated with gently flowing streams with a sandy bottom (Wilson 2004); the individual observed is therefore likely to be an immigrant from a nearby area and is unlikely to breed in this habitat there.

Table 7.7.29 Habitat evaluation for Planning Area 3: Seasonally wet grassland

Criteria	Seasonally wet Grassland
Naturalness	Semi-natural habitat on land previously used for agriculture and flooded during wet season.
Size	A moderate area of 19.75ha present.
Diversity	Moderate plant species diversity but little structural diversity; low to moderate faunal diversity.
Rarity	An uncommon but widespread habitat in Hong Kong. Greater Painted-snipe is of Local Concern. Burmese Python is of Local Concern. Tawny Hooktail is considered to be a stray from a nearby stream.
Re-creatability	Can be re-created on agricultural land if suitable hydrological conditions exist.
Fragmentation	Moderately fragmented in this area.
Ecological linkage	Ecologically linked to nearby agricultural land and grassland.
Potential value	Could be enhanced with management for suitable wetland vegetation.
Nursery/ breeding ground	Greater Painted-snipe recorded and may breed locally.
Age	Most areas probably fairly recently evolved from agricultural land.
Abundance/ Richness of wildlife	Abundance of dragonflies, butterflies and amphibians sometimes fairly high but richness generally rather low.
Ecological value	Moderate because of importance to amphibians and dragonflies and presence of Greater Painted-snipe.

Lowland Grassland

Lowland grassland habitat is present mostly as a block to the west of Ta Kwu Ling. This is dominated by a few species of large grasses of relatively low ecological value. Due to differences in soil conditions, the ecological characteristics are significantly different from lowland grassland habitats further east within the FCA, showing more similarity with grassland/shrubland habitats present nearby. A relatively poor faunal community was recorded during ecological surveys.

Table 7.7.30 Habitat evaluation for Planning Area 3: Lowland grassland

Criteria	Lowland Grassland
Naturalness	Semi-natural habitat derived from abandonment of agricultural land.
Size	Total area present is moderate at 18.42ha.
Diversity	Diversity in vegetative structure and species diversity relatively low.
Rarity	A fairly uncommon habitat at this low altitude in Hong Kong.
Re-creatability	Habitat of this type re-creatable on abandoned agricultural land.
Fragmentation	Slightly fragmented in this area.
Ecological linkage	Ecologically linked to upland grassland, agricultural land and grassland habitats near Ta Kwu Ling.
Potential value	Vegetation management could enhance ecological value, especially through planting of shrubs.
Nursery/ breeding ground	Not known to be a significant breeding ground.
Age	Derived from relatively recently-abandoned agricultural land.
Abundance/ Richness of wildlife	Low to moderate.
Ecological value	Low

Upland Grassland

Upland grassland is present on the hills at Sandy Ridge and to the east of Man Kam To Road. These have been maintained where previous fires have prevented the colonisation of shrubs and trees. The patches of this habitat in Planning Area 3 are reasonably isolated from similar habitat elsewhere and are not particularly high in elevation. They are not known to support any significant communities or species of ecological importance.

Table 7.7.31 Habitat evaluation for Planning Area 3: Upland grassland

Criteria	Upland Grassland
Naturalness	Semi-natural habitat on hill slopes subject to occasional disturbance, especially from fire.
Size	A fairly large area of 139.56ha present.
Diversity	Low diversity of vegetation, dominated by a few grass species, and low faunal diversity.
Rarity	A common habitat type in Hong Kong.
Re-creatability	Could be re-created on suitable hill slopes but this would probably require loss of high-quality shrubland habitats.
Fragmentation	Not particularly fragmented in this area.
Ecological linkage	Some ecological linkage to lowland grassland and shrubland habitats.
Potential value	Value would be enhanced by succession into shrubland habitat.
Nursery/ breeding ground	No significant breeding grounds known.
Age	Maintained in early seral stage by periodic disturbance.
Abundance/ Richness of wildlife	Diversity and abundance of wildlife relatively low.
Ecological value	Low

Grassland – Shrubland mix

Very little lowland grassland/shrubland habitat is present in Planning Area 3, and this is situated close to the Shenzhen River to the east of Man Kam To. This is derived from lowland grassland into which shrubs and small trees have been able to colonise. Nevertheless, vegetation structural diversity remains low and faunal diversity is correspondingly low.

Table 7.7.32 Habitat evaluation for Planning Area 3: Grassland – shrubland mix

Criteria	Grassland – Shrubland
Naturalness	Semi-natural habitat derived from succession on abandoned agricultural land. Fairly high levels of human disturbance.
Size	A small area of 17.21ha present.
Diversity	Low diversity of vegetation species and structure, low to moderate faunal diversity.
Rarity	A common habitat type in Hong Kong.
Re-creatability	Easily recreated by natural succession.
Fragmentation	Rather fragmented in this area.
Ecological linkage	Some ecological linkage to nearby grassland and shrubland.
Potential value	Could be improved by succession into shrubland and woodland.
Nursery/ breeding ground	No known breeding grounds present.
Age	Relatively recently evolved on abandoned agricultural land.
Abundance/ Richness of wildlife	Fairly low species abundance and richness.
Ecological value	Low in current form.

Shrubland

Most shrubland in this area is present on hill slopes where succession of natural vegetation has occurred. This is present mostly as small patches in upland grassland habitat, although more extensive areas are present to the west of the Man Kam To BCP and around Kong Nga Po. The former is relatively mature and undisturbed, and shows linkages with adjacent secondary woodland habitat. Shrubland at Kong Nga Po is, however, young and is highly disturbed by nearby human activity. Compared to shrubland habitat elsewhere in Hong Kong, this area has very low diversity in vegetation species and structure, resulting in low diversity of faunal species. A dead Many-banded Krait was observed on a road passing through this habitat to the west of Man Kam To BCP.

Table 7.7.33 Habitat evaluation for Planning Area 3: Shrubland

Criteria	Shrubland
Naturalness	Semi-natural habitat derived from succession of grassland habitats. Mostly subject to moderate levels of human disturbance.
Size	A moderate area of 95.74ha present in this part of FCA.
Diversity	Moderate plant species diversity and structural diversity, moderate faunal diversity.
Rarity	<i>A common habitat type in Hong Kong.</i>
Re-creatability	Can be re-created where suitable land exists.
Fragmentation	Moderately fragmented.
Ecological linkage	Functionally linked to woodland and grassland habitats in the area and provides linkage between woodlands outside the area.
Potential value	Value could be increased by encouraging further succession and maturation of vegetation.
Nursery/ breeding ground	No significant breeding grounds known.
Age	Shrubland in this area generally fairly young.
Abundance/ Richness of wildlife	Moderate richness of some faunal groups, but lower than in more mature shrubland elsewhere in Hong Kong. Many-banded Krait is of Local Concern (Fellowes <i>et al.</i> 2002)
Ecological value	Low to Moderate because shrubland in this area suffers from moderate levels of disturbance and consequently has lower species diversity than similar habitat in other areas.

Secondary Woodland and Plantation

Areas of secondary woodland and plantation are scattered throughout this planning area, including an area planted as mitigation at Nam Hang for habitat loss arising from the Shenzhen River Regulation Project Stage III. Many of the areas either side of the Man Kam

To Road are rather degraded and highly disturbed, while *fung shui* woodlands are dealt with separately below.

Table 7.7.34 Habitat evaluation for Planning Area 3: Secondary woodland and plantation

Criteria	Secondary Woodland	Plantation
Naturalness	Semi-natural habitat derived from natural succession. Moderate levels of human disturbance in most areas.	Some areas are semi-natural habitat derived from artificial plantation but with some colonisation of native plant species. At Nam Hang lies 4ha of mostly native species mitigation planting. Moderate levels of human disturbance in most areas.
Size	Moderate area of 79 ha.	A small area of 5.78ha present, mostly in the west of the planning area.
Diversity	Faunal, floral and structural diversity moderate.	Relatively low diversity in faunal, floral and structure in most areas.
Rarity	A common habitat type in Hong Kong.	A common habitat type in Hong Kong.
Re-creatability	Could be re-created but would take many years to fully regain ecological function.	Can be re-created in suitable locations but would take some years to fully mature.
Fragmentation	Fairly fragmented in this area.	Moderately fragmented in this area.
Ecological linkage	Some patches ecologically linked to nearby shrubland habitats.	Some functional linkage to nearby shrubland and secondary woodland.
Potential value	Value could be enhanced by increasing area or functional linkage, or perhaps by reducing disturbance.	Value would increase from enhancement of vegetation to increase native species diversity.
Nursery/ breeding ground	No significant breeding grounds known.	No significant breeding grounds known.
Age	Most patches probably fairly old.	Most plantations in this area are fairly mature, though that at Nam Hang is younger.
Abundance/ Richness of wildlife	Low to moderate abundance of fauna, moderate richness of woodland butterflies.	Abundance and richness lower than in more natural secondary woodlands.
Ecological value	Moderate as currently supports lower diversity than other woodland and is rather disturbed.	Low to Moderate because woodland is generally of fairly high value but many areas contain a high proportion of non-native trees.

Developed Land

Due to the proximity of the Man Kam To border crossing, much of the area in Planning Area 3, especially alongside Man Kam To Road, comprises Developed Land, mostly village land. The area at Kong Nga Po also includes a number of open storage sites and pig farms. Both the developed land and wasteland are subject to high levels of human disturbance, making these sites unsuitable for most wildlife species. Vegetation is typically dominated by exotic species of low ecological value.

Table 7.7.35 Habitat evaluation for Planning Area 3: Developed land

Criteria	Developed Land and Wasteland
Naturalness	An artificial habitat heavily influenced by human activity.
Size	A moderate total area of 71.57ha present, primarily developed land.
Diversity	Low habitat and species diversity.
Rarity	A very common habitat in Hong Kong.
Re-creatability	Easily re-creatable.
Fragmentation	Isolated habitat patches are moderately fragmented.
Ecological linkage	Little ecological linkage to other habitats.
Potential value	Very limited potential value.
Nursery/ breeding ground	No significant nursery or breeding grounds known.
Age	Mostly relatively recently created.

Criteria	Developed Land and Wasteland
Abundance/ Richness of wildlife	Low abundance and richness of wildlife.
Ecological value	Low

7.7.5.4 Planning Area 4

The western part of Planning Area 4 comprises a mosaic of grassland and shrubland in abandoned agricultural areas, interspersed with village development and small areas of secondary woodland. The eastern half is somewhat less diverse, with extensive areas of upland grassland dominating.

Pond Area

Very few ponds are located within Planning Area 4. Those that can be found in areas currently or formerly used for agriculture and would formerly have been used for water storage for irrigation. No significant groups of ponds occur in the area. Chinese Bullfrog, a species of Local Concern, was recorded using this habitat during the surveys.

Table 7.7.36 Habitat evaluation for Planning Area 4: Pond areas

Criteria	Ponds
Naturalness	Man-made ponds in agricultural areas.
Size	All ponds small in size, total area very small at 0.84ha.
Diversity	Low species diversity recorded.
Rarity	Small irrigation ponds are common in lowland Hong Kong. Chinese Bullfrog is of Local Concern.
Re-creatability	Readily recreated.
Fragmentation	Each pond highly fragmented from similar pond habitats.
Ecological linkage	Some ecological linkage to wet agricultural land but otherwise very little ecological linkage.
Potential value	Very limited potential for improvement.
Nursery/ breeding ground	Used for breeding by a limited number of lowland amphibian species, including Chinese Bullfrog.
Age	Ponds probably fairly recently created.
Abundance/ Richness of wildlife	High abundance of amphibian species, including Chinese Bullfrog. Abundance and richness of other wildlife relatively low.
Ecological value	Moderate due to relatively abundant amphibian community.

Drainage Channel

The Kong Yiu channel flows from the NENT landfill site past Tsung Yuen Ha village, connecting with the Shenzhen River close to Chuk Yuen. This channel is concrete-lined, with relatively low stream flow. Water quality is not high, and there is little variation in stream conditions from the effects of pools and riffles; the habitat is therefore not suitable for a diverse stream fauna (fish and odonates). Due to the concrete lining of the channel course, the riparian vegetation is poorly developed and the sides of the channel along most of the route have been planted with exotic tree species.

Table 7.7.37 Habitat evaluation for Planning Area 4: Drainage channel

Criteria	Drainage Channel
Naturalness	Stream course highly altered through channelisation, including concrete base and lining. Water quality influenced by surrounding land uses.
Size	Reasonable in length but fairly narrow.
Diversity	Habitat and species diversity low.
Rarity	A common habitat type in Hong Kong.
Re-creatability	Readily recreated.
Fragmentation	A single stream course, not particularly fragmented.
Ecological linkage	Some ecological linkage to nearby natural streams.
Potential value	Value could be enhanced by improvements to water quality and enhancement of riparian vegetation.

Criteria	Drainage Channel
Nursery/ breeding ground	No significant breeding grounds known but may support common amphibian species.
Age	Fairly recently channelised but exact date not known.
Abundance/ Richness of wildlife	Low abundance and richness, comprising common wetland species.
Ecological value	Low

Natural Streams

The upper section of the Ping Yuen River (covering most of the length within Planning Area 4) has not been channelised. This is a moderately large stream in a local context. There is some evidence of human impacts, including disturbance to riparian vegetation, although this is lower in the upstream section. Tawny Hooktail, a dragonfly species of Local Concern, was recorded in the upstream section of the river. This river is of sufficient ecological value to be added to the AFCD register of Ecologically Important Streams.

Natural stream courses are located throughout the Planning Area. These are streams draining agricultural land that are mostly very small and of relatively low ecological value.

A longer natural stream network that shows very little evidence of human impact is located near Heung Yuen Wai and Pak Fu Shan. Riparian vegetation along this stream is generally well-developed with little disturbance, and includes some areas of secondary woodland. Overall conditions provide considerable variation in microhabitat availability (including numerous pools and riffles), creating suitable conditions for a variety of stream-dependent fauna. The diversity of native fish species recorded during surveys was high, and no non-native fish were recorded, which is very rare in Hong Kong streams. This network of streams is of sufficient ecological value to be added to the AFCD register of Ecologically Important Streams.

Table 7.7.38 Habitat evaluation for Planning Area 4: Natural streams

Criteria	Upper section of Ping Yuen River	Streams at Heung Yuen Wai/Tsung Yuen Ha
Naturalness	Stream bed fairly natural but slightly influenced by nearby agricultural land.	Natural stream courses, little evidence of channelisation or pollution inputs.
Size	Stream is moderate in size and width.	Streams small in width and depth but moderate in length; stream total 6.27km.
Diversity	Some diversity in stream conditions along length. Moderate diversity of fish and odonates.	High diversity in water depth, flow rate and riparian vegetation creating a variety of stream conditions. Good diversity of native fish species and moderate diversity of stream-dependent dragonflies. Paradise Fish and one endangered crab species recorded.
Rarity	Streams are fairly common in Hong Kong, although most have a higher degree of disturbance (especially channelisation). One dragonfly of conservation importance recorded.	Undisturbed streams showing such low levels of human impact are rare and declining in Hong Kong, especially in lowland areas. No evidence of exotic fish, which is very unusual in Hong Kong.
Re-creatability	Re-creation of a stream with the relatively low levels of disturbance would be difficult.	Not easily recreated in their current undisturbed form.
Fragmentation	Not particularly fragmented.	Natural stream sections in this area are interconnected.
Ecological linkage	Ecological linkage to nearby grassland and shrubland and hydrological linkages to lower (channelised) Ping Yuen River.	Linkage between streams. Riparian vegetation shows good linkage to other nearby habitats (including woodland and grassland habitats).
Potential value	Value could be improved by enhancement of riparian vegetation.	Potential value high if disturbance is kept low.

Criteria	Upper section of Ping Yuen River	Streams at Heung Yuen Wai/Tsung Yuen Ha
Nursery/ breeding ground	Probably supports population of Tawny Hooktail.	Breeding ground of various native fish species.
Age	Age not known but stream is probably old with limited recent impacts.	Historical streams with no evidence of recent impacts.
Abundance/ Richness of wildlife	Moderate abundance and richness in fish and dragonfly communities.	Fish community abundant and diverse and does not include exotic species. Odonate diversity relatively high.
Ecological value	Moderate , especially in upstream section.	High in current undisturbed state.

Active Dry Agricultural Land

A few very small, isolated patches of active dry agriculture are scattered through the Planning Area. The crops produced from these are likely to be used predominantly for personal consumption rather than commercial sale. Levels of human disturbance in this habitat are generally high, and species diversity is low. Chinese Bullfrog has been observed in small water tanks used for storage of irrigation water in the active dry agricultural land near Tsung Yuen Ha.

Table 7.7.39 Habitat evaluation for Planning Area 4: active dry agricultural land

Criteria	Active Dry Agricultural Land
Naturalness	A habitat highly disturbed by human influences.
Size	Very small areas present in the planning area, totalling 6.66ha.
Diversity	Low habitat diversity and low faunal diversity.
Rarity	A common habitat in lowland Hong Kong. Chinese Bullfrog recorded in irrigation ponds. Common Rat Snake is of Local Concern (Fellowes <i>et al.</i> 2002).
Re-creatability	Easily re-creatable on suitable land.
Fragmentation	Several small habitat patches are highly isolated in this area.
Ecological linkage	Ecological linkage to adjacent habitats, especially grassland/shrubland.
Potential value	Potential for habitat improvement if succession allowed to proceed to grassland/shrubland.
Nursery/ breeding ground	Chinese Bullfrog breeds in water storage ponds used for irrigation.
Age	Age unknown but probably present for many years. Continuously influenced by human activity, so kept in early stage of succession.
Abundance/ Richness of wildlife	Moderate amphibian abundance in water storage tanks. Otherwise abundance and richness of wildlife low.
Ecological value	Low to Moderate due to high amphibian abundance including Chinese Bullfrog.

Inactive Dry Agricultural Land

A few very small patches of inactive dry agricultural land are scattered though the planning area. Given the very small size and relative isolation, these do not provide significant habitat for any species, although they are integrated with adjacent grassland/shrubland and will naturally mature into this habitat over time.

Table 7.7.40 Habitat evaluation for Planning Area 4: Inactive dry agricultural land

Criteria	Inactive Dry Agricultural Land
Naturalness	Recently derived from fields heavily influenced by human activity.
Size	A very small area present in this planning area, totalling 2.28ha.
Diversity	Low diversity of vegetation and fauna.
Rarity	A common habitat type in lowland Hong Kong.
Re-creatability	Readily recreated from abandonment of agriculture.
Fragmentation	Small, isolated patches are highly fragmented.
Ecological linkage	Ecological linkage to adjacent grassland/shrubland habitats.
Potential value	Ecological value would increase as succession occurs on abandoned fields.

Criteria	Inactive Dry Agricultural Land
Nursery/ breeding ground	Not known to be a significant breeding ground.
Age	Relatively recently derived from abandonment of agriculture.
Abundance/ Richness of wildlife	Relatively low abundance and diversity of wildlife.
Ecological value	Low due to very small size and fragmentation of habitat.

Seasonally Wet Grassland

A few areas within Planning Area 4 are flooded during the wet season, creating marshy conditions. These habitats are typically dominated by wetland-tolerant grasses, with low numbers of trees and shrubs that do not tolerate the wet conditions. Amphibians and dragonflies are sometimes relatively abundant, although the species involved are common in lowland wetlands. A few wetland birds, including Greater Painted-snipe, and wetland-dependent butterfly species were also recorded during surveys.

Table 7.7.41 Habitat evaluation for Planning Area 4: Seasonally wet grassland

Criteria	Seasonally wet grassland
Naturalness	Semi-natural habitat derived from lowland grassland habitats flooded during the wet season.
Size	A relatively small area within the planning area, totalling 9.92ha.
Diversity	Moderate diversity of wetland vegetation and widespread wetland species.
Rarity	A reasonably common habitat in lowland Hong Kong. Greater Painted-snipe recorded.
Re-creatability	Could be recreated if the correct hydrological conditions are present.
Fragmentation	Fairly fragmented within the area.
Ecological linkage	Limited linkage to nearby habitats.
Potential value	Management of marsh vegetation could lead to ecological benefit.
Nursery/ breeding ground	Used as a breeding ground by some common amphibian species.
Age	Most areas probably fairly young and maintained in early seral stage.
Abundance/ Richness of wildlife	Moderate abundance and richness of common wetland species.
Ecological value	Moderate value due to presence of Greater Painted-snipe and large numbers of amphibians.

Lowland Grassland

Areas of abandoned paddies near Tsung Yuen Ha and Heung Yuen Wai have evolved into a habitat dominated by grass species. This area seems to be heavily influenced by periodic fires, limiting the colonisation of herbaceous plant species. This has resulted in a habitat similar to that usually found in upland areas in Hong Kong, which is rare in lowland parts of the territory. The faunal community, especially the bird community, present in this area is also typically associated with upland areas, and species such as Chinese Francolin, Lesser Coucal and Bright-capped Cisticola are relatively common. Large Grass Warbler, a species of conservation concern normally found only above 400m in Hong Kong, was recorded during surveys for the Liantang/Heung Yuen Wai Boundary Crossing Feasibility Study.

Similar conditions are found near Ta Kwu Ling, as part of a continuous block extending to Ping Yeung, outside the existing FCA. These lowland grassland habitats are very similar to, and show very strong ecological linkage with, the upland grassland habitat in the low hills between Tsung Yuen Ha and Ta Kwu Ling; there is thus no significant ecological barrier between the lowland grassland habitats present in Planning Area 4 or between these and the lowland grassland located around Ping Che.

Table 7.7.42 Habitat evaluation for Planning Area 4: Lowland grassland

Criteria	Lowland Grassland
Naturalness	Habitat derived from natural succession on abandoned paddy fields/agricultural land, but maintained at early successional stage by disturbance from fire.
Size	A moderately-sized area of 47.33ha for a habitat that is generally rare in Hong Kong.
Diversity	Fairly low diversity of vegetation and faunal species.
Rarity	Grassland habitats of this type are rare in lowland Hong Kong, being more typical of hill slopes. Bright-capped Cisticola of Local Concern while Large Grass Warbler is Near-threatened. Bird community restricted in distribution in HK.
Re-creatability	Could be re-created by abandonment of suitable agricultural land but most of Hong Kong probably not suitable.
Fragmentation	Present as two patches but these strongly linked by similar hillside grassland.
Ecological linkage	Strong ecological linkage to upland grassland and some linkages also to shrubland.
Potential value	May be possible to enhance value with appropriate management.
Nursery/ breeding ground	Not known to be a significant breeding ground.
Age	Probably present for a moderately long time but regular disturbance keeps in early seral stage.
Abundance/ Richness of wildlife	Low to moderate abundance and richness,.
Ecological value	Moderate because of rarity of this habitat in Hong Kong and importance to bird species of conservation concern.

Upland Grassland

Upland grassland in Planning Area 4 occurs on the low hills south of Tsung Yuen Ha, on the slopes east of Heung Yuen Wai and on Pak Fu Shan. These are directly connected to the lower slopes of Robin's Nest, where extensive grassland habitat is present. Similar habitat is common in Hong Kong upland areas but it is relatively unusual for this to reach the low altitudes that it does in this area. This is generally a poor habitat for wildlife in Hong Kong, but this area has very low levels of human activity. As a result some relatively uncommon bird species are present; Bright-capped Cisticola is relatively frequent, while Eurasian Eagle Owl and Bonelli's Eagle have been recorded. Large Grass Warbler has been recorded at Robin's Nest and in lowland grassland at Tsung Yuen Ha, so can be expected to occur in upland grassland habitats in this area.

Table 7.7.43 Habitat evaluation for Planning Area 4: Upland grassland

Criteria	Upland Grassland
Naturalness	Habitat naturally derived from succession on hill slopes but maintained at early successional stage by occasional disturbance from fire.
Size	A fairly large area of this habitat present at 155.73ha.
Diversity	Moderately low diversity of vegetation and fauna.
Rarity	A common, though declining habitat in Hong Kong hills. Spotted Angle, Small Grass Yellow, Small Three-ring and Bright-capped Cisticola are uncommon in Hong Kong. Bird community distinctive.
Re-creatability	Could be re-created by removal of vegetation on hill slopes but this not usually desirable.
Fragmentation	Not particularly fragmented and connected to extensive areas of similar habitat on Robin's Nest.
Ecological linkage	Very strong ecological linkage to lowland grassland and some linkage to shrubland.
Potential value	Value for most species would be enhanced by permitting succession to shrubland. However, grassland species would benefit by maintaining at early successional stage.
Nursery/ breeding ground	No significant breeding ground or nursery known.

Criteria	Upland Grassland
Age	This habitat probably fairly old in this location but maintained at early successional stage.
Abundance/ Richness of wildlife	Overall abundance and richness of wildlife low.
Ecological value	Moderate due to presence of several species with relatively restricted ranges in Hong Kong.

Grassland – Shrubland mix

This habitat occurs mostly in lower-lying areas close to the Shenzhen River, as well as in the lowlands close to Heung Yuen Wai village. The habitat has evolved on areas that were formerly cleared for agriculture which have since been abandoned. Grasses are the dominant vegetation, with a variety of common lowland shrubs and small trees dispersed throughout the area. This habitat has tended to develop on slightly damper, more organically rich soil than the lowland grassland, and as a consequence the dominant plant species involved differ between the two habitats. This has also resulted in a difference between the faunal use of the habitats; species using the grassland/shrubland are generally widespread, lowland Hong Kong species, whereas those in the lowland grassland in this area are more typical of upland areas in Hong Kong.

Table 7.7.44 Habitat evaluation for Planning Area 4: Grassland – shrubland mix

Criteria	Grassland/Shrubland
Naturalness	A natural stage in the succession of abandoned agricultural land into shrubland and woodland but in some areas dominated by introduced plant species.
Size	Fairly large at 90.40ha, occupying most of the low-lying land in this planning area.
Diversity	Moderate diversity of vegetation structure but relatively low species diversity.
Rarity	A common habitat type in lowland Hong Kong.
Re-creatability	Easily recreated from natural succession on abandoned agricultural land.
Fragmentation	Not particularly fragmented within the area.
Ecological linkage	Strong ecological linkage to nearby agricultural land, grassland and shrubland.
Potential value	Significant potential for enhancement by encouraging succession into shrubland habitat.
Nursery/ breeding ground	Not known to be a significant breeding ground.
Age	Early successional stage suggests this habitat is generally fairly young in this area.
Abundance/ Richness of wildlife	A fairly low species richness and abundance recorded for most faunal groups.
Ecological value	Low to moderate because habitat is widespread and is currently used by relatively few species but is developing into shrubland habitat of higher ecological value.

Shrubland

Some areas on the hill slopes have developed into shrubland habitats. Within Planning Area 4, the largest areas are located near Tsung Yuen Ha, at Pak Fu Shan and on hills between Heung Yuen Wai and Lin Ma Hang. Although these patches are relatively isolated from each other, the intervening habitats (including woodland and grassland/shrubland) are suitable for dispersal of shrubland species. Furthermore, these shrubland patches provide dispersal corridors for woodland species between Wutongshan and woodland habitats in Hong Kong; this corridor will increase in value as shrubland matures into secondary woodland.

Table 7.7.45 Habitat evaluation for Planning Area 4: shrubland

Criteria	Shrubland
Naturalness	Natural habitat mostly established on hill slopes.
Size	A moderate area of 54.85ha present in this planning area.
Diversity	Reasonable diversity in vegetation structure and species.

Criteria	Shrubland
Rarity	A common habitat in Hong Kong. No rare species recorded.
Re-creatability	Readily recreated by succession of grassland habitats over a number of years.
Fragmentation	Fragments within planning area are connected by linkages with intervening habitats, limiting overall fragmentation.
Ecological linkage	Strong ecological linkages with nearby grassland/shrubland and woodland habitats, including woodland outside the FCA and woodland at Wu Tong Shan.
Potential value	Value would be increased by permitting succession into mature shrubland or woodland.
Nursery/ breeding ground	No significant breeding grounds known.
Age	Age variable but generally a few years old judging by stage in succession.
Abundance/ Richness of wildlife	Moderate abundance and richness of wildlife, especially butterflies.
Ecological value	Moderate which will increase as shrubland matures into woodland.

Secondary Woodland/Plantation

Rather fragmented areas of secondary woodland/plantation are scattered through the area.

Table 7.7.46 Habitat evaluation for Planning Area 4: Secondary Woodland/Plantation

Criteria	Secondary Woodland/Plantation
Naturalness	Semi-natural climax habitat.
Size	Individual areas not large, totally approx 28ha.
Diversity	Moderate faunal and floral diversity and structural complexity.
Rarity	Common habitat in Hong Kong.
Re-creatability	Possible, but significant time required to reach maturity.
Fragmentation	Significant fragmentation of blocks throughout planning area.
Ecological linkage	Linkages with other woodland areas, especially to the east.
Potential value	Limited potential for direct increase in habitat value as woodland is mature and area constrained.
Nursery/ breeding ground	None of significance.
Age	Unknown.
Abundance/ Richness of wildlife	Relatively low abundance of wildlife, though moderate richness.
Ecological value	Individual woodland blocks of Low ecological value, though eastern blocks of Low to Moderate value due to linkage with similar habitats to east.

Fung Shui woodlands

Table 7.7.47 Habitat evaluation for Planning Area 4: fung shui woodlands

Criteria	Fung shui woodland at Kan Tau Wai
Naturalness	Semi-natural habitat with low structural complexity and high human disturbance levels.
Size	Small in a Hong Kong context, 0.4ha
Diversity	Very low.
Rarity	Semi-natural <i>fung shui</i> woodlands with high human disturbance are very common in Hong Kong. Canopy dominated by common trees <i>Cinnamomum camphora</i> , <i>Dimocarpus longan</i> , <i>Sapium sebiferum</i> and bamboo clumps, and poor understory development.
Re-creatability	Fairly readily recreated due to low complexity of floristic structure, although trees need time to grow to achieve their full functions.
Fragmentation	Little fragmentation by the village, with the woodland embracing the village.
Ecological linkage	Some ecological linkage with adjacent grassland and agricultural fields.
Potential value	Ecological value will increase slowly with time if undisturbed, but value is limited by small size of woodland and low plant diversity.

Criteria	<i>Fung shui</i> woodland at Kan Tau Wai
Nursery/ breeding ground	Probably not a significant nursery/breeding grounds for fauna due to its low structural complexity and high levels of disturbance.
Age	Unknown, but presumably at least 50 years old.
Abundance/ Richness of wildlife	Low
Ecological value	Low to Moderate

Criteria	<i>Fung shui</i> woodland at Tsung Yuen Ha
Naturalness	Semi-natural woodland with semi-closed canopy but moderate human disturbance around the woodland fringe.
Size	Moderate woodland size in a Hong Kong context, 0.5ha to 0.9ha.
Diversity	Moderate plant diversity and good structural integrity, with 31 (Chu 1998) to 62 plant species (AFCD 2006) recorded. Recent survey revealed that this woodland supports moderate species diversity. Low to moderate faunal diversity.
Rarity	<i>Fung shui</i> woodland of this type, i.e. embracing the village and continuous with the adjacent hill, is common in Hong Kong. The wood is dominated by common mature trees and woody species.
Re-creatability	Fairly readily recreated, but requires significant period of time to develop and mature to its original structural complexity and floristic composition.
Fragmentation	Little fragmentation.
Ecological linkage	Some ecological linkage with the adjacent grassland, agricultural fields and hilly terrestrial habitats.
Potential value	Scope for the increase in ecological value with time if undisturbed.
Nursery/ breeding ground	None of significance known.
Age	Unknown, but presumably at least 50 years old.
Abundance/ Richness of wildlife	Low.
Ecological value	Low to Moderate

The *fung shui* woodland at Heung Yuen Wai is of moderate to high ecological value. Its overstorey is around 12 to 15m height, comprising a continuous canopy dominated by *Celtis sinensis*, *Cinnamomum camphora*, *Dimocarpus longan*, *Ficus microcarpa*, *Schima superba*, *Sterculia lanceolata* and *Viburnum odoratissimum*. Its subcanopy and understory are dominated by common, shade-tolerant shrub, tree and woody climber species (such as shrubs *Ardisia crenata*, *Psychotria asiatica* and *Uvaria microcarpa*, and trees *Cratogeomys cochinchinensis*, *Antidesma bunius* and *Archidendron clypearia*). In particular, a ~15m native tree *Aquilaris sinensis* and seedlings of this species and *Pavetta hongkongensis* were recorded. Both *A. sinensis* and *P. hongkongensis* are protected under the Forestry Regulation (Cap. 96A). In addition, *A. sinensis* is regarded as “Near Threatened” in the China Plant Red Data Book and the Illustrations of Rare & Endangered Plants in Guangdong Province. It is listed as a Category II nationally protected species in China (South China Institute of Botany & AFCD 2003). It is also currently protected under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). Though *A. sinensis* and *P. hongkongensis* are common species in *Fung Shui* woods and lowland forests in Hong Kong, its continued, closed canopy and proximity linkage with the adjacent extensive hilly terrain indicates that human disturbance in this woodland is scarce under the long-term protection by local villagers.

Criteria	<i>Fung shui</i> woodland at Heung Yuen Wai
Naturalness	Relatively undisturbed, near-climax habitat with good woodland integrity and close proximity to adjacent hilly lowland forest.
Size	Moderate in a Hong Kong context, 1.2ha to 1.9ha.
Diversity	Moderate to high plant diversity, with 48 (Chu 1998) to 91 plant species (AFCD 2006) identified in previous studies. Recent survey revealed that this woodland supports high species diversity.
Rarity	<i>Fung shui</i> woodlands of this type not uncommon in HK.

Criteria	<i>Fung shui</i> woodland at Heung Yuen Wai
Re-creatability	Fairly readily recreated, but requires significant period of time to develop and mature to its original structural complexity and floristic composition.
Fragmentation	Somewhat fragmented by village.
Ecological linkage	Direct linkage with the adjacent hilly shrubby grassland and forest habitats.
Potential value	Scope exists for enlarging the area and strengthening the link with the northeast New Territories via forest protection, fire prevention and enhancement.
Nursery/ breeding ground	None of significance known.
Age	Unknown, but presumably at least 50 years old.
Abundance/ Richness of wildlife	Moderately rich and abundant woodland fauna likely to be present in association with the adjacent hilly terrestrial habitats.
Ecological value	Moderate to High

Developed Land

Developed Land in this area is found in a few relatively small villages and isolated houses. The low density of human population in this area results in very low levels of disturbance to surrounding habitats. Although this habitat is generally of fairly low value for wildlife, but the low levels of disturbance experienced within the FCA and low density of development mean that wildlife uses of the villages in this area is greater than in much of Hong Kong. White-shouldered Starling, a breeding bird species of Local Concern, was recorded breeding around Ta Kwu Ling.

Table 7.7.48 Habitat evaluation for Planning Area 4: developed land

Criteria	Developed Land
Naturalness	Habitats heavily influenced by human activity.
Size	Several small patches and overall area relatively small, totalling 24.31ha.
Diversity	Low diversity of habitats and wildlife.
Rarity	A very common habitat type in Hong Kong. White-shouldered Starling is of Local Concern.
Re-creatability	Readily recreated.
Fragmentation	Habitat highly fragmented in this area.
Ecological linkage	Little ecological linkage to other habitats.
Potential value	Limited potential value for improvement.
Nursery/ breeding ground	White-shouldered Starling recorded breeding in small numbers at Ta Kwu Ling.
Age	Variable in age; most villages are relatively old but some recent village expansion.
Abundance/ Richness of wildlife	Low abundance and richness of wildlife due to high levels of disturbance.
Ecological value	Low despite small numbers of breeding White-shouldered Starlings.

7.7.5.5 Planning Area 5

Much of Planning Area 5 comprises mature woodland and closed-canopy shrubland, and the primary focus in terms of development is the Lin Ma Hang lowland village area, which largely comprises grassland and shrubland in areas of abandoned agriculture, in addition to the village area. There is a small area of seasonally wet grassland near the beginning of the valley associated with the stream.

Upland Grassland

The abandonment of upland agricultural land has resulted in succession to grassland that appears to be fire-maintained; however, succession to shrubland habitats has not yet occurred.

Table 7.7.49 Habitat evaluation for Planning Area 5: upland grassland

Criteria	Upland Grassland
Naturalness	Semi-natural habitat arising from succession on abandoned agricultural land.
Size	Fairly large in this planning area, at 76 ha.
Diversity	Relatively low diversity of vegetation.
Rarity	Dry, occasionally burnt grassland of this type is relatively common in Hong Kong.
Re-creatability	Readily recreated as it is default successional habitat on abandoned agricultural land.
Fragmentation	Some fragmentation caused by village and shrubland areas.
Ecological linkage	Some habitat linkages with lowland grassland.
Potential value	Moderate scope for restoration and enhancement with appropriate management.
Nursery/ breeding ground	None of significance known.
Age	Unknown, but maintained at early successional stage by fire.
Abundance/ Richness of wildlife	Low, though with grassland specialist bird species present.
Ecological value	Low to Moderate.

Lowland Grassland and Grassland-Shrubland

The abandonment of agricultural land has resulted in succession to grassland and grassland-shrubland that appears not to have a frequent incidence of fire.

Table 7.7.50 Habitat evaluation for Planning Area 5: lowland grassland and grassland-shrubland

Criteria	Lowland Grassland and Grassland-Shrubland
Naturalness	Semi-natural habitat arising from succession on abandoned agricultural land.
Size	Fairly large, at 22ha, with 17.3 ha of grassland. However, pure grassland area of higher ecological value small.
Diversity	Relatively low diversity of flora and fauna.
Rarity	Dry, apparently little burnt grassland of this type is relatively rare in Hong Kong. Grassland-shrubland is relatively common.
Re-creatability	Readily recreated as it is default successional habitat on abandoned agricultural land.
Fragmentation	Some fragmentation caused by village area.
Ecological linkage	No habitat linkages.
Potential value	Moderate scope for restoration and enhancement with appropriate management.
Nursery/ breeding ground	None of significance known.
Age	Unknown, but presumably at least 25 years.
Abundance/ Richness of wildlife	Moderate, with grassland specialist bird species present, and a relatively diverse butterfly fauna.
Ecological value	Areas of grassland-shrubland are of Low ecological value. Areas of grassland away from the riparian zone are Low to Moderate due to small area, while areas that constitute part of the riparian zone are regarded as High .

Seasonally Wet Grassland

A small area of seasonally wet grassland is present near the mouth of the valley associated with the stream. The lack of open water areas and the tall dense vegetation with limited floral diversity restricts the current ecological value of this habitat.

Table 7.7.51 Habitat evaluation for Planning Area 5: seasonally wet grassland

Criteria	Seasonally Wet Grassland
Naturalness	Anthropogenic habitat derived from abandonment of agricultural land with subsequent colonisation by natural vegetation.
Size	Small in area, 1.3 ha.
Diversity	Low vegetation and microhabitat diversity, and thus low floral and faunal diversity.
Rarity	Widespread in Hong Kong.
Re-creatability	Readily recreated, as this is the default successional habitat on much filled agricultural land prone to seasonal flooding.
Fragmentation	Not significantly fragmented.
Ecological linkage	Important hydrological and functional linkages to natural stream.
Potential value	Considerable scope for restoration and enhancement with appropriate management.
Nursery/ breeding ground	Chinese Bullfrog is present.
Age	Unknown.
Abundance/ Richness of wildlife	Low diversity and fauna.
Ecological value	Areas away from the riparian zone are Moderate , while areas that constitute part of the riparian zone are regarded as High .

Closed-canopy shrubland and secondary woodland

The Lin Ma Hang valley is surrounded by diverse and relatively undisturbed shrubland and woodland that has grown since abandonment of agricultural and other activities such as tree-felling. While some areas of abandoned lowland agriculture remain as grassland, others have begun the successional process leading to the development of shrubland. Areas bordering the mature woodland that surrounds the valley have more shrubland and less grassland.

Table 7.7.52 Habitat evaluation for Planning Area 5: closed-canopy shrubland and secondary woodland

Criteria	Closed-canopy shrubland and secondary woodland
Naturalness	Semi-natural climax or near-climax habitat.
Size	Approximately 217ha in this planning area, divided equally between shrubland and woodland. Part of a large area of this habitat extending toward Sha Tau Kok, comprising 539 ha in total.
Diversity	High floral and faunal diversity.
Rarity	Widespread but locally distributed in Hong Kong. Four rare ferns were recorded in secondary forest by KFBG (2004).
Re-creatability	Readily recreated, but requires significant period of time to develop and mature.
Fragmentation	Limited fragmentation by village development and grassland areas.
Ecological linkage	Important linkage with similar habitat at Wutongshan Forest Park, Shenzhen, which provides the only obvious corridor for the movement of vagile fauna between Guangdong and Hong Kong.
Potential value	Scope exists for enlarging the area and strengthening the link with the northeast New Territories via forest protection, fire prevention and enhancement.
Nursery/ breeding ground	A fairly diverse woodland avifauna is present, though in character it is similar to other similar such areas of Hong Kong.
Age	Unknown, but presumably 30-40 years.
Abundance/ Richness of wildlife	High richness of avifauna, comprising a bird community typical of mature secondary forest in Hong Kong. Surveys carried out by KFBG (2004) identified the woodland of this area as having high plant diversity.
Ecological value	High

Lin Ma Hang fung shui woodland

A *fung shui* woodland is located at Lin Ma Hang village, though its close linkage with contiguous secondary woodland means that defining the area is difficult. With a mature, closed canopy of over 15 m high, this woodland is dominated by common large tree species. Its subcanopy and understorey are also dominated by common and widespread species. The rare tree species *Xylosma longifolium* was recorded in this woodland by Chu (1998). Four rare ferns were recorded in the adjacent hillside secondary forest and woodland KFBG (2004).

Table 7.7.53 Habitat evaluation for Planning Area 5: fung shui woodland at Lin Ma Hang

Criteria	<i>Fung shui</i> woodland at Lin Ma Hang
Naturalness	Near climax habitat with good woodland integrity and close proximity to the adjacent hilly lowland forest. This woodland suffers little human disturbance, except at the woodland fringe.
Size	Moderate in a Hong Kong context, 0.5ha to 2.2ha
Diversity	Moderate to high plant species diversity, with 61 (Chu 1998) to 81 plant species (AFCD 2006) recorded. Recent survey revealed that the woodland supports high plant species diversity. As part of surrounding secondary woodland, faunal diversity high.
Rarity	<i>Fung Shui</i> woodland of this type is common in Hong Kong but its close proximity and ecological linkage with adjacent woodland are unusual.
Re-creatability	Fairly readily recreated, but requires significant period of time to develop and mature to its original structural complexity and floristic composition.
Fragmentation	Minor fragmentation by the village.
Ecological linkage	Direct linkage with the adjacent hilly shrubland and grassland and forest habitats. Some ecological linkage with Lin Ma Hang Stream.
Potential value	Scope exists for enlarging the area and strengthening the link with the northeast New Territories via forest protection, fire prevention and enhancement.
Nursery/ breeding ground	Unknown for any significant nursery/breeding grounds for fauna; moderately diverse woodland fauna likely to be present in associate with the adjacent hilly terrestrial habitats.
Age	Unknown, but presumably at least 50 years old.
Abundance/ Richness of wildlife	Woodland itself too small to support abundant or rich woodland bird community, but is part of large area of woodland that does.
Ecological value	Moderate

Natural Stream

The Lin Ma Hang Stream SSSI is a lowland freshwater stream characterised by its slow flow and shallow channel bordered with riparian vegetation. It is an unpolluted, relatively undisturbed stream course with woodland adjacent for much of its length.

Table 7.7.54 Habitat evaluation for Planning Area 5: natural stream

Criteria	Natural Stream
Naturalness	Largely natural stream in basin of abandoned agricultural land.
Size	Length approximately 2km, width 1.5m to 4.0m
Diversity	Moderate to high diversity of riparian vegetation and fauna.
Rarity	Such unchannelised, unpolluted, lowland streams are rare in Hong Kong. Fish species of conservation importance recorded.
Re-creatability	Very difficult to recreate.
Fragmentation	Little fragmentation, though some intrusion by village areas.
Ecological linkage	Strong linkage with forested upstream areas, and with the Shenzhen River.
Potential value	Little scope for increasing ecological value beyond what it is now.
Nursery/ breeding ground	Important breeding ground for native freshwater fish.
Age	Unknown.

Criteria	Natural Stream
Abundance/ Richness of wildlife	Rich fish fauna, with 20 freshwater species recorded, making it probably the richest in Hong Kong. Other fauna of low abundance and richness.
Ecological value	High on the basis of extremely diverse lowland fish community and number of rare species, reflected in designation as SSSI in July 2007.

Developed Land

In this area developed land comprises village land and roads at Lin Ma Hang.

Table 7.7.55 Habitat evaluation for Planning Area 5: developed land

Criteria	Developed land
Naturalness	Entirely anthropogenic habitat.
Size	Small in size.
Diversity	Low floral and faunal diversity.
Rarity	Widespread and common habitat in Hong Kong.
Re-creatability	Readily re-creatable.
Fragmentation	Significantly fragmented.
Ecological linkage	No significant linkages exist with habitats of ecological significance.
Potential value	Limited scope for enhancement under current conditions.
Nursery/ breeding ground	None of significance known.
Age	Variable.
Abundance/ Richness of wildlife	Low abundance and richness of wildlife.
Ecological value	Low

7.7.5.6 Planning Area 6

A substantial portion of Planning Area 6 comprises closed-canopy shrubland or secondary woodland, much of which is included in a potential Country Park. To the east, however, lie lowland areas of much greater habitat diversity, including *fung shui* woodland, village land, inactive and active agricultural areas, shrubland, seasonally wet grassland and pond areas.

Closed-canopy shrubland and secondary woodland

The western half of this Planning Area comprises the eastern section of the large area of undisturbed shrubland and woodland that extends over the hills that comprise much of this area.

Table 7.7.56 Habitat evaluation for Planning Area 6: closed-canopy shrubland and secondary woodland

Criteria	Closed-canopy shrubland and secondary woodland
Naturalness	Semi-natural climax or near-climax habitat.
Size	Total of 322ha in this planning area. Part of a large area stretching west to Robin's Nest and Lin Ma Hang, comprising 539 ha in total.
Diversity	High floral and faunal diversity.
Rarity	Widespread but locally distributed in Hong Kong.
Re-creatability	Readily recreated, but requires significant period of time to develop and mature.
Fragmentation	Some fragmentation by village development and grassland areas.
Ecological linkage	Important linkage with similar habitat at Wutongshan Forest Park, Shenzhen, which provides the only obvious corridor for the movement of vagile fauna between Guangdong and Hong Kong.
Potential value	Scope exists for enlarging the area and strengthening the link with the northeast New Territories via forest protection, fire prevention and enhancement.
Nursery/ breeding ground	A fairly diverse woodland avifauna is present, in character similar to other such areas of Hong Kong.
Age	Unknown, but presumably 30-40 years.
Abundance/ Richness of wildlife	High richness of avifauna, comprising a bird community typical of mature secondary forest in Hong Kong. Surveys carried out by KFBG (2004) identified the woodland of this area as having high plant diversity.

Criteria	Closed-canopy shrubland and secondary woodland
Ecological value	High

Lowland shrubland at Tong To

An area of shrubland exists in lowland areas near Tong To village, somewhat separate from the hillside shrubland to the north.

Table 7.7.57 Habitat evaluation for Planning Area 6: lowland shrubland near Tong To

Criteria	Lowland shrubland near Tong To
Naturalness	Semi-natural near-climax habitat.
Size	Moderately-sized area near Tong To village.
Diversity	Moderate floral and faunal diversity.
Rarity	Widespread in Hong Kong.
Re-creatability	Readily recreated, but requires significant period of time to develop and mature.
Fragmentation	Some fragmentation by village development.
Ecological linkage	Some linkage with woodland and shrubland on hill slopes to north.
Potential value	Limited scope exists for enhancement.
Nursery/ breeding ground	None of significance known.
Age	Unknown, but presumably 10-20 years.
Abundance/ Richness of wildlife	Moderate richness of butterfly fauna present in area.
Ecological value	Low to Moderate

Fung Shui woodlands

There are three small to moderately-sized *fung shui* woodlands at Tong To, Muk Min Tau and Sheung Tam Shui Hang. Size estimates of *fung shui* woodlands vary due to their often close linkage with surrounding woodland areas, and thus a range is provided that covers published estimates. Although large differences in plant diversity of Shan Tsui *fung shui* woodland were recorded by Chu (1998) and AFCD (2006), recent survey revealed that this woodland supports low plant diversity and poor understorey development, and common woody plant species dominate. The Muk Min Tau *fung shui* woodland contains *Adenantha microsperma*, *Aphananthe aspera* (specimen now felled (Xing *et al.* 2000)), *Artocarpus styracifolius*, *Cordia dichotoma*, *Erycibe obtusifolia*, *Meliosma fordii* and *Osmanthus matsumuranus* (Chu 1998), which highlights its rarity in comparison with other *fung shui* woodlands in the FCA. For example, significant populations of *Helicia cochinchinensis*, the only known population of large trees in Hong Kong, were recorded and several specimens of restricted trees *Cordia dichotoma* and *Adenantha microsperma* were present in recent survey around the woodland fringe

Table 7.7.58 Habitat evaluation for Planning Area 6: fung shui woodlands

Criteria	<i>Fung shui</i> woodland at Shan Tsui
Naturalness	Semi-natural habitat with low structural complexity; moderate disturbance to woodland fringe and some internal areas.
Size	Moderate in a Hong Kong context, 0.8 to 1ha.
Diversity	Low plant diversity and moderate structural integrity for woodland between Shan Tsui Village and Shan Tsui Village Road. Low to moderate faunal diversity.
Rarity	Semi-natural <i>fung shui</i> woodland of this type is common in Hong Kong.
Re-creatability	Fairly readily recreated, but requires significant period of time to develop and mature to its original structural complexity and floristic composition.
Fragmentation	This woodland is fragmented from the hilly terrestrial habitats by adjacent Shan Tsui Village Road.
Ecological linkage	Some ecological linkage with the adjacent hilly woodland and shrubby grassland.
Potential value	Some scope for increase via reducing disturbance.

Criteria	<i>Fung shui</i> woodland at Shan Tsui
Nursery/ breeding ground	Possibly not a significant nursery/breeding grounds for fauna due to its limited size and moderate disturbance from the surrounding environs.
Age	Unknown, presumably at least 50 years old.
Abundance/ Richness of wildlife	Butterfly richness in area is high, including woodland-associated species.
Ecological value	Low to Moderate

Criteria	<i>Fung shui</i> woodland at Muk Min Tau
Naturalness	Semi-natural climax or near-climax habitat with good structural integrity and little human disturbance.
Size	Moderate in Hong Kong context, 2.3 to 2.8ha)
Diversity	Moderate to high plant diversity of 77 (AFCD 2006) to 144 plant species (Chu 1998). Recent survey revealed that the woodland supports high species diversity, with rare/restricted species.
Rarity	<i>Fung shui</i> woodlands of this type with closed canopy and good structural integrity are quite usual in Hong Kong but the presence of seven rare species is not.
Re-creatability	Fairly readily recreated, but requires significant period of time to develop and mature to its original structural complexity and floristic composition. The several rare species may not regenerate in new land.
Fragmentation	Somewhat fragmented by the villages and agricultural fields.
Ecological linkage	Some ecological linkage with adjacent shrubby grassland and hilly woodland.
Potential value	Scope exists for enlarging the area and strengthening the link with the northeast New Territories via forest protection, fire prevention and enhancement.
Nursery/ breeding ground	Unknown for any significant nursery/breeding grounds for fauna; moderately diverse woodland fauna likely to be present in association with the adjacent hilly terrestrial habitats.
Age	Unknown, but presumably at least 50 years old.
Abundance/ Richness of wildlife	Moderately rich butterfly fauna, including high density of woodland-dependent Quaker.
Ecological value	High

Criteria	<i>Fung shui</i> woodland at Tong To
Naturalness	Semi-natural climax with shrubland, small areas of natural woodland and bamboo mosaic. Shrubby grassland along fringe suffers moderate human disturbance.
Size	Small in a Hong Kong context, 0.4ha to 0.7ha.
Diversity	Moderate plant diversity, with 44 plant species (Chu 1998) to 69 plant species (AFCD 2006) identified.
Rarity	<i>Fung shui</i> woodlands of this type are widespread in Hong Kong in regard to location and structural complexity. Majority of species present are common, although the rare tree <i>Xylosma longifolium</i> was recorded by Chu (1998).
Re-creatability	Fairly readily recreated, but requires significant period of time to develop and mature to its original structural complexity and floristic composition.
Fragmentation	Little fragmentation.
Ecological linkage	Some ecological linkage with adjacent shrubby grassland and hilly woodland.
Potential value	Scope exists for enlarging the area and more closely linking it with the adjoining hilly terrestrial habitats.
Nursery/ breeding ground	Unknown for any significant nursery/breeding grounds for fauna; moderately diverse woodland fauna likely to be present.
Age	Unknown, but presumably at least 50 years old.
Abundance/ Richness of wildlife	Butterfly richness in area is high, including woodland-associated species.
Ecological value	Moderate

Criteria	<i>Fung shui</i> woodland at Sheung Tam Shui Hang
Naturalness	Semi-natural climax habitats with shrubby grassland along the woodland fringe to near-climax habitat with mature forest at the back. Medium structural integrity but with moderate human disturbance along the woodland fringe.
Size	Moderate in Hong Kong context, 0.8ha to 2ha.
Diversity	Moderate plant diversity, with 39 plant species (AFCD 2006) to 76 plant species (Chu 1998) identified. Faunal diversity low to moderate.
Rarity	<i>Fung shui</i> woodlands of this type are common and widespread in Hong Kong. Plant species recorded in the shrubby and forest habitats are largely common and widespread throughout the territory in lowland areas.
Re-creatability	Fairly readily recreated, but requires significant period of time to develop and mature to its original structural complexity and floristic composition.
Fragmentation	Little fragmentation.
Ecological linkage	Ecologically linked with the adjoining lowland forest and shrubby shrubland.
Potential value	Scope exists for enlarging the area and more closely linking it with the adjoining hilly terrestrial habitats.
Nursery/ breeding ground	Unknown for any significant nursery/breeding grounds for fauna; moderately diverse woodland fauna likely to be present.
Age	Unknown, but presumably at least 50 years old.
Abundance/ Richness of wildlife	Moderate butterfly richness, including Danaid Egg-fly. Avifauna also moderate due to presence of forest species.
Ecological value	Moderate

Pond Area

Two adjoining fishponds lie between Sha Tau Kok Road and Starling Inlet. These are the only fishponds in the area, and appear to be inactive.

Table 7.7.59 Habitat evaluation for Planning Area 6: pond area

Criteria	Pond area
Naturalness	Anthropogenic habitat, either inactive or managed at low intensity.
Size	Total area is 1.9 ha.
Diversity	Low diversity of flora and low to moderate faunal diversity.
Rarity	Such ponds are not uncommon in the northern New Territories, though they are rare in the eastern part of the Study Area and the northeast New Territories.
Re-creatability	Readily recreated.
Fragmentation	Not fragmented.
Ecological linkage	No habitat linkages, but some linkage with Starling Inlet.
Potential value	Scope for improvement through habitat management.
Nursery/ breeding ground	None of significance known.
Age	Unknown.
Abundance/ Richness of wildlife	Low.
Ecological value	Low due to isolation and small size.

Mangrove

Small areas of mangrove are located along the edge of Starling Inlet. Although strictly-speaking outside the Study Area, any development in adjacent areas may have negative impacts.

Table 7.7.60 Habitat evaluation for Planning Area 6: mangrove

Criteria	Mangrove
Naturalness	Natural habitat.
Size	Total area in planning area is small, at 0.17 ha.
Diversity	Relatively low diversity of mangrove species, faunal diversity low to moderate.
Rarity	Locally distributed in the New Territories, mangrove stands away from Deep Bay are relatively rare and small in size.
Re-creatability	Not readily recreated.
Fragmentation	Mangrove along the western shore of Starling Inlet is fairly fragmented.
Ecological linkage	No significant habitat linkages with other areas of mangrove in Starling Inlet. Some faunal linkages with Starling Inlet as a whole.
Potential value	Very little scope for improvement due to particular requirements.
Nursery/ breeding ground	For fiddler crabs and gastropods.
Age	Unknown.
Abundance/ Richness of wildlife	Relatively low.
Ecological value	Moderate due to isolation and small size.

Natural Streams

There are three major streams in this area, adjacent to the villages of Tong To, Muk Min Tau and Ha Tan Shui Hang. Although partially modified, all retain largely undisturbed upper sections. These streams are of sufficient ecological value to be added to the AFCD register of Ecologically Important Streams.

Table 7.7.61 Habitat evaluation for Planning Area 6: natural streams at Tong To, Muk Min Tau and Tam Shui Hang villages

Criteria	Natural Stream at Tong To Village
Naturalness	Largely natural upper sections, modified lower part though with natural stream bed and riparian vegetation; surrounded by village area and abandoned agricultural land.
Size	Length approximately 3.6 km.
Diversity	Moderate to high diversity of riparian vegetation, moderate riparian faunal diversity.
Rarity	Such (partially) unchannelised, unpolluted, lowland streams are rare in Hong Kong.
Re-creatability	Very difficult to recreate.
Fragmentation	Little fragmentation, though some intrusion by village areas.
Ecological linkage	Strong linkage with forested upstream areas and with Starling Inlet, possibly including diadromous species that spawn at sea.
Potential value	Some scope for increasing ecological value.
Nursery/ breeding ground	For amphibians, fish, odonates and aquatic invertebrates.
Age	Unknown.
Abundance/ Richness of wildlife	Moderately rich riparian fauna.
Ecological value	Moderate on the basis of possible occurrence of diadromous fish community, the naturalness of the stream bed and connectivity to Starling Inlet.

Criteria	Natural Stream at Muk Min Tau Village
Naturalness	Largely natural upper sections, modified lower part, surrounded by village area and abandoned agricultural land.
Size	Length approximately 1.85 km.
Diversity	Moderate diversity of riparian vegetation, moderate riparian fauna diversity.
Rarity	Such (partially) unchannelised, unpolluted, lowland streams are rare in Hong Kong.
Re-creatability	Very difficult to recreate.
Fragmentation	Little fragmentation, though some intrusion by village areas.
Ecological linkage	Strong linkage with forested upstream areas, but very limited connectivity with Starling Inlet.
Potential value	Potential for development into good riverine habitat for stream amphibians and odonates.
Nursery/ breeding ground	For amphibians, fish, odonates and aquatic invertebrates.
Age	Unknown.
Abundance/ Richness of wildlife	Low to moderate.
Ecological value	Upper section Moderate on the basis of naturalness. Lower section Low due to modification.

Criteria	Natural Stream at Sheung/Ha Tam Shui Hang Villages
Naturalness	Largely natural upper sections, modified lower part, though latter with natural sediment and riparian vegetation. Stream surrounded by village area and abandoned agricultural land.
Size	Length approximately 4.1 km.
Diversity	High diversity of aquatic vegetation, moderate diversity of riparian fauna, including Predaceous Chub and probably the protected Giant Mottled Eel, as well as the damselfly Ferruginous-faced Sprite, which is very rare locally.
Rarity	Such (partially) unchannelised, unpolluted, lowland streams are rare in Hong Kong. Fish and odonate species of conservation importance recorded.
Re-creatability	Very difficult to recreate.
Fragmentation	Little fragmentation, though some intrusion by village areas.
Ecological linkage	Strong linkage with forested upstream areas, and with Starling Inlet, possibly including diadromous.
Potential value	Little scope for increasing ecological value beyond what it is now.
Nursery/ breeding ground	For amphibians, fish, odonates and aquatic invertebrates.
Age	Unknown.
Abundance/ Richness of wildlife	Moderately rich odonate and fish fauna.
Ecological value	Moderate to High on the basis of fish community, presence of Ferruginous-faced Sprite and connectivity to Starling Inlet.

Active Dry Agricultural Land

Two small areas of dry agricultural land are present near Tong To village.

Table 7.7.62 Habitat evaluation for Planning Area 6: active dry agricultural land

Criteria	Active Dry Agricultural Land
Naturalness	Anthropogenic habitat.
Size	Small area of 0.6 ha.
Diversity	Low species diversity and structural complexity.
Rarity	Relatively common in Hong Kong, but has declined greatly in recent years.

Criteria	Active Dry Agricultural Land
Re-creatability	Readily recreated.
Fragmentation	Fragmented by Sha Tau Kok Road and village-type development.
Ecological linkage	Some linkage with nearby areas of seasonally wet grassland.
Potential value	Limited scope exists for enhancement under current use.
Nursery/ breeding ground	None of significance known.
Age	Unknown.
Abundance/ Richness of wildlife	Low.
Ecological value	Low

Grassland and Grassland-Shrubland

The lowland areas east of the Sha Tau Kok Road are well-drained and are covered mainly by lowland grassland, while a small area of grassland/shrubland lies next to Tong To village.

Table 7.7.63 Habitat evaluation for Planning Area 6: grassland and grassland/shrubland

Criteria	Grassland and grassland/shrubland
Naturalness	Semi-natural habitat arising from succession on abandoned agricultural land; rather degraded and disturbed in this area.
Size	Fairly small, at 3.9 ha of grassland and 1.25 ha of grassland/shrubland next to Tong To village.
Diversity	Relatively low diversity of flora and fauna.
Rarity	These disturbed habitats are not rare in Hong Kong.
Re-creatability	Readily recreated as it is default successional habitat on abandoned dry agricultural land.
Fragmentation	Significant fragmentation caused by developed areas and woodland.
Ecological linkage	Limited functional linkages with similar habitat further west.
Potential value	Moderate scope for restoration and enhancement with appropriate management.
Nursery/breeding ground	None of significance known.
Age	Unknown.
Abundance/ Richness of wildlife	Low abundance and richness of wildlife.
Ecological value	Low

Upland Grassland

On the higher, well-drained slopes above areas of seasonally wet grassland lie abandoned agricultural areas that have succeeded to fire-maintained grassland.

Table 7.7.64 Habitat evaluation for Planning Area 6: upland grassland

Criteria	Upland Grassland
Naturalness	Semi-natural habitat arising from succession on abandoned agricultural land.
Size	Fairly large, at 138 ha.
Diversity	Relatively low diversity of flora and fauna.
Rarity	This type of grassland is not rare in Hong Kong.
Re-creatability	Readily recreated as it is default successional habitat on abandoned dry agricultural land.
Fragmentation	Some fragmentation by shrubland.
Ecological linkage	Limited functional linkages with grassland further west.
Potential value	Moderate scope for restoration and enhancement with appropriate management.
Nursery/breeding ground	None of significance known.
Age	Unknown.
Abundance/ Richness of wildlife	Moderate, with grassland specialist bird species present, and a relatively rich butterfly fauna.
Ecological value	Low to Moderate

Seasonally Wet Grassland

A significant area of seasonally wet grassland is present in abandoned agriculture areas in the lowlands, mainly west of Sha Tau Kok Road. The lack of open water areas and the tall dense vegetation with limited floral diversity restricts the current ecological value of this habitat. It does have significant potential for enhancement, however.

Table 7.7.65 Habitat evaluation for Planning Area 6: seasonally wet grassland

Criteria	Seasonally Wet Grassland
Naturalness	Anthropogenic habitat derived from abandonment of agricultural land with subsequent colonisation by natural vegetation.
Size	Fairly large in area (29 ha).
Diversity	Low vegetation and microhabitat diversity, and thus low floral and faunal diversity.
Rarity	Widespread in Hong Kong.
Re-creatability	Readily recreated, as this is the default successional habitat on much filled agricultural land prone to seasonal flooding.
Fragmentation	Not fragmented.
Ecological linkage	No linkages to areas of similar habitat.
Potential value	Considerable scope for restoration and enhancement with appropriate management.
Nursery/ breeding ground	None of significance known.
Age	Unknown.
Abundance/ Richness of wildlife	Low.
Ecological value	Low to Moderate in view of potential for enhancement.

Plantation woodland

Scattered, small areas of plantation woodland occur in the lowland areas, mainly along Sha Tau Kok Road, but also in Sha Tau Kok town.

Table 7.7.66 Habitat evaluation for Planning Area 6: plantation woodland

Criteria	Plantation woodland
Naturalness	Anthropogenic habitat planted for landscaping or screening purposes.
Size	Small area of 2 ha.
Diversity	Low faunal and floral diversity and structural complexity.
Rarity	Widespread in Hong Kong.
Re-creatability	Readily recreated, requiring relatively little time to develop and mature.
Fragmentation	Some fragmentation by roads and village/town development.
Ecological linkage	Some linkage with nearby shrubland on hill slopes to north.
Potential value	Limited scope exists for enhancement.
Nursery/ breeding ground	None of significance known.
Age	Unknown, but presumably 10-20 years.
Abundance/ Richness of wildlife	Low.
Ecological value	Low

Developed Land

In this area developed land comprises village land and roads on the west side of Sha Tau Kok Road, and the town of Sha Tau Kok itself to the northeast.

Table 7.7.67 Habitat evaluation for Planning Area 6: developed land

Criteria	Developed land
Naturalness	Entirely anthropogenic habitat.
Size	Including Sha Tau Kok town, fairly large in size.
Diversity	Low floral and faunal diversity.
Rarity	Widespread and common habitat in Hong Kong.
Re-creatability	Readily re-creatable.
Fragmentation	Significantly fragmented.
Ecological linkage	No significant linkages exist with habitats of ecological significance.
Potential value	Limited scope for enhancement under current conditions.
Nursery/ breeding ground	None of significance known.
Age	Variable.
Abundance/ Richness of wildlife	Low abundance and richness of wildlife.
Ecological value	Low

7.7.6 Identification and Evaluation of Ecological Impacts

Annex 8 of the Technical Memorandum on Environmental Impact Assessment (EIA) Process (Environmental Impact Assessment Ordinance, Cap 499, S.16) states that 'ecological impact refers to the effect on a habitat or species due to direct or indirect changes brought about by a project'. The normal procedure in assessing ecological impacts from a development project as part of an EIA is to evaluate the significance of an ecological impact according to certain criteria (habitat quality, species, size/abundance, duration, reversibility and magnitude). However, such a project-based assessment is not possible for the current Study as details regarding area, building height and layout, location and infrastructural provision have not yet been devised.

Instead, there exist a set of proposed broad land use zonings, in addition to proposed improvement works to roads and locations of hiking trails, and preliminary layouts for an ecolodge development near Ma Tso Lung and a residential development at Kong Nga Po. Consequently, the normal ecological impact evaluation process, which requires accurate quantification of layouts, areas and impacts, cannot be carried out. Although it is certain that some areas will be permanently and irreversibly lost, the degree to which this occurs and the potential for avoidance through sensitive design is imperfectly known.

It is assumed that for many of the development areas, some form of ecological impact assessment will be carried out in future to assess potential negative impacts from proposed development in a way that cannot be done as part of this Study. In this work potential ecological impacts are assessed by Planning Area, dealing first with those related to proposed land use zonings. Potential impacts from hiking trails and related road upgrading are dealt with under each Planning Area.

7.7.6.1 Planning Area 1

Potential ecological impacts arise from two land use zone related developments, the expanded village area of Lok Ma Chau and the eco-lodge development in the east, which extends into Planning Area 2.

Village expansion at Lok Ma Chau

In terms of Lok Ma Chau village expansion, the habitats affected are active and inactive wet agricultural land. It is assumed that construction of village housing will result in the permanent and irreversible loss of these habitats, as few controls and little influence can be exerted over development activities on land zoned as Village.

Table 7.7.68 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 1: active and inactive wet agricultural land at Lok Ma Chau

Criteria	Active and inactive wet agricultural land, and marsh at Lok Ma Chau village
Habitat quality	Anthropogenic habitat of low to moderate ecological value. Marsh is derived from inactive wet agricultural land and is very similar.
Species	Chinese Bullfrog population present, as well as diverse amphibian fauna.
Size/Abundance	Small in area, totalling 2.82 ha, relatively low numbers of fauna.
Duration	Permanent.
Reversibility	Irreversible.
Magnitude	Ultimately a total loss of agricultural fields.
Impact severity	Low to Moderate due to diversity of amphibian fauna and decline in area of this habitat in Hong Kong.

Table 7.7.69 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 1: shrubland, secondary woodland and plantation

Criteria	Shrubland, secondary woodland and plantation
Habitat quality	Low in quality due to small size, isolation and disturbance.
Species	None of conservation significance.
Size/Abundance	Small area (1.82 ha) of abundant habitat in Hong Kong.
Duration	Permanent.
Reversibility	Irreversible.
Magnitude	Total loss.
Impact severity	Low due to lack of faunal or floral significance. Ultimately, reduced fire-incidence and consequent succession may create larger area of shrubland.

Impact on flight lines of large waterbirds

In addition, there are potential impacts on the flight lines of large waterbirds to and from foraging and roosting areas at both Hoo Hok Wai and wetlands west of the Lok Ma Chau BCP. The construction and placement of village housing has a potential disturbance effect on birds using this flight line.

Table 7.7.70 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 1: flight lines of large waterbirds

Criteria	Flight lines of large waterbirds
Habitat quality	Large waterbirds are recorded flying through the airspace of the Lok Ma Chau area, largely north of Lok Ma Chau hills.
Species	Most waterbird species are of conservation importance in Hong Kong. Eagles may also use this flight line.
Size/Abundance	Up to 23% of the wintering population of Great Cormorants were recorded using the flight line in winter 2004-05. This is the only flight line between these two wetland areas.
Duration	Permanent, though negligible in extent.
Reversibility	Any impact would be irreversible.
Magnitude	Low rise buildings immediately adjacent to existing village area at the base of the hills considered to have little impact, especially as large area of open land to north present.
Impact severity	Low

Eco-lodges

An eco-lodge development is proposed for this area, and the impacts straddle Planning Areas 1 and 2. The habitats affected are natural streams, upland grassland and shrubland. Direct habitat loss will occur equal to the area of buildings and associated road provision or widening. The establishment of an eco-lodge facility will likely result in reduced incidence of fire, which in turn will cause an improvement in the value of the grassland habitat, but ultimately there will be succession to shrubland. Greater vegetation coverage may also have beneficial ecological effects on streams via provision of enlarged shade and refuge areas for wildlife.

In terms of species, there are potential direct and indirect disturbance impacts on Eurasian Eagle Owl, and these would need to be considered as part of an ecological impact

assessment at detailed planning stage. The Eco-lodge development is located within the WBA, and a 12-month Ecological Impact Assessment is required, in line with stipulation in TPB PG-12B.

Off-site disturbance impacts at Hoo Hok Wai of eco-lodge construction and operation will be insignificant due to the lack of ecological linkages (including flight lines) between the two areas and the hilly terrain, the latter of which will provide a natural barrier between the wetlands and the development area. Further, in the area where the proposed eco-lodge development area approaches the current boundary fence road, there already located the Lok Ma Chau Police Operational Base at Ngau Kok Shan and nearby terrestrial habitats, including trees, which will provide some buffer function. An assessment of the exact impact can only be made as part of an Ecological Impact Assessment; however, the overall assessment is that given appropriate siting, design of lodges and the feasibility of any mitigation, the residual impacts will be insignificant.

Table 7.7.71 Potential ecological impacts of Eco-lodges in absence of mitigation. Planning Areas 1 and 2: natural streams

Criteria	Natural hillside streams
Habitat quality	Low, as although the banks are natural, water flow appears to be highly irregular and vegetation in surrounding areas severely fire-retarded.
Species	Low diversity of flora and fauna.
Size/Abundance	Short in length, common in Hong Kong.
Duration	Development of eco-lodges unlikely to result in permanent loss, but increased disturbance and shade effects may result.
Reversibility	Loss irreversible.
Magnitude	Low.
Impact severity	Low –negative or Low-positive . Negative impacts of low significance as existing ecological value low and this habitat is common in Hong Kong. Expected reduction in hill fire incidence may have beneficial effects as increased vegetation creates more regular water flow and provides enlarged shade and refuge areas for wildlife.

Table 7.7.72 Potential ecological impacts of Eco-lodges in absence of mitigation. Planning Areas 1 and 2: upland grassland

Criteria	Upland Grassland
Habitat quality	Fire-retarded habitat of low quality
Species	Breeding bird community of upland specialist species, including Eurasian Eagle Owl. Low floral diversity.
Size/Abundance	Area of habitat impacted relatively small at 12.95ha (about 75 ha in this area); remains a common, if declining, habitat in Hong Kong.
Duration	Permanent loss of habitat and temporary construction impacts.
Reversibility	Irreversible.
Magnitude	Total loss from development footprint comprises approximately 12.6 ha, low to moderate disturbance impacts.
Impact severity	Low to Moderate impacts on bird community. Anticipated reduction in frequency of fire should result in grassland improvement, however. Ultimately, though, succession to shrubland will occur.

Table 7.7.73 Potential ecological impacts of Eco-lodges in absence of mitigation. Planning Areas 1 and 2: shrubland, secondary woodland and plantation

Criteria	Shrubland, secondary woodland and plantation
Habitat quality	Low in quality due to small size, isolation and disturbance.
Species	None of conservation significance.
Size/Abundance	Small area (0.96 ha) of habitat abundant in Hong Kong.
Duration	Permanent.
Reversibility	Irreversible.
Magnitude	Total loss.
Impact severity	Low due to lack of faunal or floral significance. Ultimately, reduced fire-incidence and consequent succession may create larger area of shrubland.

Table 7.7.74 Potential ecological impacts of Eco-lodges in absence of mitigation. Planning Areas 1 and 2: Eurasian Eagle Owl

Criteria	Eurasian Eagle Owl
Protection Status	Regional Concern (Fellowes <i>et al.</i> 2002), Class II Protected Species in China
Distribution	Fairly widespread in upland grassland areas of Hong Kong, though this habitat is probably declining as a result of succession to shrubland.
Rarity	Not rare on a worldwide scale, nor probably in South China (although nocturnal habits make it difficult to be sure). Breeding densities are probably low and so actual number of breeding territories in Hong Kong not high. Species does seem to tolerate low level human activity, however, as long as undisturbed nesting sites are available.
Impact types	Direct loss of habitat due to footprint of development, which constitutes approximately 15% of apparently available habitat in this area of hills. Disturbance impacts may result if human access to the grassland area increases, though this is more likely as a result of hiking trail. However, presumed increase in rodents or birds commensal with man should provide enlarged food source.
Impact severity	Low to Moderate

Road Improvement Works

No road improvement works are proposed for Planning Area 1.

Hiking Trail

The proposed hiking trail in this planning area passes along the existing road behind Lok Ma Chau village and through shrubland and upland grassland between there and Ma Tso Lung village. Given the relatively low ecological value of the habitats through which it passes and the relatively low intensity of use, it is anticipated there will be negligible ecological impact.

7.7.6.2 Planning Area 2

Potential ecological impacts arise from the eco-lodge development in the west of the area, which extends into Planning Area 1; this is dealt with in the previous section. The only other land use zoning that permits significant development is Village at Liu Pok. Areas near to the villages of Liu Pok and Ma Tso Lung are zoned as AGR.

AGR zoning

While AGR zoning does not permit development as such, significant modification of the habitat may occur, as currently there is very little active agriculture in this area. The nature of impact will depend on the type of agricultural modification that occurs. Conversion to a dry agricultural system would, on the whole, probably result in a decline in ecological value, while conversion to a wet agricultural system could facilitate an increase in ecological value.

Table 7.7.75 Potential ecological impacts of AGR zoning in absence of mitigation. Planning Area 2: seasonally wet grassland at Ma Tso Lung

Criteria	Seasonally wet grassland at Ma Tso Lung
Habitat quality	Low due to lack of microhabitat diversity arising from almost complete cover by limited diversity of vegetation. The few small open areas are close to sources of disturbance.
Species	Low diversity of species, though Chinese Bullfrog present.
Size/Abundance	Moderate area (8.89 ha) of a fairly common habitat in Hong Kong that has high potential ecological value with appropriate management.
Duration	Depends on duration of agricultural activities. Reversion back to wet grassland is quite likely after abandonment.
Reversibility	Not irreversible if agriculture abandoned.
Magnitude	Severe for flora and fauna affected.
Impact severity	Low to Moderate if conversion to dry agriculture occurs due to presence of Chinese Bullfrog. Neutral or Positive impact may occur if conversion to wet agricultural land occurs.

Table 7.7.76 Potential ecological impacts of AGR zoning in absence of mitigation. Planning Area 2: freshwater marsh at Ma Tso Lung and Liu Pok

Criteria	Freshwater marsh at Ma Tso Lung and Liu Pok
Habitat quality	Low due to lack of microhabitat diversity, especially open water areas.
Species	Relatively low diversity of species, although including some of conservation concern or localised distribution.
Size/Abundance	Moderate area of a habitat that is not common in Hong Kong, and has high potential ecological value with appropriate management.
Duration	Depends on duration of agricultural activities. Reversion back to wet grassland is quite likely after abandonment.
Reversibility	Not irreversible if agriculture abandoned.
Magnitude	Severe for flora and fauna affected.
Impact severity	Low to Moderate if conversion to dry agriculture occurs due to faunal interest. Neutral or Positive impact may occur if conversion to wet agricultural land occurs.

Village expansion at Liu Pok

Expansion of village development at Liu Pok will also be at the expense of a very small area of freshwater marsh. However, although any loss is highly likely to be permanent and irreversible, the area involved results in only Low ecological impact.

Table 7.7.77 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 2: freshwater marsh at Liu Pok

Criteria	Freshwater marsh at Liu Pok
Habitat quality	Low due to lack of microhabitat diversity, especially open water areas.
Species	Relatively low diversity of species, although including some of conservation concern or localised distribution.
Size/Abundance	Small area of a habitat that is not common in Hong Kong, and has high potential ecological value with appropriate management.
Duration	Permanent loss will occur.
Reversibility	Irreversible loss will occur.
Magnitude	Severe for flora and fauna affected.
Impact severity	Low due to lack of floral and faunal interest, and small area of habitat.

Road Improvement Works

No road improvement works are proposed for Planning Area 2.

Hiking Trail

The proposed hiking trail in this planning area passes through upland grassland and shrubland to the east of Ma Tso Lung village. In the Ma Tso Lung area it passes areas of secondary woodland/plantation and village area. To the east of Ma Tso Lung village, it passes through upland grassland up to the peak of Crest Hill and through village edge areas along existing roads and tracks. Given the relatively low ecological value of the habitats through which it passes, the use of existing roads and tracks, and the relatively low intensity of use, it is anticipated there will be negligible ecological impact. In respect of Ho Sheung Heung Egret, the proposed trail avoids the stretch of road along which herons and egrets are breeding. Hiking trails in the vicinity will not have significant impacts on flight lines to/from the egret due to their location and relatively low intensity of use. The proposed cycle track also avoids the relevant stretch of road, and instead lies adjacent to the Ng Tung River. Given the relatively low elevation compared to the egret, the location away from the bulk of foraging areas, the relatively low intensity of use and the existing visual barrier provided by trees along this section of road adjacent to the reinstated fishponds, it is not considered there will be any significant disturbance impact.

7.7.6.3 Planning Area 3

Most of the lowland area in Planning Area 3 is proposed for zoning as agricultural land (AGR). This includes areas north of Man Kam To Road, which are already zoned for agriculture under the existing Fu Tei Au & Sha Ling OZP, as well as lowlands around Muk

Wu and Chow Tin. Some of this land is currently used for agriculture (along Man Kam To Road, near Muk Wu); other areas are former agriculture that have been abandoned and undergone succession into seasonally wet grassland, lowland grassland and grassland/shrubland. These habitats are of low or low to moderate ecological value, being dominated by very few plant species and used by relatively low numbers and diversity of fauna. However, wet agricultural land at Sandy Ridge is of moderate to high ecological value, while an area near Chow Tin Tsuen is of moderate ecological value.

One objective of reducing the size of the Closed Area is to allow certain development activities and facilitate a significantly increased population size. Although the land use in many areas ostensibly remains agricultural, the habitat characteristics on the ground are likely to change significantly, from abandoned agricultural areas to active agriculture of one form or another. For this reason, an assessment of impact is considered appropriate, as this change in conditions will materialise as an indirect impact of burgeoning development, and increased numbers of both residents and visitors.

The promotion of sustainable agricultural practices, especially wet agriculture, has the potential to enhance the ecological value of the habitat by opening this land up for use by open-country and wetland-dependent species tolerant of human activity (similar to agricultural land at Long Valley, near Sheung Shui).

Agricultural land and fishponds south-west of Sandy Ridge (east of Ng Tung River) are currently of moderate to high ecological value due mainly to the presence of wetland-dependent bird species and Eurasian Otter. This area is currently zoned as AGR, and this zoning would not change under the current proposal. Maintaining the presence of wet agricultural land (active and/or inactive agriculture) is recommended in this area.

Agricultural land near Ta Kwu Ling village in the extreme eastern part of this Planning Area will be zoned as REC, along with adjacent areas of Planning 4. The potential impact of this is dealt with in the section regarding Planning Area 4.

AGR zoning

Changes in agricultural practices arising as an indirect impact of development and population increase in these lowland areas north of Man Kam To Road and in smaller areas immediately south will affect two agricultural habitats, dry and wet. Although loss of existing habitat will result from agricultural modification and changes to current agricultural activities, it is possible that there will be net ecological gain for a more diverse suite of open country species adapted to low intensity farming areas. However, replacement of the wet agricultural areas with a more intensive or dryland farming system is likely to have only negative impacts.

Table 7.7.80 Potential ecological impacts of AGR zoning in absence of mitigation. Planning Area 3: dry agricultural areas

Criteria	Dry active and inactive agricultural areas
Habitat quality	Dry lowland habitats to be zoned as AGR are of low ecological value.
Species	None of significance known.
Size/Abundance	A fairly large area (16.44 ha) of a habitat not uncommon in Hong Kong, limited number of organisms.
Duration	Land zoning would be long-term. Changes in land use to agricultural fields could be long-term or short-term dependent on human actions.
Reversibility	Use of land for agriculture would be reversible; if abandoned, natural succession would occur though to what kind of habitat would depend on type of agriculture originally.
Magnitude	Conversion of existing farmland would require removal of vegetation, resulting in significant changes to vegetation and fauna. Levels of disturbance would also increase. Extent of habitat change would depend on resultant farming system (i.e. wet or dry).

Criteria	Dry active and inactive agricultural areas
Impact severity	Despite large magnitude of change to vegetation the overall impact is likely to be Low . However, this would depend on nature of change. Improvement of ecological value may occur via expansion of wet or organic agriculture to the benefit of open country and wetland species of conservation importance.

Table 7.7.81 Potential ecological impacts of AGR zoning in absence of mitigation. Planning Area 3: wet agricultural area south of Sandy Ridge cemetery

Criteria	Wet agricultural and fish pond areas
Habitat quality	Moderate habitat quality of moderate to high ecological value.
Species	Chinese Bullfrog widespread through lowlands. Greater Painted-snipe to south-west of Sandy Ridge and at Chow Tin. Eurasian Otter in fish ponds southwest of Sandy Ridge, as well as suite of locally-distributed breeding bird species.
Size/Abundance	A moderately-sized area of agriculture at Sandy Ridge continues to be zoned as AGR, while new zoning applied to Chow Tin Tsuen. A small area of fishponds at Sandy Ridge continues same zoning. Total area 17.5 ha.
Duration	Changes in land use could be long-term or short-term dependent on human actions.
Reversibility	Use of land for agriculture would be reversible; if abandoned, agricultural land would probably revert to current habitat through natural succession.
Magnitude	Conversion of existing farmland would require removal of vegetation, resulting in significant changes to vegetation and fauna. Levels of disturbance would also increase but extent of overall habitat changes depend on farming system adopted. Area to the north of Man Kam To Road is already zoned as AGR, and this would not change under current proposal. Change to fishponds would depend on intensity of culture.
Impact severity	Large magnitude of change to vegetation might mean the overall impact would be of Moderate to High severity as wetland habitats are of relatively high ecological value. However, this would depend on nature of change. Improvement of ecological value may occur via expansion of wet or organic agriculture to the benefit of open country and wetland species of conservation importance.

AGR zoning will also affect areas of seasonally wet grassland, primarily in the Muk Wu and Chow Tin areas. This habitat is of low to moderate ecological value depending on location, and is not as high as freshwater marsh due to the lack of microhabitat and floral diversity. Grassland and grassland-shrubland habitats of low ecological value are also affected.

Table 7.7.82 Potential ecological impacts of development associated with AGR zoning in absence of mitigation. Planning Area 3: seasonally wet grassland at Muk Wu and Chow Tin

Criteria	Seasonally wet grassland at Muk Wu and Chow Tin
Habitat quality	Relatively low due to lack of microhabitat diversity arising from almost complete cover by limited diversity of vegetation.
Species	Moderate diversity of amphibian species, and Greater Painted-snipe present.
Size/Abundance	Moderate area (19.75 ha) of a fairly common habitat in Hong Kong that has high potential ecological value with appropriate management.
Duration	Depends on duration of agricultural activities. Reversion back to wet grassland is quite likely after abandonment.
Reversibility	Not irreversible if agriculture abandoned.
Magnitude	Severe for flora and fauna affected.
Impact severity	Low to Moderate if conversion to dry agriculture occurs due to herpetofauna diversity. Neutral or Positive impact may occur if conversion to wet agricultural land occurs.

Table 7.7.83 Potential ecological impacts of development associated with AGR zoning in absence of mitigation. Planning Area 3: lowland and upland grassland, and grassland/shrubland

Criteria	Lowland and upland grassland, grassland/shrubland
Habitat quality	Relatively low, rather degraded and somewhat fragmented.
Species	None of significance known.
Size/Abundance	Moderate areas (20.60 ha of grassland, 9.57 ha of grassland/shrubland) of fairly common habitats in Hong Kong.
Duration	Permanent loss.
Reversibility	Irreversible loss.
Magnitude	Severe for flora and fauna affected.
Impact severity	Low , possibly positive depending on agricultural modification that occurs.

Table 7.7.84 Potential ecological impacts of development associated with AGR zoning in absence of mitigation. Planning Area 3: shrubland, secondary woodland and plantation

Criteria	Shrubland, woodland and plantation
Habitat quality	Relatively low, rather disturbed and somewhat fragmented.
Species	None of significance known.
Size/Abundance	Moderate areas (16.53 ha of shrubland, 17.75 ha of secondary woodland and plantation) of fairly common habitats in Hong Kong.
Duration	Permanent loss.
Reversibility	Irreversible loss.
Magnitude	Severe for flora and fauna affected.
Impact severity	Low

Village Expansion

Planning Area 3 contains existing villages at San Uk Ling, Muk Wu, Muk Wu Nga Yiu, Chow Tin and Fung Wong Wu. It is proposed to zone the areas surrounding these villages for village expansion (V zoning). San Uk Ling village is currently zoned as V under the existing Fu Tei Au & Sha Ling OZP; this zoning will be retained and there will be no associated impacts.

Table 7.7.85 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 3: village areas

Criteria	Village expansion at Muk Wu and Muk Wu Nga Yiu	Village expansion at Chow Tin and Fung Wong Wu
Habitat quality	Habitats include active dry agriculture, seasonally wet grassland, lowland grassland and grassland/shrubland of relatively low ecological value.	Habitats potentially impacted include seasonally wet grassland and active wet agriculture of moderate ecological value.
Species	Chinese Bullfrog recorded in this area.	Greater Painted-snipe, Chinese Bullfrog and Burmese Python recorded in wet agriculture and seasonally wet grassland in this area.
Size/Abundance	A relatively small area of semi-natural habitats around each village is proposed for V zoning.	Proposed boundary of V zone is considerably larger than existing village and expansion to new boundaries would cause a moderate area of semi-natural habitat to be lost.
Duration	Development of the land for village housing would result in permanent habitat loss.	Development of the land for village housing would result in permanent habitat loss.
Reversibility	Loss of habitats to village expansion would be permanent.	Loss of habitats to village would be permanent.
Magnitude	Habitats are currently of low value so impacts of habitat loss would be of relatively low magnitude.	Expansion of the village to the proposed boundaries would result in complete loss of wetland habitats in this area.
Impact severity	Expansion of these villages to the proposed boundaries of the V zoning would result in impacts of Low significance.	Expansion of the villages to the proposed boundary of the V zone would result in a Moderate ecological impact at a local scale due to loss of wetlands.

Impacts of OU zoning south of Man Kam To Road

Land to the south of Man Kam To Road is currently zoned for agricultural use (AGR) under the Fu Tei Au & Sha Ling OZP. It is proposed to rezone this area for other specified uses, with the intention to maintain low density development while promoting the area for sustainable agriculture, potentially including local produce markets, appropriate trade/logistics facilities, tourist facilities and recreational uses consistent with the theme of sustainability.

Table 7.7.86 Potential ecological impacts of OU zoning in absence of mitigation. Planning Area 3: areas south of Man Kam To Road

Criteria	Areas south of Man Kam To Road
Habitat quality	Habitats in this area are currently disturbed and are generally of relatively low ecological value. However, shrubland and woodland of low to moderate value are present, as well as isolated and small wet areas and water storage ponds.
Species	Two butterfly species of conservation concern and Chinese Bullfrog.
Size/Abundance	A relatively large area proposed to be rezoned.
Duration	Any infrastructural developments in this area would result in permanent habitat loss.
Reversibility	Infrastructural developments would be irreversible, but changes for recreational uses may be reversible.
Magnitude	Proposed changes for limited rural development would not change the existing (disturbed) habitat to a large degree.
Impact severity	Impacts from rezoning of this area would be of Low to Moderate severity, assuming proposed theme of sustainability is followed.

Residential Zoning at Kong Nga Po

An area of land at Kong Nga Po is proposed for rezoning for residential use. Currently this area is mostly zoned as Green Belt under the Fu Tei Au & Sha Ling OZP. The habitat in this area is shrubland and upland grassland. The area is currently subject to very high levels of human disturbance due to local land uses, including open storage, pig farming and residential uses. The floral diversity is rather low, and there is little variation in vegetation structure. As a result the faunal diversity and abundance are also low. No species of conservation importance were recorded from this area during surveys in 2008.

The proposed land use for this area would be the creation of a sustainable residential community. Urban design would be based on the principle of green architecture and sustainable living. If these principles are followed, the impact of the community on the local ecology should be low, especially considering the low existing ecological value of habitats present.

Table 7.7.87 Potential ecological impacts of R zoning in absence of mitigation. Planning Area 3: Kong Nga Po

Criteria	Kong Nga Po
Habitat quality	Habitats to be impacted include upland grassland and shrubland. In this area, these habitats are of relatively low value due to high levels of human disturbance and low diversity in the shrubland.
Species	Chinese Bullfrog recorded at polluted pond.
Size/Abundance	A moderate area to be impacted.
Duration	Development for residential uses would be permanent.
Reversibility	Development of the land for residential use would not be reversible.
Magnitude	Due to existing levels of disturbance and the relatively low ecological value of the habitats present, the impacts to habitats would be of low magnitude.
Impact severity	Loss of habitats in this area considered to be of Low severity.

Road Improvement Works

Proposed road improvement works in this planning area comprise upgrading of existing roads that run largely through areas of low ecological value. For this reason, direct habitat loss and fragmentation impacts are considered to be of low significance. The exception to

this is the upgrading of the existing local road to Muk Wu Village, near Man Kam To BCP. Chinese Bullfrog was recorded in active agricultural land in this area.

Table 7.7.88 Potential ecological impacts of road improvement works in absence of mitigation.
Planning Area 3: Active agricultural land at Muk Wu

Criteria	Active agricultural land at Muk Wu
Habitat quality	Not high due to small area and high levels of disturbance.
Species	Breeding Chinese Bullfrog.
Size/Abundance	Habitat area is small. Chinese Bullfrog has a localised distribution in Hong Kong, though it is fairly common in certain areas of the FCA.
Duration	Permanent.
Reversibility	Irreversible.
Magnitude	Severe.
Impact severity	Low to Moderate impact due to presence of Chinese Bullfrog.

Hiking Trail

The proposed hiking trail in the western part of this planning area passes along the existing Lo Wu Station and Man Kam To Roads, and the road to Sha Ling Police Post; as a result, the marginal ecological impact will be negligible. In the eastern section of this planning area the hiking trail passes along existing tracks or roads through habitats of relatively low ecological value, with the exception of active wet agricultural areas at Chow Tin Tsuen. However, at the latter site, the trail follows existing, surfaced roads, and the marginal ecological impact is considered to be negligible, and thus no residual impact of significance is anticipated.

7.7.6.4 Planning Area 4

Impacts of proposed Liantang/Heung Yuen Wai Boundary Control Point

The proposed site for the Liantang/Heung Yuen Boundary Control Point (BCP) is located at the site of Chuk Yuen village in Planning Area 4. The proposed connecting road for this project passes through grassland and shrubland habitats to the south, towards Ta Kwu Ling and Ping Che. Assessment of the ecological impacts of this BCP and connecting road are covered by a separate EIA, and are beyond the scope of this report.

Impacts of AGR and REC zoning

A large area of lowland agricultural area, both active and abandoned, from Ta Kwu Ling village (in adjacent areas of Planning Area 3) to north of Kaw Liu village and east to areas either side of the Ping Yuen River is proposed for zoning as REC.

Parts of the flat lowlands in Planning Area 4 extending from Ping Che Road to Tsung Yuen Ha are proposed for zoning as agricultural land with the intention of encouraging the production of organic produce. Increasing numbers of residents and visitors may result in increased or changed agricultural activities and associated habitat modification.

Most of the lowland in the west of this Planning Area from Ping Che Road to Tung Lo Hang contains grassland and grassland/shrubland that appears to be relatively recently derived from agricultural land. Vegetation in this area is low in diversity and typical of abandoned agricultural land in Hong Kong. Use of the land for agricultural purposes would not have a significant detrimental impact on the ecology of the area. Promotion of suitable agricultural uses may, in fact, have some ecological benefit by increasing habitat availability for uncommon open country fauna; this would especially be the case if organic farming of wetland crops, in particular rice, was present in the area. Use of the land for recreational purposes would have a greater impact, though there is scope for appropriate mitigation to avoid or minimise impact on areas of local ecological concern, or for compensatory habitat provision.

Table 7.7.89 Potential ecological impacts of AGR and REC zoning in absence of mitigation. Planning Area 4: lowlands from Ping Che Road to Tung Lo Hang

Criteria	Area from Ping Che Road to Tung Lo Hang
Habitat quality	Habitats in this area comprise lowland grassland and grassland/shrubland derived from succession on land previously used for agriculture. These habitats are relatively disturbed and of low ecological value.
Species	Chinese Bullfrog fairly widespread in this area; also records of Greater Painted-snipe, Danaid Egg-fly, Small Grass Yellow and Indo-chinese Rat Snake.
Size/Abundance	A fairly extensive area of approximately 80 ha to be zoned as agricultural land or recreational use.
Duration	Impacts would occur whilst land was occupied for agriculture, the duration of which is unpredictable and dependent on human action. Impacts from use for recreation would be permanent.
Reversibility	Following abandonment of agricultural practices, vegetation would undergo succession leading to regeneration of existing conditions. Use of land for recreation would lead to irreversible impacts.
Magnitude	Conversion of land to active agricultural use or recreational use would have a large impact on vegetation and fauna through removal of vegetation.
Impact severity	Despite large magnitude of change to vegetation that would result from clearance of land for agricultural use, the overall impact is considered to be of Low significance because of the relatively low ecological value of the existing habitat. Some positive ecological benefit for open country or wetland species may occur in land used for organic farming, especially if wet agricultural or rice-growing areas were created. Some positive ecological benefit is possible in REC zoning if areas of local ecological value were enhanced or linked by creation of habitat corridors.

Lowlands towards the east of the planning area (in the low hills immediately south of Tsung Yuen Ha and lowlands to the east of these) show a different habitat character. Grassland in this area is more similar to that typically encountered in upland areas in Hong Kong as a result of soil quality (especially nutrient levels), drainage and/or occurrence of fire. The bird community is also unusual at this low altitude, including widespread species such as Chinese Francolin and Lesser Coucal as well as species of conservation importance including Bright-capped Cisticola and Large Grass Warbler (one record). Uncommon grassland butterfly species (including Spotted Angle and Small Three-ring) are also present. These grasslands form a mosaic with *fung shui* woodlands and shrubland also present in the area, providing conditions for a diverse and unusual faunal community.

Conversion of some areas to active agriculture would result in the loss of this unique (in a Hong Kong context) habitat, and changes to soil conditions may make this change irreversible even if active agriculture were abandoned at some future date. While certain areas of lower current ecological value may benefit from the application of certain agricultural regimes, many areas will not. Implementation of agricultural improvement practices and higher levels of disturbance will generally cause negative impacts.

Table 7.7.90 Potential ecological impacts of AGR zoning in absence of mitigation. Planning Area 4: grassland around Tsung Yuen Ha and Heung Yuen Wai

Criteria	Tsung Yuen Ha and Heung Yuen Wai area grassland
Habitat quality	Grassland in this area shows similarities to typical upland grassland in Hong Kong and is very unusual at this low altitude.
Species	Bright-capped Cisticola, Large Grass Warbler, Spotted Angle and Small Three-ring recorded from lowland grassland in this area.
Size/Abundance	A fairly extensive mosaic of grassland, shrubland and woodland of around 40 ha.
Duration	Changes to habitat would occur when land is being actively farmed. Changes to soil conditions or hydrology may have permanent impacts to vegetation.
Reversibility	Abandonment of agriculture would permit regeneration of semi-natural vegetation, although this may not lead to the same vegetation as currently present, especially if nutrient levels are increased.
Magnitude	Clearance of vegetation for conversion of land to active agriculture would have an impact of large magnitude for flora and fauna of local area.

Criteria	Tsung Yuen Ha and Heung Yuen Wai area grassland
Impact severity	Conversion of existing grassland habitats into active agricultural land would lead to a loss of an unusual habitat in lowland Hong Kong and would impact several species of conservation importance. Impacts would thus be of Moderate to High significance.

The upper reaches of the Ping Yuen River are natural and are of moderate ecological value. Streams around Heung Yuen Wai are currently of high ecological value due to the important fish community, and there appears to have been no significant introduction of exotic fish species. These streams could potentially be impacted by active agriculture as a result of changes in water quality due to leaching, surface runoff (including sediment, pollution and/or nutrient runoff), changes in stream substrate, changes to riparian vegetation and/or the introduction of exotic fish species. Even if an organic farming regime was implemented, nutrient inputs to soil would still be required, and these would impact the stream. The Ping Yuen River in its upper reaches could be impacted by REC zoning either side, though there is also scope for avoidance and enhancement of the riparian corridor at the design stage.

Table 7.7.91 Potential ecological impacts of AGR and REC zoning in absence of mitigation. Planning Area 4: streams at Heung Yuen Wai and Ping Yuen upper reaches

Criteria	Streams at Heung Yuen Wai and Ping Yuen upper reaches
Habitat quality	Streams around Heung Yuen Wai and to the east are of high ecological value, while the upper reaches of the Ping Yuen River are of moderate value.
Species	A good diversity of native fish species present with no evidence of exotic fish species at Heung Yuen Wai; moderate abundance of fish and odonate at Ping Yuen.
Size/Abundance	Heung Yuen Wai is a fairly extensive stream system with relatively high abundance of native fish species. Ping Yuen River section is of moderate length.
Duration	Changes to stream substrate or fish community likely to have a permanent impact on stream ecology. Impacts of leaching, runoff or pollution would be more short-lived.
Reversibility	Some impacts to streams may be reversible, but loss of fish populations, introduction of exotic fish species or extensive damage to stream substrate would be difficult to reverse.
Magnitude	Given the rarity of streams of this high quality in Hong Kong, loss of habitat quality would have an impact of high magnitude at Heung Yuen Wai.
Impact severity	Impacts to streams could arise if conversion of land to active agriculture led to increased pollution or siltation, changes to stream substrate and riparian vegetation, or introduction of exotic fish species. Use of land for active agriculture thus potentially has impact of High severity on Heung Yuen Wai stream ecology, and of Moderate severity at Ping Yuen. Potential impacts on streams from development of riparian corridor that causes direct habitat loss or indirect disturbance or other impacts are High . There is significant increased potential for human disturbance arising from increased population and visitor numbers, the impact severity of which is High .

Village Expansion

Six villages are present in Planning Area 4: Kan Tau Wai, Tong Fong, Chuk Yuen, Tsung Yuen Ha, Heung Yuen Wai and Ha Heung Yuen. Chuk Yuen is located on the site of the proposed Liantang/Heung Yuen Wai Boundary Crossing Point and will be relocated to an area north of Kaw Liu village. Land around the other five villages is proposed for rezoning as village land (V zoning), permitting construction of village houses and consequently loss of habitats. Land close to the villages is inevitably impacted by human disturbance, reducing the ecological value. Expansion of the village into this land would have lower direct impact, but disturbance would increase in the land around the revised village boundary.

Table 7.7.92 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 4: Kan Tau Wai, Tong Fong, Chuk Yuen, Tsung Yuen Ha, Heung Yuen Wai and Ha Heung Yuen

Criteria	Village expansion at Kan Tau Wai, Tong Fong and near Kaw Liu	Village expansion at Tsung Yuen Ha, Heung Yuen Wai and Ha Heung Yuen
Habitat quality	Proposed village land is currently occupied by lowland grassland and grassland/shrubland of relatively low ecological value.	Village land would be expanded into lowland and upland grassland, seasonally wet grassland and grassland/shrubland close to the existing village (and thus already slightly disturbed). High quality streams at Heung Yuen Wai also potentially impacted by village expansion.
Species	White-shouldered Starling breeds around these villages but suitable habitat would remain for this species.	Important fish community recorded in streams at Heung Yuen Wai. No other species of conservation importance recorded.
Size/Abundance	A relatively small area would be zoned as village land.	Expansion of villages to boundaries of proposed zoning would lead to a considerable increase in village size,
Duration	Construction of village houses would have a permanent impact on habitats.	Expansion of village would have a permanent impact on local vegetation. Impacts to streams may be permanent or temporary (during construction of buildings only).
Reversibility	Village development would be permanent and irreversible.	Construction of village housing would be permanent and irreversible.
Magnitude	A total loss of habitat, although this area is relatively disturbed and of fairly low ecological value.	A considerable increase in village size (and potentially therefore disturbance) would result from expansion to the boundaries of the proposed village land.
Impact severity	Impact of Low severity by expansion of existing village into adjacent disturbed habitat.	Impacts to terrestrial habitats would occur in areas that are already subject to human disturbance. Direct impacts to these habitats would be of Low significance, although increased disturbance would lead to greater impacts of Low to Moderate severity. Impacts to streams would be of Moderate to High severity if construction is permitted close to high-quality streams, or if sewage contaminates the streams.

REC Zoning

The area in the north of Planning Area 4, either side of Lin Ma Hang Road and east of Pak Fu Shan, is proposed for zoning for recreational use. Recommended uses include passive uses such as botanic park, BBQ/bicycle park, hiking camp or horse riding/stabling facilities. Residential development would also be required to support the recreational facilities. Severity of the impacts would depend upon the recreational facilities supported in the area. Passive uses, as recommended for the area, would have a relatively low impact on the habitats present in the area and would thus be of relatively low ecological impact. Recreational uses requiring development of facilities are liable to have a more significant impact through loss of habitat and increased disturbance for wildlife.

Table 7.7.93 Potential ecological impacts of REC zoning in absence of mitigation. Planning Area 4: east of Pak Fu Shan

Criteria	Areas east of Pak Fu Shan
Habitat quality	Habitats present in this area include grassland/shrubland and secondary woodland.
Species	East Asian Porcupine, Common Rat Snake and Chinese Bullfrog recorded in this area.
Size/Abundance	A reasonably extensive area to be rezoned for recreational use.
Duration	Any recreational activities are likely to impact the area on a more-or-less permanent basis.

Criteria	Areas east of Pak Fu Shan
Reversibility	The proposed recreational uses are of low intensity, and removal of the recreational use would permit regeneration of a habitat similar to that currently present. Any associated infrastructural development impact (e.g. residential development) would be irreversible.
Magnitude	Any proposed recreational uses would be of relatively low density. The provision of these facilities would encourage human activity in these areas, and this would impact the local ecology; the magnitude would be dependent upon the number of tourists attracted to the area.
Impact severity	Impacts would be of Low Significance assuming passive recreational uses are adopted, which would avoid loss of local habitats. Low-density development associated with such facilities would also have a Low Impact. Other recreational facilities requiring extensive development of the area would lead to loss of habitat which at present is largely undisturbed. The impacts of this would be of Moderate severity due to habitat loss and increased disturbance to certain species, especially mammals.

Road Improvement Works

Proposed road improvement works in this planning area comprise upgrading of the existing Lin Ma Hang Road, part of the local roads leading to the Leachate Treatment Works, and a section of road near Ha Heung Yuen Village. At the latter two localities, Chinese Bullfrog was recorded. While a species of conservation significance, it appears to be fairly widespread in the FCA, and local provision of mitigation habitat for any loss is considered feasible. Upgrading of the local road near Ha Heung Yuen Village has the potential for impacting the Heung Yuen Wai stream. In addition, some increased fragmentation of habitats may occur along the section of Lin Ma Hang Road east of the junction with road to Heung Yuen Wai village.

Table 7.7.94 Potential ecological impacts of road improvement works in absence of mitigation. Planning Area 4: stream at Heung Yuen Wai

Criteria	Stream at Heung Yuen Wai
Habitat quality	Streams around Heung Yuen Wai and to the east are of high ecological value.
Species	A good diversity of native fish species present with no evidence of exotic fish species.
Size/Abundance	Small area of stream will be affected. Potentially large number of aquatic organisms affected, depending on downstream impacts.
Duration	Potential permanent direct impacts and temporary direct and indirect impacts.
Reversibility	Potentially irreversible direct impacts from construction.
Magnitude	Potentially severe depending on design.
Impact severity	Potential Severe impact.

Table 7.7.95 Potential ecological impacts of road improvement works in absence of mitigation. Planning Area 4: grassland shrubland habitats at Heung Yuen Wai

Criteria	Grassland and shrubland habitats at Heung Yuen Wai
Habitat quality	Adjacent inactive agricultural land has succeeded to grassland and shrubland.
Species	Chinese Bullfrog and a distinctive bird community present in area.
Size/Abundance	Very small area of habitat will be affected by direct habitat loss. Larger area of habitat affected by fragmentation impacts.
Duration	Both permanent and temporary direct and indirect impacts.
Reversibility	Potentially irreversible direct impacts from construction.
Magnitude	Potentially severe depending on design.
Impact severity	Potential Low impact.

Table 7.7.96 Potential fragmentation impacts of road improvement works in absence of mitigation. Planning Area 4: upland grassland, grassland, shrubland and woodland habitats along Lin Ma Hang Road

Criteria	Various habitats along Lin Ma Hang Road
Habitat quality	Low to moderate areas of grassland/shrubland, shrubland and woodland; rather undisturbed.
Species	East Asian Porcupine, Common Rat Snake and Chinese Bullfrog recorded in this area.

Criteria	Various habitats along Lin Ma Hang Road
Size/Abundance	Rather small areas of each habitat, all abundant in Hong Kong.
Duration	Permanent marginal fragmentation impacts.
Reversibility	Irreversible.
Magnitude	Low, given existing road present.
Impact severity	Potential Low to Moderate impact.

Hiking Trail

The proposed hiking trails in this planning area utilise existing Lin Ma Hang and Heung Yuen Wai Roads, and marginal ecological impact will, as a result, be negligible. At Heung Yuen Wai the trail avoids the natural streams, and thus ecological impact to these is not anticipated.

7.7.6.5 Planning Area 5

Proposed land use zonings that allow development comprise Village at Lin Ma Hang and San Kwai Tin, and Agriculture in the rest of the Lin Ma Hang valley and adjacent areas along the Border Fence Road. Village-related development in particular could have significant negative consequences on Lin Ma Hang Stream.

Village expansion at Lin Ma Hang and San Kwai Tin

Any expansion of village housing will result in permanent and irreversible loss without mitigation due to the lack of influence over such developments in village areas. Construction in the area zoned for village expansion may also directly impact Lin Ma Hang Stream.

Table 7.7.97 Potential ecological impacts in absence of mitigation of V zoning. Planning Area 5: seasonally wet grassland at Lin Ma Hang

Criteria	Seasonally wet grassland at Lin Ma Hang
Habitat quality	Low due to small size and low floral diversity with no open water.
Species	Probably provides habitat and refuge areas for riparian fauna.
Size/Abundance	Very small area of habitat common in lowland areas of New Territories.
Duration	Permanent.
Reversibility	Irreversible.
Magnitude	Severe due to complete loss.
Impact severity	Low significance due to lack of faunal or floral diversity, except in areas both sides of the stream, for which the severity is potentially High .

Table 7.7.98 Potential ecological impacts in absence of mitigation of V zoning. Planning Area 5: lowland grassland and grassland/shrubland at Lin Ma Hang

Criteria	Lowland grassland and grassland/shrubland at Lin Ma Hang
Habitat quality	Overall of moderate quality, though variable.
Species	Certain grassland specialist species such as Bright-capped Cisticola present.
Size/Abundance	Moderately-sized area of a habitat that is relatively scarce in Hong Kong.
Duration	Construction phase impacts will occur at times, as development will likely be piecemeal. Ultimately, habitat loss will be permanent.
Reversibility	Irreversible.
Magnitude	Total loss of certain areas will result.
Impact severity	Moderate impact on lowland grassland due to scarcity of habitat in Hong Kong, though impact on grassland-shrubland area Low .

Table 7.7.99 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 5: Lin Ma Hang Stream

Criteria	Lin Ma Hang Stream
Habitat quality	Very high
Species	Diverse array of fish fauna including rare and protected species, moderate to high riparian vegetation diversity.
Size/Abundance	Approx 2km in length, 1.5m to 4.0m width, Such unchannelised, unpolluted lowland streams are very rare in Hong Kong.

Criteria	Lin Ma Hang Stream
Duration	Permanent loss of the riparian zone will affect stream fauna due to lower floodwater absorption and sediment trapping, reduced energy input and fewer refugia for wildlife. Permanent disturbance impacts will also result due to greater population size. Temporary construction impacts are anticipated from increased pollution and sediment loadings or dumping of material.
Reversibility	Depends on nature of impact; some irreversible.
Magnitude	Potentially great.
Impact severity	Potentially Severe impact.

Impacts of AGR zoning

Use of some part of the lowland grassland and grassland/shrubland area for certain agricultural purposes could benefit the ecology of the area by increasing habitat availability for uncommon, open country fauna. However, Lin Ma Hang Stream is of very high ecological value, and would potentially be impacted by active agriculture as a result of changes in water quality due to leaching, surface runoff (including sediment, pollution and/or nutrient runoff), changes in stream substrate, changes to riparian vegetation and/or the introduction of exotic fish species.

An organic farming model throughout the valley would reduce significantly the potential for nutrient pollution of the stream, as well increase the possibility of overall ecological benefit over and above the current situation. However, conversion of the riparian corridor to agricultural crops is likely to negatively impact the stream due to the loss of breeding and refuge habitats. The introduction of wet agricultural practices could severely impact stream ecology if the exotic Apple Snail becomes established.

Table 7.7.100 Potential ecological impacts of AGR zoning in absence of mitigation. Planning Area 5: Lin Ma Hang Stream

Criteria	Lin Ma Hang Stream
Habitat quality	Very high
Species	Diverse array of fish fauna including rare and protected species, moderate to high riparian vegetation diversity.
Size/Abundance	Approx 2km in length, 1.5m to 4.0m width, Such unchannelised, unpolluted lowland streams are very rare in Hong Kong.
Duration	Permanent conversion of the riparian zone to agriculture will affect stream fauna due to fewer refugia and reduced breeding habitat for wildlife. In addition, changes in water quality will also have permanent negative impacts. Permanent disturbance impacts will also result due to increased human activity.
Reversibility	Depends on nature of impact; some irreversible.
Magnitude	Potentially great.
Impact severity	Potentially Severe impact arising from changes to water quality caused by nutrient run-off and leaching, introduction of exotic flora and fauna, and habitat changes to riparian zone reducing breeding sites and refugia for fauna. Apple Snail colonisation of the valley and stream would have a severe negative impact.

Table 7.7.101 Potential ecological impacts in absence of mitigation of AGR zoning. Planning Area 5: upland grassland at Lin Ma Hang

Criteria	Upland grassland at Lin Ma Hang
Habitat quality	Overall of moderate quality.
Species	Certain grassland specialist bird species present.
Size/Abundance	Moderately-sized area of a grassland habitat that is not scarce in Hong Kong.
Duration	Depends on agricultural practices.
Reversibility	Cessation of farming would result in succession to the same habitat as currently present.
Magnitude	Total loss of small areas will result.
Impact severity	Low, as very small area potentially impacted.

Table 7.7.102 Potential ecological impacts in absence of mitigation of AGR zoning. Planning Area 5: lowland grassland and grassland/shrubland at Lin Ma Hang

Criteria	Lowland grassland and grassland/shrubland at Lin Ma Hang
Habitat quality	Overall of moderate quality, though variable.
Species	Certain grassland specialist species such as Bright-capped Cisticola present.
Size/Abundance	Moderately-sized area of a grassland habitat that is relatively scarce in Hong Kong.
Duration	Depends on agricultural practices.
Reversibility	Cessation of farming would result in succession, though not certainly to the same habitat as currently present.
Magnitude	Total loss of certain areas will result.
Impact severity	Moderate due to scarcity of lowland grassland in Hong Kong, though impact on grassland-shrubland area Low .

Table 7.7.103 Potential ecological impacts in absence of mitigation of AGR zoning. Planning Area 5: shrubland

Criteria	Shrubland at Lin Ma Hang
Habitat quality	Areas that might be affected west of the Lin Ma Hang Stream are slightly more fragmented from surrounding woodland, while area to east is not.
Species	Woodland fauna of area will use these habitats.
Size/Abundance	Not a large area of habitat that is abundant.
Duration	Depends on agricultural practices.
Reversibility	Cessation of farming would result in succession, though it would take significant amount of time to revert to shrubland.
Magnitude	Total loss of certain areas will result.
Impact severity	Moderate due to ecological linkage with forest area.

Road Improvement Works

Proposed road improvement works in this planning area comprise upgrading of a short section of the existing Lin Ma Hang Road as far as the village itself and the construction of an associated transport terminus. This will involve the loss of some habitat arising from widening of the existing road and associated slope-cutting. No fragmentation impacts are anticipated from this, as the section of road lies alongside the Shenzhen River, and there is little habitat or functional connectivity. As currently proposed, there would appear to be little, if any, direct impact from the transport terminus on the Lin Ma Hang Stream. However, there is potential for impact on the SSSI or the proposed buffer from road upgrading (including possible construction of a bridge over the stream). Building works in SSSI is a Designated Project and an Environmental Impact Assessment is required for the works. Should impact be unavoidable, there would be scope for stream restoration in upstream areas to act as adequate mitigation.

Table 7.7.104 Potential ecological impacts of road improvement in absence of mitigation. Planning Area 5: Lin Ma Hang Road and Stream

Criteria	Lin Ma Hang Road and Stream
Habitat quality	Habitats affected along road are grassland – shrubland and secondary woodland, though quality of each low due to small size and isolation from other areas of similar habitat. Lin Ma Hang Stream, however, is of high ecological value.
Species	No known impacts on ecologically significant species of flora or fauna, unless stream impacts unavoidable.
Size/Abundance	Area of terrestrial habitats affected very small, number of organisms low. Stream area affected also low.
Duration	Permanent and temporary construction impacts.
Reversibility	Direct impacts irreversible.
Magnitude	Low for shrubland, woodland and grassland habitats as area is small. However High for stream.
Impact severity	Low in areas of shrubland and grassland as areas of habitat impacted are small. Potential Severe impact on lower reaches of stream.

Hiking Trail

The proposed hiking trail in this planning area passes along the existing Lin Ma Hang Road to Lin Ma Hang village and along existing road or track in the Heung Yuen Wai area to Wong Mau Hang Shan, and down to Lin Ma Hang. The use of existing roads or tracks and passage through areas of upland grassland and grassland-shrubland on the north slope of Wong Mau Hang Shan means that any marginal ecological impact from an enhanced, though still low, intensity of use is not likely to be significant.

Passage through the Lin Ma Hang valley, however, involves crossing the Lin Ma Hang Stream and its associated riparian zone, which are of very high ecological value. There is the potential for significant ecological impact in this area and thus this development will need to be carefully managed so as to prevent this. The management of the development should include proper assessment of the potential ecological impact and possible mitigation measures, including avoidance of Lin Ma Hang Stream. Access to the stream course and its riparian zone should be discouraged or prevented, while at the same time allowing for any interpretative materials regarding the stream to be read in context.

Passage through the village of Lin Ma Hang should not provide significant ecological impact. To the south of here, the proposed trail climbs the steep, wooded hills toward Robin's Nest and then heads east, branching down toward Sha Tau Kok. Aside from Lin Ma Hang Stream, these areas of woodland and closed-canopy shrubland are the habitat of greatest ecological significance with regard to the hiking trail. However, although some disturbance effects to larger mammals, in particular Barking Deer, may be anticipated, the low-intensity of usage, its concentration at weekends and public holidays and the comparatively large area of habitat should render this impact insignificant. The narrow width of a walking trail will mean that fragmentation effects are negligible.

Table 7.7.105 Potential ecological impacts of hiking trail in absence of mitigation. Planning Area 5: Lin Ma Hang Stream

Criteria	Lin Ma Hang Stream
Habitat quality	Very high
Species	Diverse array of fish fauna including rare and protected species, moderate to high riparian vegetation diversity.
Size/Abundance	Approx 2km in length, 1.5m to 4.0m width, Such unchannelised, unpolluted lowland streams are very rare in Hong Kong.
Duration	Permanent disturbance impacts will also result due to increased human activity, possibly directly in stream.
Reversibility	Depends on nature of impact; some irreversible.
Magnitude	Potentially great.
Impact severity	Potentially Severe impact.

7.7.6.6 Planning Area 6

The majority of Planning Area 6 is proposed as Country Park, in addition to a significant area of Green Belt and Conservation Area. Consequently, the only area scheduled for development comprises the lowlands either side of Sha Tau Kok Road, which have been proposed for zoning as either Village or Agriculture.

Expansion of village areas

Expanded village areas are proposed for Tong To, San Tsuen (Ha Wai and Tsiu Hang), Muk Min Tau, Shan Tsui and both Sheung and Ha Tam Shui Hang. Impacts for all of these are dealt with together under the appropriate habitat classification. Habitats directly affected are natural streams, seasonally wet grassland and shrubland. As with other Village zoning, the lack of significant influence or control over housing construction means that an assumption of total habitat loss is made for the seasonally wet grassland.

Table 7.7.106 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 6: natural stream at Tong To

Criteria	Natural Stream at Tong To
Habitat quality	Upper sections good quality, lower section moderate.
Species	Moderately diverse riparian fauna, possibly including diadromous fish species.
Size/Abundance	Moderate length, rare in Hong Kong.
Duration	Permanent loss of the riparian zone will affect stream fauna due to lower floodwater absorption and sediment trapping, reduced energy input and fewer refugia for wildlife. Temporary construction impacts of village housing anticipated from increased pollution and sediment loadings or dumping of material.
Reversibility	Depends on nature of impact; some irreversible.
Magnitude	Potentially great.
Impact severity	Potentially Severe to upper reaches.

Table 7.7.107 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 6: natural stream at Muk Min Tau

Criteria	Natural Stream at Muk Min Tau
Habitat quality	Upper sections good quality, lower section not.
Species	Moderately diverse riparian vegetation and fauna.
Size/Abundance	Moderate length, rare in Hong Kong.
Duration	Permanent loss of the riparian zone will affect stream fauna due to lower floodwater absorption and sediment trapping, reduced energy input and fewer refugia for wildlife. Temporary construction impacts of village housing anticipated from increased pollution and sediment loadings or dumping of material.
Reversibility	Depends on nature of impact; some irreversible.
Magnitude	Potentially great.
Impact severity	Potentially Moderate impact.

Table 7.7.108 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 6: natural stream at Tam Shui Hang villages

Criteria	Natural Stream at Sheung/Ha Tam Shui Hang Villages
Habitat quality	Upper sections good quality, lower section moderate.
Species	Diverse riparian flora and fauna, possibly including diadromous fish species.
Size/Abundance	Moderate length, rare in Hong Kong.
Duration	Permanent loss of the riparian zone will affect stream fauna due to lower floodwater absorption and sediment trapping, reduced energy input and fewer refugia for wildlife. Temporary construction impacts of village housing anticipated from increased pollution and sediment loadings or dumping of material.
Reversibility	Depends on nature of impact; some irreversible.
Magnitude	Potentially great.
Impact severity	Moderate to Severe

Table 7.7.109 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 6: seasonally wet grassland near Sha Tau Kok

Criteria	Seasonally wet grassland near Sha Tau Kok
Habitat quality	Low due to low floral diversity and lack of microhabitat diversity.
Species	None of significance.
Size/Abundance	Moderately-sized area of 20.22 ha of habitat common in lowland areas of New Territories.
Duration	Permanent.
Reversibility	Irreversible.
Magnitude	Severe due to complete loss.
Impact severity	Low significance due to lack of faunal or floral diversity.

Table 7.7.110 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 6: lowland and upland grassland

Criteria	Lowland and upland grassland
Habitat quality	Low to moderate, though somewhat fragmented.
Species	Butterfly community fairly diverse in this area.

Criteria	Lowland and upland grassland
Size/Abundance	Small in size (0.18 ha of lowland and 1.93 ha of upland grassland), abundant habitats in Hong Kong.
Duration	Permanent.
Reversibility	Irreversible.
Magnitude	Total loss of certain areas.
Impact severity	Low , given small area affected.

Table 7.7.111 Potential ecological impacts of V zoning in absence of mitigation. Planning Area 6: shrubland

Criteria	Shrubland
Habitat quality	Moderate, though somewhat fragmented.
Species	Butterfly community fairly diverse in this area.
Size/Abundance	Small in size, an abundant habitat in Hong Kong.
Duration	Permanent.
Reversibility	Irreversible.
Magnitude	Total loss of certain small areas of shrubland.
Impact severity	Low to Moderate

Impacts of AGR zoning

It is proposed that AGR zoning is applied to lowland areas outside of the expanded village areas. Increased population size and visitor numbers will encourage the establishment of agricultural modification in areas currently abandoned. The habitats affected are mainly seasonally wet grassland and upland grassland, as well as the important natural streams in the area. Impacts to currently inactive and active agricultural areas, including an irrigation pond, are considered to be of low severity due to the very small areas of these habitats present. Should wet agriculture be introduced, there is the possibility that the exotic and destructive Apple Snail could be introduced, which could have a severe ecological impact on the ecology of the area, in particular the streams.

Table 7.7.112 Potential ecological impacts of AGR zoning in absence of mitigation. Planning Area 6: seasonally wet grassland

Criteria	Seasonally wet grassland
Habitat quality	Rather poor in current state.
Species	Low diversity of flora and fauna.
Size/Abundance	Fairly large area of habitat commonly found in Hong Kong.
Duration	Changes to habitat would occur when land is being actively farmed. Changes to soil conditions or hydrology may have permanent impacts on vegetation.
Reversibility	Abandonment of agriculture would permit regeneration of semi-natural vegetation, although this may not lead to the same vegetation as currently present.
Magnitude	Clearance of vegetation for conversion of land to agriculture would have an impact of large magnitude for flora and fauna of local area.
Impact severity	Could vary from Low to Severe depending on agricultural practices adopted.

Table 7.7.113 Potential ecological impacts of AGR zoning in absence of mitigation. Planning Area 6: upland grassland

Criteria	Upland grassland
Habitat quality	Low, despite fairly large area, due to low diversity of flora and microhabitats.
Species	None of significance.
Size/Abundance	Very small area of habitat common in lowland areas of New Territories.
Duration	Changes to habitat would occur when land is being actively farmed. Changes to soil conditions or hydrology may have permanent impacts on vegetation.
Reversibility	Abandonment of agriculture would permit regeneration of semi-natural vegetation, although this may not lead to the same vegetation as currently present.
Magnitude	Clearance of vegetation for conversion of land to active agriculture would have an impact of large magnitude for flora and fauna of local area.

Criteria	Upland grassland
Impact severity	Conversion of existing grassland habitats to active agricultural land could potentially lead to an increase in ecological value depending on farming practice. However, whatever change occurs, impact severity is Low to Moderate as current habitat not of high ecological value.

Table 7.7.114 Potential ecological impacts of AGR zoning in absence of mitigation. Planning Area 6: lowland grassland and grassland-shrubland

Criteria	Lowland grassland and grassland/shrubland
Habitat quality	Low, despite fairly large area, due to low diversity of flora and microhabitats.
Species	None of significance.
Size/Abundance	Very small area of habitats common in lowland areas of New Territories. 3.5 ha of lowland grassland and 1.18 ha of grassland/shrubland.
Duration	Changes to habitat would occur when land is being actively farmed. Changes to soil conditions or hydrology may have permanent impacts on vegetation.
Reversibility	Abandonment of agriculture would permit regeneration of semi-natural vegetation, although this may not lead to the same vegetation as currently present.
Magnitude	Clearance of vegetation for conversion of land to active agriculture would have an impact of large magnitude for flora and fauna of local area.
Impact severity	Conversion of existing habitats to active agricultural land could potentially lead to an increase in ecological value depending on farming practice. However, whatever change occurs, impact severity is Low as current habitat not of high ecological value.

Table 7.7.115 Potential ecological impacts of AGR and REC zoning in absence of mitigation. Planning Area 6: natural streams at Tong To, Muk Min Tau and Sheung/Ha Tam Shui Hang

Criteria	Streams at Tong To, Muk Min Tau and Tam Shui Heung
Habitat quality	Streams in this area are of good quality, especially the upper reaches.
Species	A good diversity of odonate and native fish species present, including diadromous species.
Size/Abundance	Fairly extensive stream systems of a type rare in Hong Kong.
Duration	Changes to stream substrate or fish community likely to have a permanent impact on stream ecology. Impacts of leaching, runoff or pollution would be more short-lived.
Reversibility	Some impacts to streams may be reversible, but loss of fish populations, introduction of exotic fish species or extensive damage to stream substrate would be difficult to reverse.
Magnitude	Given the rarity of streams of this quality in Hong Kong, loss of habitat quality would have an impact of high magnitude.
Impact severity	Impacts to streams from conversion of land to active agriculture could arise through increased leaching of nutrients, pollution, siltation, changes to stream substrate and riparian vegetation, or introduction of exotic species. Use of land for active agriculture thus potentially has impact of High severity on stream ecology. REC zoning near Tong To has potential direct habitat loss and indirect disturbance impacts of Moderate severity.

Road Improvement Works

Road improvement works proposed for this planning area are limited and comprise upgrading of the existing village road to Shan Tsui. This is predicted to cause minimal ecological impact.

Hiking Trail

The proposed hiking trail in this planning area passes down existing tracks on the southern and eastern slopes of Robin’s Nest, and through the villages of Sheung and Ha Tam Shui Hang and Tong To. As stated under Planning Area 5, due to the relatively low intensity of usage, it is not anticipated that disturbance or fragmentation impacts on the shrubland and woodland in these areas will be of significance, nor will it be with regard to upland grassland. In lowland areas there is the potential for impact on the streams at Tong To and the Tam Shui Hang villages. Thus, passage across this area will need to be carefully considered so as to prevent ecological impact. Access to the stream and its riparian zone should be

discouraged or prevented, while at the same time allowing for interpretative materials regarding the stream to be read in context.

7.7.7 Mitigation Measures

7.7.7.1 Summary of impacts and possible mitigation

A summary of the potential impacts of developments proposed for the area that will be exciaed from the FCA and proposed mitigation is provided for each planning area below. Impacts are rated on a scale from Positive through Neutral to Low, Moderate and Severe.

Planning Area 1

Table 7.7.117 Planning Area 1: potential ecological impacts and their significance, the feasibility and effectiveness of proposed mitigation measures and the extent of residual impacts

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
Direct habitat impacts		
V zone development impacts on active/inactive wet agricultural land at Lok Ma Chau. Low to Moderate significance due to diversity of amphibian fauna and decline in area of this habitat in Hong Kong.	<i>In situ</i> mitigation not feasible on land zoned V. Off-site mitigation to compensate for loss of ecological function is theoretically possible.	Neither <i>in situ</i> nor <i>ex situ</i> mitigation is feasible as there is no mechanism to achieve either in areas zoned V. In absence of mitigation, Low to Moderate permanent adverse impacts would result.
Eco-lodge development impacts on natural streams. Low due to current low ecological value.	Despite low impact, given natural state of stream and potential for increase in ecological value, avoidance of stream courses through careful design recommended. Where required, reference should be made to ETWB TCW No. 5/2005.	Careful design at detailed planning stage is feasible and would be effective in reducing residual impacts further. As stipulated in the TPB PG No. 12B, an Ecological Impact Assessment is required for developments within the WBA to assess the possible off-site impacts on the WCA. Since the Eco-lodge is within the proposed WBA, an Ecological Impact Assessment should be conducted. This will also allow assessment of all possible impacts.
Eco-lodge development impacts on upland grassland. Low to Moderate impacts on bird community, in particular Eurasian Eagle Owl.	Minimise the land area of development. Ecological Impact Assessment required for assessing habitat requirements and site usage by Eurasian Eagle Owl prior to detailed design in order to avoid impacts on nesting or roosting areas. Anticipated reduction in frequency of fire should result in grassland improvement. Ultimately, though, succession to shrubland will occur.	Detailed ecological impact assessment is feasible (and stipulated in TPB PG No. 12B) and would allow ecological requirements of Eurasian Eagle Owl and other fauna to be considered. It should then be possible to reduce residual impacts to Low .
Eco-lodge development impacts on shrubland. Low due to lack of faunal or floral interest.	Avoidance via careful design as part of environmental impact assessment. Ultimately, reduced fire-incidence and consequent succession may create larger area of shrubland.	Feasible and would be effective in reducing residual impacts to Low .

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
<u>Indirect impacts</u>		
Off-site pollution arising from construction or operational impacts associated with village housing. Moderate to Severe given ecological significance of adjacent downstream areas.	Provision of suitable sewage disposal facilities prior to expansion of village development (if not already present). Control of construction impacts such as silt-laden run-off.	Provision of sewage treatment facilities is feasible and would be effective in reducing this potential residual impact to Low . Minimisation of off-site impacts from village housing development may be difficult to control, and residual adverse Low to Moderate impact may result.
Disturbance impacts of village housing to fauna in adjacent wetlands and flight lines of large waterbirds. Low to Moderate in terms of adjacent wetlands. Low in terms of flight lines due to existing buildings and location of village.	Appropriate fencing during construction and planting with native tree species along northern boundary of village would minimise disturbance impacts once built.	Control of off-site impacts from village housing development may not be feasible. Low to Moderate residual disturbance impacts in absence of buffer, Low with buffer.
Disturbance impacts to Eurasian Eagle Owl in upland areas arising from eco-lodge development. Low to Moderate impact.	Minimise land take, avoid areas of Eurasian Eagle Owl activity, including foraging, roosting and breeding and design to minimise such issues as lighting impact.	Area lies within WBA and thus EIA will be required. The potential impacts on the owl can be assessed at this stage.

Planning Area 2

Table 7.7.118 Planning Area 2: potential ecological impacts and their significance, the feasibility and effectiveness of proposed mitigation measures and the extent of residual impacts

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
<u>Indirect impacts</u>		
AGR zoning of seasonally wet grassland at Ma Tso Lung. Potential direct habitat loss of Low to Moderate significance, though impact will depend on agricultural regime adopted. A wet agricultural system may well enhance ecological value.	Encourage implementation of wet agricultural system.	Under wet agricultural system, residual impact would be Neutral or Positive . However, there is no mechanism for ensuring wet agriculture is adopted, and so this is not feasible
AGR zoning of freshwater marsh at Ma Tso Lung and Liu Pok. Direct habitat loss of Low to Moderate significance, though impact will depend on agricultural regime adopted. A wet agricultural system may well enhance ecological value.	Encourage implementation of wet agricultural system.	Under wet agricultural system, residual impact would be Neutral or Positive . However, there is no mechanism for ensuring wet agriculture is adopted, and so this is not feasible
Off-site pollution arising from construction or operational sewage waste associated with village housing and other developments. Moderate to Severe , given ecological significance of adjacent and downstream areas.	Provision of suitable sewage disposal facilities prior to expansion of village development, if not already established. Control of construction impacts such as silt-laden run-off. Ecological Impact Assessment required to measure impacts and mitigation in detail.	Prior establishment of sewage treatment feasible and effective. Although minimisation of construction impacts would be effective in reducing residual indirect impacts to Low , they are not all feasible for development in land zoned as V. Overall, residual impacts of Low to Moderate significance may result.

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
Disturbance impacts arising from development and associated infrastructure provision. Low to Moderate depending on location.	Minimise disturbance impacts through careful timing of work and use of screening during construction and operational periods.	Although minimisation of construction impacts would be effective in reducing residual indirect impacts to Low , they are not all feasible for development in land zoned as V. Overall, residual impacts of Low to Moderate significance may result.

Planning Area 3

Table 7.7.119 Planning Area 3: potential ecological impacts and their significance, the feasibility and effectiveness of proposed mitigation measures and the extent of residual impacts.

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
<u>Direct habitat loss</u>		
Village expansion at Muk Wu and Muk Wu Nga Yiu villages. Expansion of these villages to the proposed boundaries of the V zoning would result in impacts of Low Significance.	Not required.	Not applicable.
Village expansion at Chow Tin and Fung Wong Wu villages. Expansion of the villages to the proposed boundary of the V zone would result in a Low to Moderate ecological impact at a local scale due to loss of wetlands.	<i>In situ</i> mitigation not feasible on land zoned V. Off-site mitigation to compensate for loss of ecological function is theoretically possible.	Neither <i>in situ</i> nor <i>ex situ</i> mitigation is feasible as there is no mechanism to achieve either in areas zoned V. Low to Moderate permanent adverse impacts result.
OU Zoning south of Man Kam To Road. Impacts from rezoning of this area would be of Low to Moderate severity, assuming proposed theme of sustainability is followed.	Avoidance of shrubland habitats and unmodified natural streams. Compensate for loss of shrubland or woodland with planting of native species.	Mitigation is feasible and would be effective.
Residential zoning at Kong Nga Po. Low due to low ecological value of habitats.	Avoid shrubland habitats and unmodified natural streams. Compensate for loss of shrubland or woodland areas with planting of native species.	Mitigation is feasible and would be effective.
Road improvement works at Muk Wu. Low to Moderate significance due to presence of Chinese Bullfrog.	Avoid locations where Chinese Bullfrog breeds. Compensate by utilisation or creation of nearby wetland areas suitable for Chinese Bullfrog, and via translocation of tadpoles. Ecological Impact Assessment required to measure impacts and mitigation in detail.	Mitigation is feasible and would be effective in reducing impact on small wetland areas of significance. Residual impact Low .

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
<u>Indirect impacts</u>		
Increased agricultural conversion and cultivation in currently inactive dryland agricultural areas arising from expanded V zone and related increased numbers of visitors and residents. Despite large magnitude of change to vegetation arising from agricultural conversion, the overall impact is likely to be Low . However, this would depend on nature of change.	Not required. However, any change to organic polycultural or wet agricultural systems would likely result in improvement of ecological value, to the benefit of open country and wetland species of conservation importance.	Not applicable.
Agricultural conversion of currently wet agricultural habitats, including fishponds, south of Sandy Ridge. Large magnitude of change to vegetation means overall impact would be Moderate as wetland habitats are of relatively high ecological value.	Encourage retention of habitat mosaic of active and inactive wet agriculture. Encourage organic wet agricultural farming, where possible. Improvement of ecological value may occur via expansion of wet or organic agriculture to the benefit of open country and wetland species of conservation importance.	Although filling of fishponds is not permitted in AGR zones, it is not possible to guarantee continuation of current agricultural practices. Thus, while continuation of current agricultural practices would be effective in avoiding ecological impact, impacts would result if any significant change occurred. In this case, residual impact would be Moderate in this area. If current wet agriculture regime continues, residual impacts absent.
Off-site pollution and other construction or operational impacts associated with village housing and other developments. Low to Moderate , depending on ecological significance of adjacent or downstream areas.	Provision of suitable sewage disposal facilities prior to expansion of village development. Control of construction impacts such as silt-laden run-off. Ecological Impact Assessment required for ecologically sensitive areas to measure impacts and mitigation in detail.	Although these measures would be effective in reducing residual indirect impacts to Low , they are not all feasible for development in land zoned as V. Thus, limited residual impacts of Low to Moderate significance may result.
Disturbance impacts arising from development and associated infrastructure provision. Low to Moderate depending on location.	Minimise disturbance impacts through careful timing of work and use of screening during construction and operational periods.	Although these measures would be effective in reducing residual disturbance impacts to Low , they are not all feasible for development in land zoned as V. Thus, limited residual impacts of Low to Moderate significance may result.

Planning Area 4

Table 7.7.120 Planning Area 4: potential ecological impacts and their significance, the feasibility and effectiveness of proposed mitigation measures and the extent of residual impacts

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
<u>Direct habitat loss</u>		
V zoning at Kan Tau Wai and Tong Fong. Impact of expansion of existing village into adjacent disturbed habitat of Low severity.	Not required.	Not applicable.

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
<p>V zoning at Tsung Yuen Ha, Heung Yuen Wai and Ha Heung Yuen. Impacts to terrestrial habitats already subject to human disturbance are of Low significance. Impacts to streams of village house construction potentially Moderate to Severe.</p>	<p>No mitigation required for habitats of low ecological value. The boundaries for indigenous villages have been designated to reflect the existing village environs and have been calculated in ensuring that there is adequate land available for village development as per the 10 year small-house demand. LandsD administrative guidelines on Small House development within 15m of natural stream should be applied. Any application lodged for a NTEH within a distance of 20m from the stream should be referred to AFCD. Reference should be made to ETWB TCW No. 5/2005 and EPD ProPECC PN5/93.</p>	<p>If no small house or other development occurs in riparian corridor, residual impacts are Low. Should such development occur, or should detrimental agricultural conversion occur in the riparian zone, then Moderate residual impacts may result. It is not feasible to prevent agricultural modification of the riparian zone.</p>
<p>Recreation Zoning in areas along Lin Ma Hang Road, near Heung Yuen Wai and east of Pak Fu Shan. Recreational facilities requiring extensive development of the area would lead to loss of habitat which at present is largely undisturbed. The impacts of this would be of Moderate severity due to habitat loss and increased disturbance to certain species, especially mammals. However, opportunity exists to enhance ecological value through sensitive and tailored development.</p>	<p>Adopt passive recreational and residential uses that avoid loss of or disturbance to natural habitats, in particular shrubland. Minimise via design to avoid habitats of ecological significance and fragmentation effects. <i>In situ</i> compensation possible via planting of native shrubland and trees attractive to wildlife or other measures. Ecological Impact Assessment required to measure impacts and mitigation in detail.</p>	<p>Measures are feasible as part of ecological impact assessment to ensure compliance with EIAO, and would be effective in reducing to Low the residual impacts.</p>
<p>REC zoning in riparian corridor areas of streams at Heung Yuen Wai and upper reaches of Ping Yuen River. Potential for direct habitat loss that impacts ecological function of streams, and indirect impacts arising from disturbance or run-off. However, opportunity exists to enhance ecological value through sensitive and tailored development.</p>	<p>Avoidance and minimisation of impact on riparian corridor through appropriate design required. Some stream enhancement may be possible in certain areas.</p>	<p>Mitigation measures are feasible as part of an ecological impact assessment that ensures compliance with EIAO.</p>
<p>Road improvement and hiking trail provision works on Heung Yuen Wai stream. Potentially Severe direct and indirect impacts.</p>	<p>Avoid impacts to stream via careful design, tight monitoring of construction practices. Should ground works be conducted in areas of high ecological value, Ecological Impact Assessment is required to identify impacts and mitigation measures. Supporting facilities should be located in ecologically non-sensitive areas. Reference should be made to ETWB TCW No. 5/2005.</p>	<p>Measures are feasible and would be effective in reducing to Low the residual impacts.</p>

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
<u>Indirect impacts</u>		
<p>Increased agricultural conversion and cultivation in currently inactive agricultural areas in western part of planning area arising from expanded V zone and related increase in numbers of visitors and residents. Despite large magnitude of change to vegetation that would result from clearance of land for agricultural use, the overall impact is considered to be of Low to Moderate significance because of the relatively low ecological value of the existing habitat.</p>	<p>Avoid water storage ponds used for irrigation. Compensate via creation of new water storage ponds, and translocate tadpoles if feasible. Some ecological benefit for open country or wetland species may be derived from land being used for organic farming, especially if wet agricultural land was created.</p>	<p>Impacts on amphibians can be mitigated, and this would reduce residual impacts to Low.</p>
<p>Agricultural conversion of areas adjacent to upper reaches of Ping Yuen Stream as a result of increased numbers of visitors and residents, and better infrastructure provision. Potentially Moderate impact arising from habitat changes to riparian zone reducing breeding sites and refugia for fauna.</p>	<p>Avoid through not carrying out agriculture in riparian corridor. Minimise via adoption of organic polycultural farming practices in catchment areas. Avoid modification of existing natural stream. Minimise through exclusion of Plant Nursery from agricultural use.</p>	<p>Exclusion of Plant Nursery from Column 1 use is feasible. Not otherwise feasible to restrict area or type of agricultural use, and potential residual impacts of moderate significance may result. Protection of riparian corridor would reduce impacts to Low.</p>
<p>Agricultural conversion of lowlands of Tsung Yuen Ha and Heung Yuen Wai as a result of increased numbers of visitors and residents, and better infrastructure provision. Conversion of existing high quality grassland habitats into active agriculture would lead to a loss of an unusual habitat in lowland Hong Kong and would have limited impact on species of conservation importance. Impacts would thus be Moderate.</p>	<p>Minimise through agricultural conversion of areas of lowest ecological significance only, and via adoption of organic polyculture farming regime.</p>	<p>Probably not feasible to wholly influence agricultural activities adopted, in which cases residual impacts of moderate significance would result; however, mitigation suggested would be effective measure to reduce residual impacts to Low.</p>
<p>Agricultural conversion (as a result of increased numbers of visitors and residents, and better infrastructure provision) of catchment area and riparian corridor of Heung Yuen Wai Stream. Potentially Severe impact arising from changes to water quality caused by nutrient run-off and leaching and silt run-off, changes to stream substrate and riparian vegetation that reduce breeding sites and refugia for fauna, introduction of exotic fish and other fauna. Disturbance impacts will also result from increased human activity in area.</p>	<p>Minimise through not carrying out agriculture in riparian zone. Minimise via practising of organic farming in catchment area, and particularly in riparian zone. Minimise by not carrying out wet agriculture, due to the likelihood that the invasive, exotic pest species Apple Snail will be introduced. Avoid stream modification. Minimise through exclusion of Plant Nursery from agricultural use. Human access to stream edge should be discouraged by physical barriers.</p>	<p>Not feasible to restrict area or type of agricultural use (with exception of Plant Nursery). In this case potentially at least moderate residual impacts may result, depending on nature of conversion. If riparian corridor remains unmodified and disturbance levels low, residual impacts would be Low.</p>

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
Off-site pollution and other construction or operational impacts associated with village housing and other developments. Low to Severe , depending on ecological significance of adjacent and downstream areas. Any modification of sections of streams of high ecological value would potentially result in Severe impacts.	Avoid stream modification. Provision of suitable sewage disposal facilities prior to expansion of village development. Control of construction impacts such as silt-laden run-off.	Prior establishment of sewerage treatment is feasible and effective. Control of indirect construction impacts and avoidance of any stream modification would reduce residual impacts to Low .
Disturbance impacts arising from development and associated infrastructure provision. Low to Severe depending on location. Stream modification in many areas will have Severe adverse impact.	Minimise disturbance impacts through careful timing of work and use of screening during construction and operational periods. Avoid stream modification. Ecological Impact Assessment required for ecologically sensitive areas to measure impacts and mitigation in detail.	Control of indirect construction impacts and avoidance of stream modification would reduce residual impacts to Low .

Planning Area 5

Table 7.7.121 Planning Area 5: potential ecological impacts and their significance, the feasibility and effectiveness of proposed mitigation measures and the extent of residual impacts

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
Direct habitat loss		
Village expansion at Lin Ma Hang. Low to Moderate impacts on areas of seasonally wet grassland, lowland grassland and mixed grassland/shrubland are predicted, except in areas adjacent to Lin Ma Hang Stream, for which impacts are potentially Severe .	The boundaries for indigenous villages have been designated to reflect the existing village environs and have been calculated in ensuring that there is adequate land available for village development as per the 10 year small-house demand. LandsD administrative guidelines on Small House development within 15m of natural stream should be applied. Any application lodged for a NTEH within a distance of 20m from the stream should be referred to AFCD. Reference should be made to ETWB TCW No. 5/2005 and EPD ProPECC PN5/93.	If riparian corridor remains unmodified and disturbance levels low, residual impacts would be Low . Should riparian corridor be significantly affected, residual impacts are potentially Severe .
Village expansion at San Kwai Tin. Low to Moderate impacts; though a very small area of woodland, it is closely linked to surrounding shrubland and forest habitats.	<i>In situ</i> mitigation not feasible on land zoned V. Off-site mitigation to compensate for loss of ecological function is theoretically possible.	Neither <i>in situ</i> nor <i>ex situ</i> mitigation feasible on land zoned V, and thus residual impact Low to Moderate .
Road upgrading on Lin Ma Hang Stream. Severe due to high ecological value.	Avoidance as far as possible. Stream restoration in upstream areas.	With appropriate combination of avoidance and mitigation, it should be possible to reduce residual impacts to Low . An EIA is required to assess impacts and devise suitable mitigation.

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
Road improvement works on shrubland, secondary woodland and grassland/shrubland habitats along Lin Ma Hang Road. Low as habitat areas are small and rather isolated.	Not required.	Not applicable.
Hiking trail on Lin Ma Hang Stream. Severe due to high ecological value of site and potential downstream impacts.	Careful design of access to and over stream required to avoid impacts. Minimise potential disturbance impacts by restricting access to stream. Reference should be made to ETWB TCW No. 5/2005.	Reference to relevant circular and careful design and dry season timing of construction are both feasible and effective. Residual impacts Low .
Indirect impacts		
Agricultural conversion (as a result of increased numbers of visitors and residents, and better infrastructure provision) of catchment area and riparian corridor of Lin Ma Hang Stream. Potentially Severe impact arising from changes to water quality caused by nutrient run-off and leaching and silt run-off, changes to stream substrate and riparian vegetation that reduce breeding sites and refugia for fauna, introduction of exotic fish and other fauna. Disturbance impacts will also result from increased human activity in area.	Avoid any modification of stream. Minimise through not carrying out agriculture in riparian zone. Minimise via facilitation of organic farming in catchment area, and particularly in riparian zone. Minimise through exclusion of Plant Nursery from agricultural use. Minimise by not carrying out wet agriculture, due to the likelihood that the invasive, exotic pest species Apple Snail will be introduced. Human access to stream edge should be discouraged by physical barriers. Expansion of SSSI to include riparian zone.	Exclusion of Plant Nursery from Column 1 use is feasible. Probably not feasible to restrict area or type of agricultural use. If no agricultural conversion of riparian corridor occurs, then residual impacts are Low . Though effective, expansion of SSSI appears not to be feasible. Agricultural modification of riparian corridor potentially has Moderate adverse residual impacts.
Agricultural conversion (as a result of increased numbers of visitors and residents, and better infrastructure provision) of lowland grassland and grassland/shrubland. Low to Moderate due to scarcity of lowland grassland in Hong Kong.	Avoid areas of grassland with higher ecological value. Minimise via practising of organic polycultural practices more beneficial to wildlife. Expansion of SSSI to include riparian zone would prevent impact on grassland areas inside.	Expansion of SSSI to include riparian zone reduces impacts in the designated this area to Low . Avoidance of grassland areas of higher ecological value reduces residual impacts to Low . Not feasible to determine agricultural practices. Nature of adverse residual impacts depends on extent and nature of agricultural modification, but potentially Moderate .
Agricultural conversion (as a result of increased numbers of visitors and residents, and better infrastructure provision) of shrubland. Moderate , due to linkage of this habitat with surrounding forest area.	Avoid areas of higher ecological value.	Residual impact Low . However, not feasible to prevent agricultural conversion of land zones AGR. Thus, potential residual impact is Moderate .

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
Hiking trail on Lin Ma Hang Stream. Severe due to high ecological value of site and potential downstream impacts.	Careful design of access to and over stream required to avoid impacts. Minimise potential disturbance impacts by restricting access to stream. Reference should be made to ETWB TCW No. 5/2005.	Reference to relevant circular and careful design and dry season timing of construction are both feasible and effective. Residual impacts Low .
Road upgrading on Lin Ma Hang Stream. Severe due to high ecological value.	Avoidance as far as possible. Stream restoration in upstream areas.	With appropriate combination of avoidance and mitigation, it should be possible to reduce residual impacts to Low . An EIA is required to assess impacts and devise suitable mitigation.
V zoning on Lin Ma Hang stream. Off-site pollution and other construction or operational impacts associated with village housing and other developments. Low to Severe , depending on ecological significance of adjacent and downstream areas.	Avoid via prior establishment of sewage treatment measures that effectively prevent stream contamination. Control of construction impacts such as silt-laden run-off. Ecological Impact Assessment required for other developments in ecologically sensitive areas to assess impacts and mitigation in detail.	Prior establishment of sewerage treatment is feasible and effective. Control of indirect construction impacts, while effective, may not be feasible with regard to development on land zoned V. Application of EcolIA not feasible on land zoned V. Potential adverse residual impact is Moderate .
V zoning on surrounding habitats. Disturbance impacts arising from development and associated infrastructure provision. Low to Moderate depending on location. Stream modification will have Severe adverse impact.	Avoid stream modification. Minimise disturbance impacts through use of screening during construction and operational periods.	Control of indirect construction impacts, while effective, may not be feasible with regard to development on land zoned V. Application of EcolIA not feasible for all projects. Avoidance of stream modification and control of indirect construction impacts reduces residual impacts Low .

Planning Area 6

Table 7.7.122 Planning Area 6: potential ecological impacts and their significance, the feasibility and effectiveness of proposed mitigation measures and the extent of residual impacts

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
Direct habitat loss		
<p>Village expansion on natural streams at Tong To, Muk Min Tau and Sheung/Ha Tam Shui Hang. REC zoning in riparian corridor of Tong To stream. Potentially Severe impacts on upper reaches of all and Moderate impacts on lower reaches of Tong To and Sheung/Ha Tam Shui Hang.</p>	<p>Avoid modification of stream courses. The boundaries for indigenous villages have been designated to reflect the existing village environs and have been calculated in ensuring that there is adequate land available for village development as per the 10 year small-house demand. LandsD administrative guidelines on Small House development within 15m of natural stream should be applied. Any application lodged for a NTEH within a distance of 20m from the stream should be referred to AFCD. Sensitive design of REC development that preserves the riparian corridor, designed and implemented in response to ecological impact assessment. Reference should be made to ETWB TCW No. 5/2005, and EPD ProPECC PN5/93.</p>	<p>Administrative measures proposed are feasible, though may not be entirely effective in preventing construction within 20m of stream course. In this case potential adverse residual impacts are Low to Moderate. Should sensitive design of REC development not prove feasible, potential adverse residual impacts are Moderate to Severe depending on location. Residual adverse impacts potentially Low should mitigation be effective in all cases.</p>
<p>Village expansion on seasonally wet grassland. Of High significance if part of riparian corridor; otherwise Low.</p>	<p>The boundaries for indigenous villages have been designated to reflect the existing village environs and have been calculated in ensuring that there is adequate land available for village development as per the 10 year small-house demand. LandsD administrative guidelines on Small House development within 15m of natural stream should be applied. Any application lodged for a NTEH within a distance of 20m from the stream should be referred to AFCD. Reference should be made to ETWB TCW No. 5/2005.</p>	<p>Residual adverse impacts potentially Low in nature will result, if no development in riparian zone</p>

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
<u>Indirect impacts</u>		
<p>Agricultural conversion (as a result of increased numbers of visitors and residents, and better infrastructure provision) of upland grassland. Conversion of existing grassland habitats to active agricultural land could potentially lead to an increase in ecological value depending on farming practice. However, whatever change occurs, impact severity is Low as current habitat of low ecological value.</p>	<p>None required.</p>	<p>Not applicable.</p>
<p>Agricultural conversion (as a result of increased numbers of visitors and residents, and better infrastructure provision) of natural stream at Tong To, Muk Min Tau and Sheung/Ha Tam Shui Hang. Potentially Severe impact arising from changes to water quality caused by nutrient run-off and leaching and silt run-off, changes to stream substrate and riparian vegetation removing breeding habitats and refugia for wildlife, introduction of exotic fish and other fauna. Disturbance impacts will also result from increased human activity in area.</p>	<p>Avoid through not carrying out agriculture in riparian zone. Minimise via practising of organic, polyculture farming. Minimise by not carrying out wet agriculture, due to the likelihood that the invasive, exotic pest species Apple Snail will be introduced. Minimise through exclusion of Plant Nursery from agricultural use. Human access to stream edge should be discouraged by physical barriers.</p>	<p>Exclusion of Plant Nursery from Column 1 use is feasible. Suggested mitigation reduces residual impacts to Low. However, most are not feasible, and in absence of these potential adverse residual impacts are High.</p>

Potential Impact and Significance	Mitigation	Feasibility and effectiveness
V zoning on natural stream at Tong To, Muk Min Tau and Sheung/Ha Tam Shui Hang. Off-site pollution and other construction or operational impacts associated with village housing and other developments. Low to Severe , depending on ecological significance of adjacent and downstream areas.	Avoid via provision of suitable sewage disposal facilities prior to expansion of village development. Avoid modification of stream courses. The boundaries for indigenous villages have been designated to reflect the existing village environs and have been calculated in ensuring that there is adequate land available for village development as per the 10 year small-house demand. LandsD administrative guidelines on Small House development within 15m of natural stream should be applied. Any application lodged for a NTEH within a distance of 20m from the stream should be referred to AFCD. Reference should be made to ETWB TCW No. 5/2005 and EPD ProPECC PN5/93. Ecological Impact Assessment required for ecologically sensitive areas to measure impacts and mitigation in detail.	Prior establishment of sewerage treatment is feasible and effective. Control of indirect construction impacts and disturbance, while effective, may not be feasible with regard to development on land zoned V. Application of EcolIA not feasible for all projects. If no village expansion into riparian zone either side of streams, residual impacts potentially Low . Administrative measures proposed are feasible, though may not be entirely effective in preventing construction within 20m of stream course. In this case potential adverse residual impacts are Low to Moderate .
Disturbance and other impacts arising from development and associated infrastructure provision. Low to Severe depending on location. Stream modification in many areas will have Severe adverse impact.	Avoid modification of streams. Minimise disturbance impacts through careful timing of work and use of screening during construction and operational periods. Reference should be made to ETWB TCW No. 5/2005. Ecological Impact Assessment required for ecologically sensitive areas to measure impacts and mitigation in detail.	Control of indirect construction impacts, while effective, may not be feasible with regard to development on land zoned V. Application of EcolIA not feasible for all projects. Thus, potential adverse residual impacts of Moderate significance. If no development in riparian zone either side of streams, residual impact Low .

Appendix H summarises the total amount of each habitat directly and indirectly impacted by proposed land use zonings with development implications (i.e. excluding those such as GB, CA and CP). Impacts from road upgrading have also been excluded as insufficient data are available regarding design and layout to calculate these. Based on **Appendix H, Table 7.7.123** summarises the cumulative potential impacts on habitats of various ecological values across the Study Area arising from direct and indirect impacts. Indirect impacts, however, are confined to those that might potentially arise from agricultural modification, as it is not possible to calculate other indirect impacts arising from disturbance or construction activities. Column three of **Table 7.7.123** relates to habitats potentially lost, while column four deals with habitats potentially impacted. Residual impacts are dealt with in **Section 7.7.9**.

Table 7.7.123 Total area of each habitat directly and indirectly impacted by development zonings according to habitat value

Value of habitat and habitat type	Total area in FCA (ha)	Potential area of direct impact (ha)	Potential area of indirect impact (ha)
Low			
Stream	11.2	-	0.17
Drainage Channel	26.72	4.95	3.16
Pond	418.37	-	0.62
Active Wet Agriculture	3.99	-	0.17
Inactive Wet Agriculture	11.76	-	0.07
Active Dry Agriculture	20.45	1.35	16.17
Inactive Dry Agriculture	7.49	0.59	6.55
Lowland Grassland	91.9	6.31	16.59
Seasonally Wet Grassland	73.18	20.22	7.92
Upland Grassland	662.54	3.46	19.70
Grassland/Shrubland	113.34	7.02	14.67
Shrubland	642.07	2.32	4.51
Secondary Woodland/Plantation	336.77	4.51	11.26
Wasteland	7.64	-	2.07
Low to Moderate			
Pond	418.37	-	0.11
Marsh	76.52	0.36	9.98
Active Wet Agriculture	3.99	1.86	-
Inactive Wet Agriculture	11.76	0.34	-
Seasonally Wet Grassland	73.18	9.09	17.373
Lowland Grassland	91.9	8.90	-
Upland Grassland	662.54	23.01	12.27
Shrubland	642.07	12.86	31.48
Secondary Woodland/Plantation	336.77	10.74	17.75
Low to High depending on location			
Seasonally Wet Grassland	73.18	-	0.96
Lowland Grassland	91.9	-	-
Upland Grassland	662.54	-	25.97
Grassland/Shrubland	113.34	-	45.47
Shrubland	642.07	-	21.76
Secondary Woodland/Plantation	336.77	-	12.14
Moderate			
Active Wet Agriculture	3.99	1.15	-
Lowland Grassland	91.9	4.49	11.972
Shrubland	642.07	-	10.83
Secondary Woodland/Plantation	336.77	-	4.90
Moderate to High			
Pond	418.37	-	9.01
Active Wet Agriculture	3.99	-	0.56
Inactive Wet Agriculture	11.76	-	7.94
High			
Streams	11.2	0.27	1.94

It can be seen from **Table 7.7.123** that direct impacts, broadly speaking, affect habitats of Low and Low to Moderate value, while indirect impacts affect proportionately more heavily habitats of higher ecological value.

The habitat of highest ecological value potentially most heavily impacted is streams, which may suffer direct and, in particular, indirect impacts, the latter arising from agricultural modification that is likely to occur as a consequence of the increased population of both residents and visitors to the area that will be excised from the FCA, as well as the increased

infrastructure provision. For streams at Heung Yuen Wai, Lin Ma Hang and the three villages of Tong To, Muk Min Tau and Sheung/Ha Tam Shui Hang near Sha Tau Kok, the potential impacts are severe in the absence of mitigation. Expansion of the SSSI at Lin Ma Hang Stream to include the riparian zone either side will protect the stream from adverse impacts. If the riparian corridor of the relevant sections of the remaining three streams is also protected from development and agricultural modification, low impacts result.

Areas of active and inactive wet agriculture and fishponds are the next highest value habitats to be affected, and this particularly applies to the area of these habitats south of Sandy Ridge cemetery, as well as a wet agricultural area near Chow Tin Tsuen. The impacts on these habitats are, however, generally of an indirect nature, and will not arise for as long as current agricultural practices are adopted. At Lok Ma Chau village, however, this loss arises from the direct impact of village house construction.

Agricultural modification in Planning Areas 3 and 4 potentially has indirect impacts on a large area and a variety of habitats (see **Appendix H**). With regard to the Planning Area 3, the potential impacts are generally predicted to be of Low Significance. However, in Planning Area 4 the impacts are potentially severe in the case of streams (see above), or range from low to moderate depending on the location of the habitats. The most sensitive area in this respect are habitats around Tsung Yuen Ha and Heung Yuen Wai, where agricultural modification of grassland and shrubland habitats in particular may have moderate ecological impacts.

7.7.8 Cumulative Impacts

7.7.8.1 Cumulative impacts within the Study Area

Table 7.7.123 (above) lists the area of habitats of differing ecological values within the Study Area impacted directly and indirectly. In general, the area of each habitat directly impacted constitutes a relatively small proportion of the total area of each habitat present in the Study Area. The exception appears to be Active Wet Agriculture, for which approximately 75% of the 3.99 ha present in the Study Area will potentially be impacted by direct habitat loss. It does not appear feasible to mitigate for any of this loss as it is caused by development related to V zoning.

A total of 1.94 ha of high ecological value stream habitat of the estimated total of 11.2 ha of all stream habitats present in the Study Area may be affected by indirect impacts. These impacts are exerted through impacts on the riparian zone. Further, this impacted area of stream is assessed to be of high ecological value and the impacts correspondingly severe, especially given the dearth of high quality lowland stream habitat in Hong Kong.

The widespread and scattered nature of developments and infrastructure provision potentially has cumulative impacts not apparent at the scale of each planning area. Cumulative disturbance impacts will occur due to increases in projected population and visitor numbers. Areas currently relatively undisturbed will be subject to increased numbers of both residents and visitors, while any burgeoning of agricultural activities arising directly or indirectly from the influx of people would introduce human activity to currently undisturbed areas. Further, related agricultural conversion and nutrient input would have cumulative impacts on natural streams in the Study Area, a number of which are of high ecological value.

Cumulative disturbance impacts will largely affect larger mammals and larger birds, especially species that utilise lowland wetland and open grassland habitats. Smaller mammals and small birds and most other fauna will be entirely or largely unaffected. Cumulative disturbance impacts can often be reduced by sensitive design and other mitigation measures at source and/or at the point of impact.

Impacts on stream ecology can only be mitigated for via the creation of a riparian corridor buffer in which habitat modification, high levels of uncontrolled disturbance and dumping of

waste materials are prevented. Impacts could be minimised by the adoption of organic farming practices in the stream catchment areas.

In terms of the territory-wide areas of these habitats, some comments are possible based on the *2004 Update of Terrestrial Habitat Mapping and Ranking Based on Conservation Value* (Scott Wilson Ltd 2005), although the habitat categories adopted for the current Study differ slightly. The reason for the difference is that at the level of this Study, more detailed habitat categories were considered possible and necessary than were adopted for the 2005 work. For example, this Study divides the single habitat 'Cultivation' into active and inactive dry and wet agriculture, due to their differing ecological significances. Despite this, however, certain observations can be made with regard to habitats of ecological significance.

Natural Streams: the total area of streams potentially affected by indirect impacts is 2.11ha, which is a very small proportion of the total area of natural watercourse habitat present in Hong Kong (803.9ha). However, the ecological value of 1.94ha of this habitat in the Study Area is high, and the potential impact disproportionately significant in consequence.

Cultivation: the total area of cultivation in Hong Kong was estimated in 2005 at 3838.3ha, which includes all land previously or currently used for cultivation. Consequently, this probably includes not only habitats defined in this Study as active and inactive agricultural land, but also seasonally wet grassland and possibly certain grassland areas. Inactive and active wet and dry agricultural land constitutes 43.69ha of the Study Area. However, certain areas are of moderate or higher ecological value, and modification to agricultural regimes of lower ecological value would have a disproportionate impact. The area of seasonally wet grassland impacted is low, but those areas that form part of the riparian zone of streams of moderate to high ecological value could potentially suffer disproportionate ecological impact.

Fishpond: the area of fishpond in the Study Area comprises approximately 40% of the total area of this habitat in Hong Kong. The area potentially affected by development or modification, however, is only 9.74ha, which constitutes approximately 0.9% of the total area of this habitat in Hong Kong. Although much of this potentially impacted pond area is of moderate to high ecological value, the impacts would be felt on a local scale, rather than territory-wide.

Secondary Woodland/Plantation: the area potentially impacted by development is 51.36ha, although the area that constitutes woodland of ecological value other than Low comprises 12.06ha directly impacted and 33.89ha indirectly impacted. As a proportion of the total area of this habitat in Hong Kong, which is estimated at 417ha, these figures are rather low, especially in the context of the ongoing maturation of terrestrial habitats throughout Hong Kong to closed-canopy shrubland and woodland.

Shrubland: totals of 12.49ha and 62,69ha of this habitat are potentially impacted directly and indirectly respectively. The ecological value of these shrubland areas varies, however, and not all reach moderate ecological significance. The total area of shrubland in Hong Kong was estimated in 2005 at 15,196.5ha. Thus, in a territory-wide context the area potentially impacted is small.

Grassland/shrubland: although 45.47ha of this habitat are potentially indirectly impacted by development or modification, ecological value varies and depends on location. The total area of Shrubby Grassland in 2005 was estimated at 24,674.8ha, and the area potentially impacted in the Study Area is a very low proportion of this.

Grassland: the area of this habitat was estimated at 21,572ha in 2005. In the Study Area a total of 121.7ha is potentially impacted by development or agricultural modification, which comprises 0.57% of the area within the SAR. In addition to being a very small area, significant ecological impacts are concentrated in a small number of areas only.

7.7.8.2 Cumulative impacts relating to other areas/developments

The large area of land to be removed from the Closed Area inevitably means that cumulative impacts will accrue related to developments or development proposals outside the Study Area. These comprise proposed developments of Lok Ma Chau Loop and the New Development Areas in the northeast New Territories at Kwu Tung North, Fanling North and Ping Che Ta Kwu Ling, as well as the already finalized Liantang/Heung Yuen Wai Border Crossing Point (BCP) and its associated access road.

Lok Ma Chau Loop area

With respect to the proposed development of the Lok Ma Chau Loop, the sole issue pertains to development within the Hoo Hok Wai. If this occurs sufficiently close to the Loop, this would mean that the cumulative disturbance impacts of development within the Loop would be greater.

Northeast New Territories New Development Areas

Another area where significant cumulative impacts may occur is at Ho Sheung Heung, where there is located one of Hong Kong largest colonies of breeding egrets and herons. The breeding season flight lines to and from foraging areas have been protected by the designation of Conservation Area and Green Belt in the relevant area of the current study. However, certain developments are permissible in areas zoned Green Belt, and if adjacent areas of the Kwu Tung North NDA also contain provision for development, the cumulative impacts on the flight lines may be significant. There would appear to be no other potential cumulative impacts in this NDA, as areas adjacent to the area that will be excised from the FCA are zoned as Green Belt and abut areas also zoned as this. Any development that might impact flight lines in this area should be avoided.

The Fanling North NDA would appear to provide limited potential for cumulative impacts as at no point is it contiguous with the Closed Area, with the closest approach occurring in the area east of the Water Treatment Works north of Sheung Shui, to within approximately 150m. As the zoning in this part of the NDA is proposed as Green Belt and District Open Space, and as habitats south of Man Kam To Road in the Study Area are generally of low ecological value, no significant cumulative impacts are forecast.

The Ping Che/Ta Kwu Ling NDA lies close to the western section of Planning Area 4, separated by approximately 100m. Proposed zoning in this area, however, is Green Belt except in the area of Ping Che Road. However, habitats in this part are of low ecological value and no significant cumulative impact is predicted in this respect. However, development of areas adjacent to Ping Che Road will require upgrading of this road, which means that access to the Closed Area will become significantly easier once closed area status is removed. If, for example, road access is required to either the BCP at Man Kam To or Liantang/Heung Yuen Wai via Ping Che Road, there may be cumulative impacts regarding further upgrading of the road. These impacts would need to be assessed by an ecological impact assessment during the design stage with appropriate recommendations incorporated to minimise impact.

Liantang/Heung Yuen Wai Border Crossing

The ecological impacts of the Liantang/Heung Yuen Wai Boundary Control Point (BCP) are beyond the scope of this study and will be addressed in a separate EIA study. The presence of this BCP and the connecting road will contribute to an increase in fragmentation of the area that will be excised from the FCA. In particular, the connecting road may disrupt any ecological corridor between the west and east of the FCA. This will be exacerbated by increased disturbance around Heung Yuen Wai/Ha Heung Yuen and Tsung Yuen Ha villages. This problem would be reduced by provision of the road connecting with the new BCP on viaduct or within tunnels, as proposed, because this would permit the presence of connecting habitat between the east and west.

An increase in human activity in this area may lead to an increase in pressure for development of this area, which currently has little disturbance. Improved road connections to the BCP (including the connecting road and the upgrading of Lin Ma Hang road for construction of the BCP) would also increase human access into this area. Developments may include authorised developments, such as residential developments or authorised car parking facilities, as well as an increased risk of illegal development from fly-tipping of waste. Land use zonings with limited controls on development (for example Village zones) may be particularly at risk to this increase in disturbance, and adoption of land-use zones with tighter controls on development (for example Green Belt or Conservation Area) would assist in limitation of the risk.

Construction of the BCP will require resiting of the existing Chuk Yuen village, to another site within the current FCA east of Kaw Liu village, which largely comprises grassland-shrubland and shrubland habitats of limited ecological value.

Noise Barriers

The use of noise barriers potentially poses both a fragmentation impact and a direct mortality risk, especially with regard to birds. A recent study of five transparent noise barriers at Shap Pat Heung, Yuen Long, found 31 birds of 15 species dead or dying from November 2006 to March 2008 (<http://www.hkbws.org.hk/BBS/viewthread.php?tid=405>). This was not a systematic study, yet it indicates the potential for bird mortality from the use of these barriers, especially if applied at a number of locations across the Study Area. To avoid this issue, opaque or other non-transparent materials should be used.

7.7.8.3 Fragmentation Impacts arising from the Implementation of Study Proposals

Fragmentation impacts will increase as a result of expanded areas of village housing and agriculture, the latter of which will be directly facilitated by village expansion, the increased population of residents and visitors and greater infrastructural provision. Agricultural conversion of certain areas may fragment and isolate certain areas of ecological significance.

Fragmentation also occurs due to presence of linear features such as roads, which, in particular, tend to have impacts on wildlife and wildlife habitats that are disproportionate to the area of land that they occupy (Forman 2000). In addition to impacts on habitat, increased traffic along roads is a source of road mortality of wildlife, especially when traffic volume is high on small roads, which can cause local population size to decline.

Fragmentation impacts manifest in different ways depending upon species vagility and sensitivity to disturbance. If habitats become fragmented the isolated habitat fragments may become too small to support viable populations of non-vagile fauna such as reptiles, amphibians and some invertebrates. Populations may not disappear immediately but may be lost over time due to lack of recruitment and/or to stochastic effects such as bad weather. In the case of more vagile taxa such as larger birds and mammals, the fragments may be too disturbed to be utilized, even if the total area remains larger than the habitat area required for the species if the habitat is continuous. More subtle fragmentation impacts may be a consequence of different responses to habitat change. This is most obvious with respect to flora, where habitat fragmentation may assist open country pantropical weeds which 'follow' anthropogenic features such as roads into natural habitats.

A particular type of fragmentation impact that is of particular concern in the Study Area is the potential loss of connectivity in forest and wetland habitats, both within the Study Area and between the Study Area and similar habitats in neighbouring areas. For example, forest Wutongshan Forest Park, Shenzhen connects with Pat Sin Leng Country Park via shrubland and woodland in the Study Area at Robin's Nest; wetlands at Hoo Hok Wai are linked to the main Mai Po Inner Deep Bay wetland system via an ecological corridor through the Lok Ma

Chau area; and the Ho Sheung Heung Egret is connected to wetlands at Hoo Hok Wai by a flight line followed by pond herons and egrets during the breeding season.

Noise barriers do not generally pose a significant fragmentation barrier to birds, as they can usually fly above. However, it may be in certain areas that a barrier to movement of herpetofauna or small mammals is erected. It is recommended that a proper assessment of the impact of any noise barrier be carried out prior to installation.

Fragmentation impacts can often be mitigated by maintaining connectivity between habitat patches. In the case of terrestrial fauna this can take the form of physical bridges or underpasses that allow fauna to cross linear barriers such as roads; nevertheless, both terrestrial and non-terrestrial fauna will often make use of habitat islands in otherwise unsuitable habitat. Other measures that may reduce fragmentation impacts include limiting light levels on roads (many fauna species will cross unlit roads but are deterred by high lighting levels), orientating development parallel with rather than perpendicular to wildlife movement corridors and breaking up development blocks in a fashion analogous to the avoidance of a ‘wall effect’ in urban development areas.

Table 7.7.124 summarises the potential impacts on wildlife of fragmentation issues in the Study Area. The fauna referred to occur in the Study Area, while habitat fragmentation refers to local losses of habitat either through development or modification, and linear fragmentation refers to the road upgrading proposed as part of this Study. With regard to the latter, in addition to the footprint of the road, traffic volumes will undoubtedly increase, though there is no way to quantify the impacts of fragmentation or mortality from this at the present time.

Table 7.7.124 Potential impacts on fauna of fragmentation issues in the Study Area

Wildlife group/species	Impact of habitat fragmentation	Impact of linear fragmentation by roads
Insects	Increase in distance between areas of habitat will reduce local carrying capacity.	Probably not significant, as width and traffic use insufficient to pose severe barrier. Increased mortality, however.
Herpetofauna	Increase in distance between areas of habitat will reduce local carrying capacity. Local species diversity and population size may decrease, especially in more isolated fragments.	Road mortality will increase, which may affect population size. Impact may be especially severe if road is perpendicular to a movement corridor to breeding wetland areas.
Two-striped Grass Frog	Within the FCA, populations of this species are isolated due to widely separated habitats. These isolated populations would be affected significantly if these habitats are impacted.	Road mortality will increase, which may affect population size.
Small mammals	Impact potentially limited if sufficient sub-optimal habitat allows passage between areas.	Road mortality will increase.
Eurasian Otter	Potentially severe impact due to specific habitat requirements that limit ability to move.	Road mortality may increase. Potentially severe impact due to specific habitat requirements that limit ability to move.
Larger mammals	Potentially significant impact due to specific habitat requirements. Local groups more susceptible to factors that negatively impact population.	Road mortality will increase, though effect on mobility between nearby areas of habitat probably limited.
Birds (general)	Most species will suffer population loss due to reduction in continuous habitat area. Species that are not affected are likely to be generalist species or those commensal with man	Noise barriers likely to result in increased mortality if design or placement inappropriate.

Wildlife group/species	Impact of habitat fragmentation	Impact of linear fragmentation by roads
Breeding ardeids	Birds prefer closer foraging areas to maximise efficiency. If flight distances increase, this will decrease and may impact productivity. Beyond a certain distance, total loss may occur.	As flight altitudes are low, then increased traffic or new road construction has potentially severe adverse impacts.
Large waterbirds	Capable of long flight distances to and from foraging areas. No significant loss of wetland habitat anticipated in Study Area.	Although ability to overfly Lok Ma Chau BCP proven, parallel road alignments or expansion of adjoining developed area may have significant impacts, especially if high levels of lighting employed.
Forest birds	Reduced available habitat area limits population size. Impact on flight line connections depends on intervening distance, but generally more susceptible than other species.	Generally little impact if suitable habitats exist both sides of road.
Eagle Owl	Tolerant of some habitat fragmentation, but only at low development intensities where barriers are relatively easy surmounted.	Road mortality will increase, though probably not a significant issue in Study Area.

Table 7.7.125 summarises the potential mitigation measures that might be effectively employed. It is advisable that prior to design of road upgrading work with potential fragmentation issues, an ecological impact assessment is carried out to identify, assess and suggest mitigation for possible fragmentation.

Table 7.7.125 Potential mitigation of impacts on fauna of fragmentation in the Study Area

Wildlife group/species	Impact of habitat fragmentation	Impact of linear fragmentation by roads
Insects	Reduce distance between habitat areas or retain intervening (smaller) areas of habitat.	Reduce lighting.
Herpetofauna	Reduce distance between habitat areas or retain intervening (smaller) areas of habitat.	Employ and maintain wildlife underpasses to allow passage and maintain connectivity.
Two-striped Grass Frog	Retain habitat integrity and reduce/prevent disturbance.	Employ and maintain wildlife underpasses to allow passage and maintain connectivity.
Small mammals	Reduce distance between habitat areas or retain intervening (smaller) areas of habitat.	Employ and maintain wildlife underpasses to allow passage and maintain connectivity.
Eurasian Otter	Retain corridor of continuous suitable habitat (including watercourse) that allows passage between areas of optimal habitat.	Employ and maintain wildlife underpasses to allow passage and maintain connectivity.
Larger mammals	Retain corridor of continuous suitable habitat that allows passage between areas of optimal habitat.	Employ and maintain wildlife over- or underpasses to allow passage and maintain connectivity.
Birds (general)	Retain corridor of suitable habitat that allows passage between areas of optimal habitat.	Avoid use of transparent noise barriers.
Breeding ardeids	Development restrictions on building location, type and height may be required.	Restrictions on size and nature of road type may be required. Avoidance/re-routing of new road construction should be considered, where necessary.

Wildlife group/species	Impact of habitat fragmentation	Impact of linear fragmentation by roads
Large waterbirds	Avoid large unsuitable intervening developed areas.	Avoid alignments parallel to flight line, avoid strong lighting. Fragmentation impacts greater if works carried out in dry season, and thus these should be completed in wet season.
Forest birds	Reduce distance between habitat areas or retain intervening (smaller) areas of habitat.	Ensure suitable forest or mature shrubland habitat remains close to road on both sides.
Eagle Owl	Retain corridor of continuous suitable habitat that allows passage between areas of optimal habitat.	Shrubland either side of road will require birds to fly higher.

7.7.9 Residual Impacts

Table 7.7.123 (above) summarises the area of habitats of differing ecological values within the Study Area impacted directly and indirectly arising from zonings proposed in this Study, arranged according to the significance of impact. Residual impacts, however, are summarised below.

In **Planning Area 1**, a residual impact of more than Low significance will arise from V zoning in the wet agricultural land at Lok Ma Chau village.

In **Planning Area 2**, village expansion into freshwater marsh at Liu Pok would result in permanent adverse impact of Low significance if suggested mitigation is not possible.

The ecological impact arising from the development of LMC Loop is being assessed under the EIA of the Planning and Engineering Study on Development of the Lok Ma Chau Loop, conducted by PlanD and CEDD.

Residual indirect impacts arising from construction of village housing or infrastructure of Low significance may result if minimization of construction impacts, especially in land zoned V, is possible.

In **Planning Area 3** Low to Moderate residual impacts are predicted as a result of village expansion and agricultural modification in wet areas at Muk Wu and Chow Tin Tsuen into wetland agricultural areas. In addition, agricultural modification arising from indirect impacts of increased population and visitor numbers in the area may result in Moderate to Severe residual impacts at the wet agriculture and fishpond area north of Man Kam To, near Sandy Ridge. However, the extent and nature of this modification would largely determine the magnitude of impact. For as long as the current wet agriculture regime continues, impacts will be neutral.

Residual indirect impacts of Low to Moderate significance may occur as a result of off-site construction or operational impacts associated with village housing or other related developments, especially in the Chow Tin area. That control of construction impacts is not feasible in land zoned V means that permanent adverse impacts may result. The same applies to disturbance impacts.

In **Planning Area 4** Moderate to Severe residual impacts may occur should village expansion directly impact the riparian corridor of Heung Yuen Wai stream, but would remain Low if the riparian corridor remains unaffected. That control of construction impacts is not feasible in land zoned V means that permanent adverse impacts may result to this stream of high ecological value.

Agricultural conversion of land adjacent to Heung Yuen Wai stream and the upper reaches of the Ping Yuen River arising from the indirect impacts of village expansion, infrastructure provision and increased numbers of both visitors and residents may have Moderate (in the case of Ping Yuen River) to Severe (in the case of Heung Yuen Wai stream) permanent adverse impacts. Retention of a natural riparian corridor either side of the stream would

mean Low residual impacts. However, it should also need to take into account the private land ownership of the area next to the stream. In the meantime, an administrative buffer would appear to be able to protect the stream from the direct and indirect impacts of village house development, LandsD administrative guidelines on Small House development within 15m of natural stream should be applied. Any application lodged for a NTEH within a distance of 20m from the stream should be referred to AFCD. Agricultural conversion of high quality grassland in the Tsung Yuen Ha area would have Moderate to High residual impacts, as it is not feasible to control the type of agricultural activity carried out.

Off-site pollution or disturbance impacts of village house construction or infrastructure provision in the vicinity of Heung Yuen Wai stream or the upper reaches of the Ping Yuen River may result in Low to Severe residual impacts, with the actual severity depending on the ecological significance of adjacent or downstream areas.

In **Planning Area 5** the designation of an expanded SSSI zone to include a riparian corridor on either side of the stream would reduce potentially Severe residual impacts to Low. However, it should also need to take into account the private land ownership of the area next to the stream. In the meantime, an administrative buffer would appear to be able to protect the stream from the direct and indirect impacts of village house development, LandsD administrative guidelines on Small House development within 15m of natural stream should be applied. Any application lodged for a NTEH within a distance of 20m from the stream should be referred to AFCD. Related agricultural conversion of lowland grassland habitat in the riparian corridor could result in Low to Moderate residual impacts.

In **Planning Area 6** potentially Severe residual impacts on the streams at Tong To, Muk Min Tau and Sheung/Ha Tam Shui Hang may result from agricultural modification or expansion of the V zone in the area, given the lack of influence over such construction activity. These impacts are reduced to Low if a riparian corridor either side is preserved. However, it should also need to take into account the private land ownership of the area next to the stream. In the meantime, an administrative buffer would appear to be able to protect the stream from the direct and indirect impacts of village house development, LandsD administrative guidelines on Small House development within 15m of natural stream should be applied. Any application lodged for a NTEH within a distance of 20m from the stream should be referred to AFCD. Any modification of these streams, apart from the lower reaches of Muk Min Tau stream, would have a severe negative impact; only avoidance reduces this to Low.

7.7.10 Conclusion

Potential ecological impacts and possible mitigation measures have been evaluated and discussed. Further assessments required in the future. There remains further scope for reducing ecological impacts, particularly with regard to the impact of agricultural modification on natural streams, currently wet agricultural areas and certain areas of lowland grassland, the direct and indirect impacts of village expansion on certain habitats, especially natural streams.

7.8 Cultural Heritage Impact

7.8.1 Introduction

This section presents the preliminary assessments of potential cultural heritage impacts in areas from which developments are proposed under the landuse planning. It evaluates the potential cultural heritage implications and the environmental acceptability of the proposed landuse framework, including the identification of the existing historical buildings within the Closed Area and potential impact of the proposed development areas on these buildings, as well as identification of the proposed development areas of potentially high archaeological impacts and preliminary impact on archaeological resources. Moreover, a preliminary archaeological field evaluation has been carried out in selected areas on Government Land in order to collect information on the archaeological potential of areas where the proposed developments may cause potential impacts. Proposals of mitigation measures required to

alleviate the cultural heritage impacts and further detailed cultural heritage assessment requirement in the next stage have been recommended.

7.8.2 Legislation, Standards and Guidelines

Legislation, standards, guidelines and criteria relevant to the consideration of cultural heritage impacts under this study include the following:

- Antiquities and Monuments Ordinance
- Environmental Impact Assessment Ordinance
- Hong Kong Planning Standards and Guidelines
- Technical Memorandum on Environmental Impact Assessment Process.
- Guidelines for Cultural Heritage Impact Assessment

7.8.2.1 Antiquities and Monuments Ordinance

The Antiquities and Monuments Ordinance (the Ordinance) provides the statutory framework to provide for the preservation of objects of historical, archaeological and paleontological interest. The Ordinance contains the statutory procedures for the Declaration of Monuments. The proposed monument can be any place, building, site or structure, which is considered to be of public interest by reason of its historical, archaeological or paleontological significance.

Under Section 6 and subject to sub-section (4) of the Ordinance, the following acts are prohibited in relation to certain monuments, except under permit;

- To excavate, carry on building or other works, plant or fell trees or deposit earth or refuse on or in a proposed monument or monument;
- To demolish, remove, obstruct, deface or interfere with a proposed monument or monument.

The discovery of an Antiquity, as defined in the Ordinance must be reported to the Antiquities Authority (the Authority), or a designated person. The Ordinance also provides that, the ownership of every relic discovered in Hong Kong after the commencement of this Ordinance shall vest in the Government from the moment of discovery. The Authority on behalf of the Government may disclaim ownership of the relic.

No archaeological excavation may be carried out by any person, other than the Authority and the designated person, without a licence issued by the Authority. A licence will only be issued if the Authority is satisfied that the applicant has sufficient scientific training or experience to enable him to carry out the excavation and search satisfactorily, is able to conduct, or arrange for, a proper scientific study of any antiquities discovered as a result of the excavation and search and has sufficient staff and financial support.

7.8.2.2 Environmental Impact Assessment Ordinance

The Environmental Impact Assessment Ordinance (EIAO) was implemented on 1 April 1998. Its purpose is to avoid, minimise and control the adverse impact on the environment of designated projects, through the application of the EIA process and the Environmental Permit (EP) system.

7.8.2.3 Hong Kong Planning Standards and Guidelines

Chapter 10 of the HKPSG details the principles of conservation of natural landscape and habitats, historical buildings and archaeological sites. 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.

7.8.2.4 Technical Memorandum on Environmental Impact Assessment Process

The general criteria and guidelines for evaluating and assessing impacts to Cultural Heritage are listed in Annexes 10 and 19 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM). The guidelines state that preservation in totality and measures for the integration of sites of cultural heritage into the proposed project will be a beneficial impact. It also states that destruction of a site of cultural heritage must only be undertaken as a last resort.

7.8.2.5 Guidelines for Cultural Heritage Impact Assessment

This document, as issued by the Antiquities and Monuments Office, outlines the specific technical requirement for conducting terrestrial archaeological and built heritage impact assessments. It includes the parameters and scope for the baseline study, specifically desk-based research, field survey and the reporting requirements. As well, the prerequisite conditions for conducting impact assessment and mitigation measures are presented in detail.

7.8.3 Baseline Conditions

7.8.3.1 Introduction

This section describes a baseline profile of the cultural heritage resources present in the Study Area. This is achieved through undertaking a desk-based review of existing information.

7.8.3.2 Scope of resources covered in the baseline profile

Archaeology

Both known archaeological sites and generalised areas of archaeological potential have been identified and included in the baseline study.

Built Heritage

Pre-1950 structures, including built features, such as; domestic structures, ancestral halls, temples, shrines, monasteries and nunneries, village gates, wells, schools (graves and cultural/ historical land use features are dealt with in a separate section), any post-1950 structure deemed to possess features containing architectural or cultural merit; all pre-war clan graves and Cultural and Historical landscape features, such as Fung Shui woods and ponds, historical tracks and pathways, stone walls and terraces and other agricultural features, have been identified.

7.8.3.3 Methodology

Archaeology

A desk-based review of existing information has been undertaken for the entire Study Area to identify all known archaeological sites. Maps are presented showing the boundaries of known archaeological sites located within the Study Area. A preliminary archaeological survey of selected areas on Government Land has been conducted in order to collect information on the archaeological potential of areas where the proposed developments may cause potential impacts.

Built Heritage

A desk-based review has been undertaken to identify Declared Monuments, Proposed Graded Buildings, Graded Buildings, historical villages and any areas that have the potential to contain built heritage resources. The latter category includes areas that can be seen to contain graves on maps and cultural landscape features on aerial photographs. Maps have been compiled showing the locations of all Declared Monuments, Graded Buildings and historical villages.

7.8.3.4 Baseline Profile of Archaeology in the Study Area

i. Desk-based review

Geological and topographical background

The topography of the Study Area ranges in character from flat alluvial valleys and low-lying wet land, to very steep ranges of hilly terrain.

Geology of the eastern part of the Study Area at Sha Tau Kok is dominated by Shing Mun Formation, which consists mainly of coarse ash crystal tuff with subordinate vitric and fine ash tuff and occasional siltstone. Small areas of Pleistocene debris flow deposits and terraced alluvium, as well as strips of Holocene alluvium are found along the coast.

In the northwest area near Man Kam To, the geology is dominated by the presence of an extensive outcrop of volcanic rocks of metasediments of Lok Ma Chau Formation.

Dark grey Holocene marine mud of Hang Hau Formation is the major geology occupying the western end of the Study Area at Mai Po.

In general, the onshore superficial deposits of the Study Area comprise mainly alluvial, debris flow, estuarine, and intertidal deposits of Pleistocene and Holocene age. Alluvium is widespread along the Shenzhen River and River Indus valleys, forming extensive floodplains (GEO 1996).

Archaeological Background

There are AMO archaeological sites located within or in close vicinity of the Study Area boundary (see **Figures 7.8.1a to f** for locations):

Sha Tau Kok San Tsuen Archaeological Site (Grid Reference: 3-NE-12B, D & 13A & C)

The site was first identified during the 1998 Territory-wide Survey, with the discovery of some Qing Dynasty materials (AMO 1999). Field investigations in 2000 revealed that the site contained rich prehistoric cultural deposits including Warring States hard pottery sherds and Late Neolithic stone implements (Au 2000). An excavation was conducted at the centre of the archaeological site in San Tsuen in 2001 prior to a small village house construction. Four cultural layers (Early Neolithic, Mid Neolithic, Late Neolithic and Bronze Age), as well as a large amount of stone artefacts, 3 postholes, 2 pits and stone workshop remains were identified (Mok 2001).

Sha Tau Kok Shek Kiu Tau Archaeological Site (Grid Reference: 3-NE-16B & D, 17A & C)

This archaeological site is located in the vicinity of the Study Area at Shek Kiu Tau, Sha Tau Kok.

The site was first recorded by the Second Territory-wide survey. Field investigation in 2000 discovered prehistoric cultural remains and ceramic sherds of Song and Ming periods.

Pok Tau Ha Old Lime Kiln (Grid Reference: 3-NE-17C)

This known kiln site is located in close proximity to the Study Area at Pok Tau Ha, Sha Tau Kok.

The kiln was recorded by an archaeological survey in 2001.

Sha Tau Kok Old Stone Lime Kilns (Grid Reference: 3-NE-22A)

Four limekilns at Luk Keng Road of Sha Tau Kok were first reported in 1978. Subsequently, field investigation recorded three limekilns near Luk Keng Road in 2001.

Tong To Shan Archaeological Site (Grid Reference: 3-NW-15A-D)

This site was first recorded in 2001 during an investigation carried out for the NENT Landfill project. An early 17th century to early 20th century settlement site was identified at Tong To Shan/ Lin Ma Hang area. Findings included 6 stone trackways covered on the surface with

flat stone plates, 74 slope-protection walls and remains of nine houses and one cistern (HKIA 2002). Further field evaluation was carried out at Tong To in 2005 for the NENT Landfill Feasibility Study and no archaeological material was identified (AAL 2005)

Muk Wu Nga Yiu Kilns (Grid Reference: 3-NW-12C & D)

Four kilns were first recorded in 2000 during the Shenzhen River Regulation Project, of which three were located in Nga Yiu Tsuen and the other in Muk Wu Nga Yiu Tsuen. The kilns were used for brick and tile production, with a history of approximately 100 years (HKIA 2001).

Other sites of Archaeological Interest located within the Study Area:

Tsung Yuen Ha

The monitoring of the sewerage excavations in 2004 resulted in the discovery of a Ming Dynasty occupation at Tsung Yuen Ha, whilst a settlement of indeterminate age was identified beneath the standing historical buildings of the present village. The underlying structural remains were shown to have a different orientation to the current historical village, but the finds were undiagnostic for date. The exact extent of the site could not be established due to the geographical limitations of the monitoring works and the concrete covering of the current village. Further investigation is needed to understand the extent both geographically and chronologically of the site (AAL 2005).

Tong Fong

The village has a settlement history of approximately 200 years. At the rear of the village at a depth of 1 m below the surface a single ceramic jar was found. Although no exact date could be given to the object, the find suggests that the village may contain remains from earlier historical periods, which can only be confirmed through further investigation (AAL 2005).

Yuen Leng Chai

The site was first identified in 2001 during the archaeological investigation for the Shenzhen River Regulation Project. Field scan, auger test and test pit survey collectively produced finds spanning Bronze Age, Song-Yuan and Ming-Qing Dynasties (HKIA 2001). Since the areas with archaeological potential identified at Yuen Leng Chai would be directly impacted by the proposed works, rescue excavation was subsequently carried out in 2001 as mitigation measure. Two burials dated to the Song-Yuan period, as well as some Bronze Age geometric sherds, were recorded in the excavation (HKIA 2003).

Other previous archaeological investigations:

Territory-wide Survey

Field investigations were carried out in areas near Sha Tau Kok Hoi and south bank of Shenzhen River as part of the 1997-98 Territory-wide Survey. Some of the investigated areas were located within the current Study Area boundary:

Shan Tsui (NW) – 1 auger hole test; high water table, confirmed as having no archaeological potential.

Sha Tau Kok – 4 auger hole tests; highly modified landform/ landscape, impossible to locate the original alluvial deposits.

Lin Ma Hang – Surface scan and 8 auger hole tests; no archaeological materials were identified.

Pak Fu Shan – Surface scan and 7 auger hole tests; Qing Dynasty-recent period porcelain sherd was collected on surface.

Tsung Yuen Ha – Surface scan and 3 auger hole tests; Qing Dynasty-recent period porcelain sherd was collected on surface.

Chuk Yuen – Surface scan and 3 auger hole tests; modern porcelain sherd was collected on surface.

Lo Shu Ling – Surface scan and 3 auger hole tests; modified landform/ landscape, no archaeological materials were identified.

Muk Wu Nga Yiu – 1 auger hole test; no archaeological materials were identified.

Muk Wu – 1 auger hole; no archaeological materials were identified.

Yuen Leng Chai – Surface scan and 1 auger hole; no archaeological materials were identified.

The 2000 Archaeological Survey & Assessment for Shenzhen River Regulation Project Stage III

An archaeological field investigation as part of the EIA was undertaken in 2000 for the above project. The entire Study Area was located within the closed area, along the Shenzhen River. A Song/ Yuen period site was identified at Yuen Leng Chai. Several Warring States-Han Dynasty geometric pottery surface finds were also collected at the site. In addition, four early 20th century kilns at Muk Wu Nga Yiu area were recorded (HKIA 2001).

Rescue Excavation at Yuen Leng Chai

This Song/ Yuen site was identified during the archaeological investigation carried out for the Shenzhen River Regulation Project Stage III in 2000. Since the site would be directly impacted by the proposed work, a rescue excavation was conducted in 2002-2003 prior to the construction work. Two well preserved burials dated to Song/Yuen period were recorded, along with some associated finds such as celadon bowls and cloth-pattern tiles and nine iron nails associated with the decayed coffins (HKIA 2003).

Agreement No. CE64/96, Planning & Development Study on NENT, CHIA

A field investigation was carried out for the above project at Kwu Tung, Ma Tso Lung, Fung Kong, Ho Sheung Heung, Yin Kong and Lo Wu Correctional Institute and its adjacent hills. Only the investigated area at Ma Tso Lung and Lo Wu Correctional Institute were located within the current Study Area boundary. A surface survey, 19 auger hole test and 8 test pit excavations (1m x 1.5m) were conducted in Ma Tso Lung. Two Song celadon sherds were collected on the surface and some Qing Dynasty bowl base sherds were found in one of the test pits. All finds were identified as secondary deposit. For the investigated area at Lo Wu Correctional Institute, no archaeological materials had been identified from the surface scan and test pit excavation. According to the report, the valley was filled by soil excavated from the hill slope during the levelling and filling for the construction of the Lo Wu Camp (now known as the Correctional Institute). Any in situ ancient cultural remains had been destroyed and the entire area was confirmed by the field testing as having no archaeological potential (ERM 2001).

The 2001 Archaeological Survey & Assessment for the Proposed NENT Landfill Extension

An early 17th century to early 20th century settlement site was identified at Tong To Shan/ Lin Ma Hang area. Findings included 6 stone trackways covered on the surface with flat stone plates, 74 slope-protection walls and remains of nine houses and one cistern. 40 graves were also identified in the Ngong Tong area. Some Wun Yiu style blue-and-white porcelain sherds were collected at/ near the house ruins (HKIA 2002).

Agreement No. CE20/2004 (EP), NENT Landfill Extension – Feasibility Study, CHIA

A total of ten auger hole tests and two test pit excavations were conducted at Tong To Shan. The results indicated that the hill slope and terraces consist of moderate to deeply weathered colluvium. No archaeological material was recovered during the auger testing and test pit excavations (AAL 2005).

Northeast New Territories Village Sewerage: Archaeological Monitoring and Condition Survey

Archaeological watching brief was conducted within the closed border area at Ta Kwu Ling during the construction phase of the NENT Village Sewerage project. Significant findings included the identification of a Ming Dynasty occupation at Tsung Yuen Ha and a settlement indeterminate in age underneath the still standing historical buildings. Other historical materials were also collected from nearby historical villages, such as Tong Fong and Ping Che (AAL 2005).

ii. Existing Impacts

Generally speaking, impacts from development are low in the Closed Border Area due to the sensitivity and restriction of the area. The existing impacts can be summarised as roads, ponds, streams, car park, paths, residential development and development of public spaces. There are basically no drains, utilities, sewerage and water supply serving the Closed Area, except the Sha Tau Kok rural town, village clusters and boundary control points (Planning Department).

iii. Assessment of Archaeological Potential

The archaeological potential of the closed area is generally high as there has been little disturbance to potential deposits in the past, except for areas with ponds, rivers and other existing impacts. As well, only limited archaeological investigations have been conducted within the closed area, which provide very little information regarding the nature and extent of archaeological deposits. The areas of high potential are located around the historical villages (see **Table 7.8.1**) and on the lower hill slopes and around the bases of the hillocks that are scattered throughout the Study Area.

Table 7.8.1 List of traditional historical villages

Sha Tau Kok Area	Ta Kwu Ling Area	Lok Ma Chau Area
1. Kong Ha	9. Lin Ma Hang	21. Liu Pok
2. Shan Tsui	10. Heung Yuen Wai	22. Lok Ma Chau
3. Sheung Tam Shui Hang	11. Ha Heung Yuen	
4. Ha Tam Shui Hang	12. Tsung Yuen Ha	
5. Tsiu Hang	13. Kan Tau Wai	
6. Muk Min Tau	14. Tong Fong	
7. San Tsuen	15. Muk Wu Nga Yiu	
8. Tong To	16. Muk Wu Tsuen	
	17. San Uk Ling	
	18. Lei Uk	
	19. Fong Wong Wu	
	20. Chow Tin Tsuen	

7.8.3.5 Baseline Profile of Built Heritage in the Study Area

The result of the desk-based built heritage study is described below.

i. Declared Monuments (as of May 17 2010)

The Residence of Ip Ting-sz, Lin Ma Hang (Declared Monument)

Ip Ting-sz (1882-1942) was an indigenous villager of Lin Ma Hang village and a member of Tongmenghui (United League) in Thailand in the 1900s. The Residence of Ip Ting-sz is a green brick two-storey structure built around 1908. The house was built with a mixture of Chinese and western architectural elements. It is reputed that the house is modeled on the mansion of Dr. Sun Yat-sen in Zhongshan (AMO files).

ii. Graded Historic Buildings (as of May 17 2010)

Thirteen existing graded buildings are located within the Study Area while three existing graded buildings are located outside but in proximity of the Study Area. There are also twelve proposed graded buildings in the Study Area. The locations of these graded buildings can be found on **Figures 7.8.2a to f**.

Ta Kwu Ling Police Station (Grade 3)

Ta Kwu Ling Police Station is located at the junction of Ping Che Road and Lin Ma Hang Road. It was built in 1905 as a base for the policing of the border. The Police Station was substantially expanded in 1937 by adding a new block (AMO Website) and it continues in use today.

Shan Tsui Tsuen, Hip Tin Temple, Sha Tau Kok (Grade 1)

The Hip Tin Temple is located to the east of Shan Tsui near the Sha Tau Kok Control Point outside but in proximity of the Study Area. The temple was constructed in 1895 by the Wong Clan. It has been used as a school and may have been used as a site to interrogate suspected guerrillas during the Japanese Occupation. The main deity is Kwan Tai. It is a Qing style building with two halls and side chambers. The building is constructed of green brick with plaster covering (AMO Website)

The MacIntosh Forts, at Ma Tso Lung, Nam Hang, Nga Yiu, Pak Fu Shan, Kong Shan and Pak Kung Au (Grade 2)

These Forts were constructed during the period 1949 to 1953 to provide police with a strong visible presence along Hong Kong's first line of defence. The posts were exactly the same design and were first referred to as 'MacIntosh Cathedrals, presumably because of their distinctive appearance and outline against the skyline, and later re-named as MacIntosh Forts' after Mr. Duncan William MacIntosh, C.M.G., O.B.E., the then police commissioner of HK (1946-1953) whose idea it was to build them (AMO Website).

Lok Ma Chau Police Station (Grade 2)

Lok Ma Chau Police Station is positioned on a hilltop behind Lok Ma Chau village outside but in proximity of the Study Area. The Police Station was built in 1915. The original station has been extended and the original open verandas on either side of the main entrance have been enclosed. The roof has also been modernised. The building which contains a mixture of old and new features can be categorised as Modern Eclectic (AMO Website). The building continues to be used as a police station today.

Ip Ancestral Hall (Lin Ma Hang) Grade 3

The hall is a Qing Vernacular style building with two halls and one courtyard plan of three bays. The walls are constructed of green bricks. The building has pitched tile roofs with curling end ridges. There is a finely carved altar at the end wall of the middle bay (AMO Website).

Nos. 57, 58 and 59 (Tsung Yuen Ha) Grade 3

The structure consists of a block of two storey buildings built by Ho Wa-shau and probably dates to the 1930's. There is a verandah on the front of the building and balcony on the upper floor. It is constructed of green brick, granite and concrete building materials and is of a mixed architectural style (AMO Website).

Nos. 1A, 1, 1B, 2, and 3 (Heung Yuen Wai) Grade 1

The buildings were constructed by the Man clan and funded by remittances sent from clan members working overseas in Panama. The houses were built in 1928 and are built in Qing vernacular style of one hall layout with two storeys. They were constructed of green brick and rammed earth walls with cut granite doorframes, lintels and corner stones (AMO Website).

Nos. 4 and 5 (Heung Yeung Wai) Grade 1

The buildings were constructed by the Man clan and funded by remittances sent from clan members working overseas in Panama. The houses were built in 1928 and are built in Qing vernacular style of one hall layout with two storeys. They were constructed of green brick and rammed earth walls with cut granite doorframes, lintels and corner stones (AMO Website).

Watchtower (No. 4 Heung Yuen Wai) Grade 1

The watchtower was built around the same time as No. 1, 2, 3, 4 and 5. It was situated at the corner of No. 4 and joined up the rows of buildings. It is constructed of green brick and granite trim (AMO Website).

Chung Ancestral Hall (Ha Tam Shui Hang) Grade 3

The building is thought to have been constructed prior to 1874 by the Chung Clan. It was built by members of the Chung clan. It is a Qing Vernacular style building of one hall and one courtyard style plan (AMO Website).

The Tung Shan Temple (Wing Ping Tsuen) Grade 3

The building was constructed prior to 1894. It is a Qing vernacular style building with two halls, one courtyard and two bays layout. The building is constructed of green bricks with granite columns, pitched roofs with clay tiles.

iii. Proposed Graded Historic Buildings (as of May 17 2010)*Old Bridge (near Lin Ma Hang) Proposed Grade 3*

The bridge consists of cut granite spans and support. It is located on the pathway leading to the Residence of Ip Ting-sz, though it is thought to predate the building. It is believed that the bridge was originally used for access to the agricultural fields around the village. The bridge is in good condition (AMO Website).

Koon Ancestral Hall (Lin Ma Hang) Proposed Grade 3

The construction date of the hall is unknown, but it may date back as far as 300 years. The building is a Qing Vernacular style building with a two hall and one courtyard plan. It is constructed of green brick and mud brick walls. It has a pitched tile roof. The walls have been plastered and painted and the steps and curbs are cut granite (AMO Website).

Kiu Fong Ancestral Hall (Tsung Yuen Ha) Proposed Grade 3

The ancestral hall is a detached building situated in the southwest section of the village. It dates to 1933 and is built in the Qing Dynasty style and is a two hall- one courtyard plan. It consists of green brick and mud brick walls with a tile roof and curling end roof ridge (AMO Website).

Nos. 76 to 78 (Heung Yuen Wai) Proposed Grade 1

It consists of a row of three houses built in the early 1930's by F. C. Man after he returned to the village after working in Panama. They are built in the Qing vernacular style with nos. 76 and 77 being identical and no. 78 having an additional side chamber on the left and right hand side (AMO Website).

Ng Ancestral Hall (Fung Wong Wu) Proposed Grade 3

The building was constructed in the 1920's by members of the Ng clan. It is a detached building in the Vernacular Qing style of two hall – one courtyard. It has green brick walls and a pitched tile roof. It was damaged by flooding in 1994 and repaired in the original style (AMO Website).

Yeung Ancestral Hall (Fung Wong Wu) Proposed Grade 3

The hall was built between 1924 and 1945 (based on aerial photographs). It is a two hall – one courtyard style Qing vernacular building. The walls are of green brick with some sections being covered in plaster. It has been renovated in 1950 and in the 1970's, in the original style (AMO Website).

Wing Kit Study Hall (Tong Fong) Proposed Grade 3

The building was constructed in 1889 by Man Sing-fat to commemorate his grandfather. It is a Qing vernacular building with a two hall and one courtyard plan with side chambers. It was constructed of green bricks and has granite door frame at the main entrance. There is a large walled courtyard in front of the building (AMO Website).

Tin Hau Temple (Muk Wu) Proposed Grade 3

The temple was built around 1912-1913 by members of the To Clan. It is a Qing Vernacular style building in an assymetrical layout. It is a green brick structure with a pitched tile roof supported by timber rafters and purlins (AMO Website).

Entrance Gate (Muk Wu) Proposed Grade 3

Muk Wu is a walled village that originally had watchtowers at the corners and the entrance gate is situated at the middle of the front wall. It is connected to the buildings on either side. It is a Qing Vernacular style building with one hall and is rectangular in shape and constructed of green bricks (AMO Website).

Mi Tak Study Hall (Main Block and Ancillary Building) Lok Ma Chau Proposed Grade 2

The building is also known as Hin Cheung Tong and is believed to have been built around 1870. It was built by the descendants of Cheung Mi-tak. It is a Qing vernacular building of two hall – one courtyard plan with three bays. It is constructed of green brick walls with pitched tile roof. There are elaborate decorations on the building (AMO Website).

Kwan Ah School (Formerly Pan Lam Study Hall) Sheung Tam Shui Hang Proposed Grade 3

The school was originally known as the Pan Lam Study Hall and was built in 1930. The construction was funded by donations from the local villagers and was constructed by the Wan Clan. The building is two stories in height and rectangular in shape. The roof was originally pitched but was replaced by a flat concrete roof in the 1960's. There are two more modern blocks that are separate buildings from the original two storey building (AMO Website).

Shop-houses at Nos. 1-22 San Lau Street (Sha Tau Kok) Proposed Grade 2

Numbers 1-22 San Lau Street is a row of two-storey balconied shop-houses built in 1933 - 1934. The ground floors are mainly for commercial use and the upper floor residential. The buildings have narrow frontages and elongated plans. The roofs are pitched with Chinese tiles. The shop houses contain a mixture of western and Chinese elements and are a variation on the typical Veranda Shophouse stye, which can be classified as Chinese Eclectic.(AMO Website).

iv. Historical Villages

There are 20 traditional historical villages located within the Study Area and one located outside but in proximity of the Study Area (see **Table 7.8.1** above for the list of these

villages and **Figures 7.8.3a to f** for locations). A brief description of these historical villages is provided in the following:

Sha Tau Kok Area

Kong Ha

The village is recorded in the 1688 and 1819 Records. The villagers are Hakka people of the Tang clan who established their village about 300 years ago. Kong Ha is positioned on the eastern coast of Hong Kong at Sha Tau Kok outside but in proximity of the Study Area. The village faces south and comprises three rows of houses. Behind the village, the Yuen Tuen Shan hill was formerly a camp site for the British army from around 1950 to 1980 and is also the village graveyard (ERM 2007).

At Kong Ha features with cultural heritage value exist in the form of the Tang Ancestral Hall and the following village houses: Nos. 1, 2, 8-10, 23-27, 30, 36 and 43 Kong Ha (ERM 2007: KH01-07).

Shan Tsui

The village is located at the foot of a mountain spur, which may indicate the origin of the village's name (Shan Tsui meaning mountain spur/mouth of mountain). This may also be the reason for the village being referred to as Shan Tsui Che in the 1688 Record. Shan Tsui is a Hakka mixed clan village and has been in existence for over 300 years. Members of the Yaus, Mos, Tsui, Los and Lis clans lived here. The village is mainly south or south-east facing and has a large Fung Shui woodland behind it (ERM 2007: ST23).

At Shan Tsui the Hip Tin Temple is a Grade 2 Listed historical building, which is located outside but in proximity of the Study Area. Whilst features with cultural heritage value survive in the form of the Dizhen Huang Ancestral Hall, Shuding Huang Ancestral Hall, Siu Lung Yau Ancestral Hall, Earth Shrine, village houses Nos. 8-10, 27, 36, 38-39, 57, 59-61, 70-80, 87-88, 89b, 90 and 95-96, storage houses associated with Nos. 56 and 57b, and ruined houses Nos. 65-69 and are located within the Study Area. (ERM 2007: ST01-22).

Ha Tam Shui Hang

The village is situated at Nam Luk, Hung Fa Leng.. The village name means “carrying water from a stream” and is closely related to its geographical and environmental setting (ERM 2007). It is a Hakka village with mixed clan groups including the Wans, Chans, Yaus, Los and the Cheungs. The village was established in the mid-18th century. The original village, called Tam Shui Hang, consisted of both the current Ha Tam Shui Hang Village and Sheung Tam Shui Hang (AMO Website.).

At Ha Tam Shui Hang features with cultural heritage value exist in the form of the Wen Ancestral Hall, Tse Ancestral Hall, Chung Ancestral Hall, an Old Well and the following village houses: Nos. 52e, 54-56, 69-70, 75-77, 83-84, 94-95, 100, 101b, 102a, 108-110a, 120, 120a, 121a, 123b-124a, 126-126a, 128-131a, 132 and 136 Ha Tam Shui Hang (ERM 2007: HTSH01-19).

Sheung Tam Shui Hang

The village is situated at Nam Luk, Hung Fa Leng. The village name means “carrying water from a stream” and is closely related to its geographical and environmental setting (ERM 2007). It is a Hakka village with mixed clan groups including the Wans, Chans, Yaus, Los and the Cheungs.

At Sheung Tam Shui Hang features with cultural heritage value exist in the form of the Kwan A School, Chan Ancestral Hall, Yau Ancestral Hall, Fung Shui hill, and the following village houses: Nos. 4, 18-21, 23, 26-27, 47 and 50a Sheung Tam Shui Hang, and two storage houses (ERM 2007: STSH01-12).

Tsiu Hang

The Hakka village of Tsiu Hang was established around 100 years ago and is occupied by the Lis, a branch of the family originating in San Tsuen Sheung Wai. The village is located north-east of San Tsuen along the western side of the Sha Tau Kok Road. A Fung Shui woodland is positioned south-west of the village (ERM 2007: STSW08).

At Tsiu Hang features with cultural heritage value survive in the form of a Fung Shui wood and two village houses, namely Nos. 1 and 5 Tsiu Hang (ERM 2007: TH01-2).

Muk Min Tau

The Hakka village of Muk Ming Tau was founded about 100 years ago. It is occupied by the Li clan and the ancestors of this village were originally of the Tsiu Hang (ERM 2007). The village is well known for its substantial Fung Shui woodland.

At Muk Min Tau features with cultural heritage value exist in the form of an old well and four village houses, namely Nos. 1-3, 6, 7 (building north of), and 17-19 Muk Min Tau (ERM 2007: MMT01-5).

San Tsuen

This mixed Hakka clan village is inhabited by members of the Yau, Lin, Chan, Lan and Li families. The village has two distinct settlement foci: Sheung (Upper) Wai on higher ground and Ha (Lower) Wai located closer to the coast. There is a Fung Shui woodland positioned to the north and north-east of San Tsuen Sheung Wai (ERM 2007: STSW08).

At San Tsuen Sheung Wai features with cultural heritage value exist in the form of the Li Ancestral Hall, Yau Ancestral Hall, two earth shrines, a Fung Shui wood, and three village houses – namely Nos. 6-7, 8 (building east of), and 10-11 San Tsuen Sheung Wai (ERM 2007: STSW01-7).

At San Tsuen Ha Wai features with cultural heritage value survive in the form of seven village houses, namely Nos. 14-16, 22a, 23a, 28-32, 34, 35-36, building west of 35-36, and 44d San Tsuen Ha Wai (ERM 2007: STHW01-7).

Tong To

The Hakka village of Tong To is sub-divided into two areas associated with different clans: Tong To occupied by the Yaus and Tong To Ping Tsuen occupied by the Cheungs. The former clan established Tong To approximately 160 years ago, whilst the Cheungs migrated from Yim Tso Ha of Sha Tau Kok to found their village some 80 years ago (ERM 2007).

At Tong To features with cultural heritage value comprise a footbridge associated with an earth shrine, six village houses – namely Nos. 1a, 6-7 and 16, 8c and 10, 14-14a, 20 and 22 Tong To, and a storage house. Whilst at Tong To Ping Tsuen features with cultural heritage value comprise one village house (No.24-25) and a storage house (ERM 2007: TT01-10).

Ta Kwu Ling Area

Lin Ma Hang

According to local informants (former and present village representatives), Lin Ma Hang was established approximately about 600 years ago. It was first founded by the Lau and Kwun clans, who were later joined by the Sin clan and lastly by the Hakka Yip clan from Po On, who settled here about 300 years ago. Nowadays, the village is almost occupied entirely by members of the Yip clan. There is only one Lau family still living in the village. Most of the clans, whether resident in the village or not still maintain their ancestral hall and members of the Lau and Kwun clans still come back to visit their ancestral halls every year. The Sin clan ancestral hall collapsed in the 1970s. The name "Lin Ma Hang" was derived from the fact that in the past, a lot of "lin ma" fruit could be found in the stream. The villagers used to grow rice and sweet potatoes and regularly took any extra rice and collected wood to Sha

Tau Kok Hui and Shenzhen Hui for sale. According to local informants the historical graves at Ngong Tong belong to former residents of Lin Ma Hang, whose descendants immigrated a number of years ago. The informants also noted that a path between Lin Ma Hang and Ngong Tong had once existed, but that today it is not used and graves in Ngong Tong are now accessed through the NENT landfill site. The Declared Monument, the Residence of Ip Ting-sz is located near Lin Ma Hang village.

At Lin Ma Hang features with cultural heritage value exist in the form of the Residence of Ip Ting-sz, Ip Ancestral Hall, Koon Ancestral Hall, Lau Ancestral Hall (Which has been evaluated under the grading exercise and will remain an ungraded item, Kwan Tai Temple (which has been evaluated under the assessment of 1,444 historic buildings in Hong Kong undertaken by the Antiquities Advisory Board and will remain an ungraded item, Kwun Yam Temple, three entrance gates, three earth shrines, a footbridge, and a Fung Shui pond and hill. In addition, the following village houses were considered to have cultural heritage value: Nos. 31-32, 34, 41, 43-44, 59, 63-64, 88-90, 113, 158-160 and 183-185 Lin Ma Hang (ERM 2007: LMH01-25).

Heung Yuen Wai

Heung Yuen Wai is a Hakka village situated at the base of a hill facing south-west onto former agricultural fields. The village contains a relatively high percentage of historical buildings, but the majority are in poor to ruinous condition. To the west of the main village there are two compounds; one is a traditional terraced residential structure, whilst the second is a residential block in the form of a watchtower, constructed in the early part of the twentieth century by a villager who after making his fortune abroad returned to his native village and built this structure not only as a residence, but also as a lookout for bandits.

At Heung Yuen Wai features with cultural heritage value exist in the form of the Chaoxun Man Ancestral Hall, the watchtower at Nos. 4-5 Heung Yuen Wai, an earth shrine, a Fung Shui hill and woodland and six village houses – namely Nos. 1-3, 17, 68-74, and 76-78 Heung Yuen Wai (ERM 2007: HYW01-08).

Ha Heung Yuen

Ha Heung Yuen is a small village situated on an area of slightly raised land and surrounded by lower lying former agricultural fields. The village consists almost entirely of modern structures with a few traditional buildings, most of which are abandoned and in poor condition. To the south of the village there is a large traditional residential compound, which has been completely abandoned.

At Ha Heung Yuen features with cultural heritage value exist in the form of the Ting Yip Man Ancestral Hall, Man Ancestral Hall, and two village houses – namely Nos. 86 and 101-102 Ha Heung Yuen (ERM 2007: HHY01-04).

Tsung Yuen Ha

The village of Tsung Yuen Ha is situated at the base of a small hillock. The majority of the buildings in the village are modern, but there are a small number of historical structures interspersed throughout the village. Situated slightly to the Southwest of the main village is an old mansion which displays a mix of western and Chinese architectural features.

At Tsung Yuen Ha features with cultural heritage value survive in the form of the Ho Ancestral Hall, Kiu Fong Ancestral Hall, a large Fung Shui woodland, an old mansion (south-west of village), and six village houses – namely a building east of the Ho Ancestral Hall, a building between numbers 7 and 9, Nos. 34-38, a building east of No.48, Nos. 57-59, No. 61 (ERM 2007: TYH01-09) and 62 Tsung Yuen Ha (Which has been evaluated under the assessment of 1,444 historic buildings in Hong Kong undertaken by the Antiquities Advisory Board and will remain an ungraded item at present).

Kan Tau Wai

Kan Tau Wai is a medium sized village located near the junction of Ping Che and Lin Ma Hang Roads. The front row of the village consists of a mixture of modern and historical residential terraces, some of which are in very poor condition and abandoned and some of which have been renovated and are inhabited. There are a few other isolated historical buildings in the village, but all are in poor condition.

At Kan Tau Wai features with cultural heritage value survive in the form of the Fuk Tak Temple and seven village houses – namely Nos. 1-2, 4a, 6a-10, 14, 15-17, 18 and 27-27b (ERM 2007: KTW01-08).

Tong Fong

Tong Fong is a small village just within the boundaries of the closed border area that was founded approximately 200 years ago by the Hakka Man clan. The name derives from the past practice of growing sugar cane at the front of the village. The village contains a high percentage of historical buildings, including a large residential hall that has been maintained in excellent condition. It should also be noted that many of the historical structures still have their traditional decorative features intact.

At Tong Fong features with cultural heritage value exist in the form of the Wing Kit Study Hall and four village houses – namely Nos. 3-5, 8-9 (The Fuk Sin Tai: which has been evaluated under the assessment of 1,444 historic buildings in Hong Kong undertaken by the Antiquities Advisory Board and will remain an ungraded item at present), 18-19a, and 21-24 Tong Fong (ERM 2007: TF01-05).

Muk Wu Nga Yiu Tsuen

The village was settled by the Hakka Kong family originating in Jiangxi. It is believed that the clan settled in Hong Kong from Shenzhen in Late Qing. A watch tower was constructed for the protection of the village. The village is absent from the 1899 Record suggesting that it is little more than 100 years old. According to a local representative, before the 1950s the village produced bricks and roof tiles (ERM 2007).

At Muk Wu Nga Yiu Tsuen features with cultural heritage value exist in the form of a watch tower, two disused kilns and an abandoned village house at No. 12 Muk Wu Nga Yiu Tsuen (ERM 2007: MWN1-04).

Muk Wu Tsuen

Muk Wu Tsuen was founded perhaps as much as 600 years ago. It was once a walled village with four watch towers – two of which survive as residential properties, whilst portions of the walls are still extant including a gateway. There are currently three clans in the village, To, Wong and Yum. The village was founded by a brother of the founder of Chow Tin Tsuen. The village contains a mixture of modern and historical buildings. There is also a Tin Hau temple beside the village. The village is situated in the middle of a low lying agricultural area on a small hillock.

At Muk Wu Tsuen features with cultural heritage value survive as follows: a Tin Hau Temple, an associated earth shrine, a ruined To Ancestral Hall, an entrance gate, an old well, a Fung Shui hill/woodland and 21 village houses – namely 2-4b, 6, 8-12, 16, 18, 19, 21, 24a and b, 25, 27b, 32, 49, 51, 54-55, 57, 62, 78-79, 82, 84-85, 100, 112-114 Muk Wu Tsuen (ERM 2007: MWT01-27).

San Uk Ling

San Uk Ling is approximately 300 years old and was settled by the Punt Cheung family from Wong Pui Leng. The village used to have a wall but it was demolished some years ago. The village is situated at the base of a hill and has mostly modern buildings and a small number of historical residences.

At San Uk Ling features with cultural heritage value exist as follows: the Cheung Ancestral Hall, an entrance gate, and three village houses – namely No. 9 of First Row, No. 7 of Fourth Row, and Nos. 2-4 Fifth Row San Uk Ling (ERM 2007: SUL01-05).

Lei Uk

The Lei clan originated in Shaanxi and local informants considered the clan to be Hakka people (ERM 2007). About 350 years ago, the Lei clan migrated from Shaanxi and eventually settled in Lei Uk village about 150 years ago. Villagers were connected with the Lei clan of the Ko Po village in Fanling. The founder of the village was Mr. Li Wei Fu who settled in Lei Uk with his three sons. Thereafter, the villagers were separated into three branches known as fong, which included the descendents of these three sons. In the 1960s, the village population was over 400 people although, since then, many people had emigrated to the United Kingdom and Holland. Today, there are approximately 100 households registered in the village; however, roughly half of them actually live in the village. The village is located on the flood plain east of Ping Yuen River in proximity of the Study Area and generally faces north or north-west. Three small hills, located c. 500 metres south of the village, are regarded as Fung Shui woodlands by the village.

At Lei Uk features with cultural heritage value survive as follows: the Lei Ancestral Hall, a small ancestral hall at No. 6 Lei Uk (attached to village house 6a and nine village houses – namely Nos. 1a, 6a, 25a, 34, 36a, 37a, and 41a-c Lei Uk (ERM 2007: LU01-10).), The village also contains three Fung Shui woods and two Fung Shui trees,

Fung Wong Wu

Fung Wong Wu is a multi-surname village with members of the Hakka Ng and Yung clans and also with the Punti Yick clan. The village has a high percentage of historical buildings, some being abandoned and in poor condition whilst others are well maintained and inhabited. The village's Fung Shui wood surrounds the rear and sides of the village and contains mature camphor and banyan trees and large stands of bamboo. The village itself is situated on slightly elevated land in an area of low-lying marshy agricultural fields.

At Fung Wong Wu features with cultural heritage value survive as follows: the Yeung Ancestral Hall, Ng Ancestral Hall, earth shrine, Fung Shui wood, and nine village houses – namely Nos. 13, 15, 17-18, 21-21a, 22-23, 24-27, 29-31, 32, and 35-37 Fung Wong Wu (ERM 2007: FWW01-12).

Chow Tin Tsuen

Chow Tin Tsuen is a large village populated mainly by members of the To clan, but also by the Siu clan. The village contains a very high percentage of historical buildings, mostly abandoned and in relatively poor condition. The majority of the buildings are former green brick terraced units, but a school and large mansion were also identified during the site visit. The village is situated in slightly elevated land in an area of very low lying marshy land, parts of which are still under cultivation. The village has a number of mature camphor trees, stands of bamboo and banyan trees in the Fung Shui wood to its rear and also large individual specimens throughout the village.

At Chow Tin Tsuen features with cultural heritage value survive as follows: the Siu Ancestral Hall, Fuk Tak Temple, Ho Mansion with entrance gate, Chow Tin School, Kwun Tai Study Hall, entrance gate, Fung Shui wood, Fung Shui pond, and 15 village houses – namely Nos. 2-3, 6, 11-12, 15a-15b, 17-18, 30, 54-61, 62-65, 69f, 80 (which has been evaluated under the assessment of 1,444 historic buildings in Hong Kong undertaken by the Antiquities Advisory Board and will remain an ungraded item, 83, 88-93, 106, 113-113a-114, 116-118 Chow Tin Tsuen (ERM 2007: CTT01-20).

Lok Ma Chau Area

Liu Pok

Liu Pok is occupied by the Kwong clan and the first settlers were Kwong Yu and his two sons (ERM 2007). Those presently living in the village are part of the 23rd generation of the clan group; however, the village is now significantly depopulated as a result of emigration to Britain and Holland. The village is located in the northern foothills of Tai Shek Mo hill, west of Lo Wu KCRC Station. The village is north and north-west facing and comprises twelve parallel rows of houses. An open walkway forms the village's central axis and the Fuk Tak Kung temple is located at its southern end (ERM 2007).

At Liu Pok features with cultural heritage value survive as follows: the Fuk Tak Kung Temple, earth shrine, two old wells – one associated with a Shrine, 15 village houses – namely No. 2 First Row; Nos. 4, 12 and 15-16 Second Row; Nos. 8, 20 and 22 Third Row; Nos. 1 and 2 Fourth Row; Nos. 2a, 10-11, Sixth Row; No. 2 Seventh Row, Nos. 6, 8 and 11 Eighth Row, and two storage houses – one in front of No.9 First Row and the other north of No. 22 Third Row Liu Pok (ERM 2007: LP01-20).

Lok Ma Chau

Lok Ma Chau village was listed in the 1688 Record (ERM 2007). The villagers are Cantonese members of the Cheung clan, which originates in Fuqing, Fujian province, and they first settled in Lok Ma Chau in 1466. The village is situated in the western foothills of Fung Kong Shan, to the east of the Shenzhen River and west of the Ha Wan Tsuen Road. According to the village representative, the village was so named because the mountain behind it looks like a horse and Lok Ma means “get off from the horse”. Houses within the village are laid out in rows (ERM 2007).

At Lok Ma Chau features with cultural heritage value exist as follows: the Mi Tak Study Hall (Proposed Grade 2 Historic Building), earth shrine, and 15 village houses – namely No. 21-23, 26-28, 30c and 31, 39-40, 50, and 51 Lok Ma Chau (ERM 2007: LMC01-08).

v. Buildings and other features of cultural heritage value in Sha Tau Kok town

Boundary Stones along Chung Ying Street

Eight Anglo-Chinese Boundary Stones are recorded in Chung Ying Street, which formed the boundary between China to the east and British territory to the west (ERM 2007). The marker stones are made of granite and have rectangular cross-section, widening somewhat towards the base. They were erected to mark the new frontier following the leasing of the New Territories to Britain. Each stone carries a sequential number and an inscription in English “Anglo-Chinese Boundary 1899” on the side facing British territory. The side facing China bears the same inscription in Chinese with the date expressed as the 24th year of the reign of Emperor Kuan Hsu. In a recent field survey only five stones could be located on the ground. (ERM 2007: STK03).

Tin Hau Temple, Shun Lung Street

The Tin Hau Temple at the south end of Shun Lung Street was reconstructed in 1990 for the Yim Liu Ha village (ERM 2007). The temple is south facing and has an AI-type layout with extension structures on each sidewall. An open area in front of the temple houses a paper burner and earth shrine. The extensive use of modern materials in the reconstruction has meant that it is now regarded as a post-1950 building (ERM 2007).

Tin Hau Temple, Shun Hing Street

The Tin Hau Temple at the west end of Shun Hing Street was constructed in 1993 to replace an earlier structure whose Fung Shui was compromised by recent development (ERM 2007). The temple is south facing and has an AI-type layout with an extension structure on its eastern sidewall. An open area in front of the temple houses a paper burner and earth shrine (ERM 2007).

7.8.4 Identification and Evaluation of Archaeological impact

This section is to provide a preliminary assessment and recommendations for each proposed development based on desk-based information available at this stage and the findings of the preliminary archaeological survey. Details of the assessment of archaeological potential, evaluation of impacts and recommendations of each proposed development area are provided in the following **Table 7.8.2**. A general discussion of each Planning Area is given in the section below.

Table 7.8.2: Assessment of archaeological potential, evaluation of impacts and recommendations of each proposed development area

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
1. Planning Area 1			
1.1. * Proposed Eco-lodge (refer to Figures 4.113 to 4.115)			
Near Tse Koo Hang *The proposed eco-lodge will also extend into Planning Area 2.	No archaeological potential	The proposal is based on a series of scattered bungalows throughout a site looking north over the Hoo Hok Wai wetlands. It utilizes a pole-mounted design for the bungalows to mitigate impact on the ground cover. The proposed site of the eco-lodge is situated on hilly terrain consisting of solid geology of metasandstone with metaconglomerate and phyllite. Although there will still be direct impacts as a result of the proposed construction works, the area is evaluated as having no archaeological potential, and therefore, no mitigation measures are recommended.	No further action is required.
1.2. Lok Ma Chau Village Zone			
Lok Ma Chau Village	Low archaeological potential	The village is situated in a flat topography consisting of debris flow deposits. Although Lok Ma Chau is a traditional historical village with the potential for buried historical deposits, there is extensive disturbance from previous utility groundworks. In addition, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Project are anticipated. As well, the entire area is located on private lots.	No further action is required.
2. Planning Area 2			
2.1. Liu Pok Village Zone			
Liu Pok	Some archaeological potential	This historical village is mainly situated on Pleistocene and Holocene debris flow deposits and Holocene alluvium, with an average elevation of +6 to +13m PD. Liu Pok is an historical village with the potential for buried historical deposits. No previous archaeological testing had been carried out in this area and disturbance from utilities is limited. However, the proposed residential area of Liu Pok is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Project are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
2.2. Adaptive reuse of Lung Kai Public School			
Lung Kai Public School, Ma Tso Lung	No archaeological potential	Only refurbishment and redecoration works will be involved. There is no construction of utilities and drainage/sewerage pipes for the adaptive reuse of the school building at this planning stage. No impacts on underground deposits are anticipated from the proposed work.	No further action is required.
3. Planning Area 3			
3.1. Kong Nga Po Comprehensive Development Area			
Kong Nga Po	No archaeological potential	The landform was severely altered as a result of borrow area activities. The area is evaluated as having no archaeological potential, and therefore, no mitigation measures are recommended.	No further action is required.
3.2. San Uk Ling Village Zone			
San Uk Ling	No archaeological potential	The village is situated in a flat topography consisting of debris flow deposits. Although San Uk Ling is a traditional historical village with the potential for buried historical deposits, there is disturbance from recent construction of new village houses and utility groundworks. Moreover, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Project are anticipated.	No further action is required.
3.3. Muk Wu Nga Yiu Village Zone			
Muk Wu Nga Yiu Tsuen	Some archaeological potential	The village is situated in a flat topography consisting of debris flow deposits. Muk Wu Nga Yiu Kilns is situated in the western part of the village. Muk Wu Nga Yiu is also a traditional historical village with the potential for buried historical deposits. In addition, no previous testing was carried out in this area. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Project are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.
3.4. Muk Wu Village Zone			
Muk Wu Tsuen	Some archaeological potential	The village is situated in a flat topography consisting of debris flow deposits. Muk Wu Nga Yiu is a traditional historical village with the potential for buried historical deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Project are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
3.5. Chow Tin Village Zone			
Chow Tin Tsuen	Some archaeological potential	The village is situated in Pleistocene terraced alluvium and debris flow deposits. Chow Tin Tsuen is a traditional historical village with potential for buried historical deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Project are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.
3.6. Fung Wong Wu Village Zone			
Fung Wong Wu	Some archaeological potential	The village is situated in Pleistocene terraced alluvium and debris flow deposits. Fung Wong Wu is a traditional historical village with the potential for buried historical deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Project are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.
3.7. Crematorium and Columbarium at Sandy Ridge			
Sandy Ridge	No archaeological potential	Sandy Ridge Cemetery is situated in a mountainous and rocky area with thin soil cover. In addition, the proposed crematorium and columbarium are located within the boundary of the existing Sandy Ridge Cemetery. Although there will be direct impacts as a result of the proposed construction works, the area is evaluated as having no archaeological potential, and therefore, no further action is recommended.	No further action is required.
3.8. Adaptive reuse of Sam Wo Public School			
San Uk Ling	No archaeological potential	Only refurbishment and redecoration works will be involved. There is no construction of utilities and drainage/sewerage pipes for the adaptive reuse of the school building at this planning stage. No impacts on underground deposits are anticipated from the proposed work.	No further action is needed.

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
3.9. Man Kam To Development Corridor			
Near Man Kam To Road and Kong Nga Po Road	Some archaeological potential	<p>The area consists of Pleistocene terraced alluvium, debris flow deposits and solid geology of undivided phyllite, metasiltstone with metasandstone and graphite schist. The area is partially occupied by some existing container, vehicle parking, open storage and workshops. The overall planning intention of this OU zone is to enhance the local environment and permit non-polluting uses within a clean high quality environment. This zone is intended primarily for the preservation of the character of the rural area through the provision of logistics and commercial uses. It is anticipated that the proposed upgrading of the current open storage and workshops, provision of landscape buffer and eating places will not cause impacts on underground deposits. However, potential archaeological deposits may be damaged as a result of the proposed commercial, retail and warehouse buildings within this zone.</p> <p>Part of this area is located on private lots, testing of the entire area prior to land resumption is not feasible under this current study.</p> <p>A preliminary field evaluation was carried out in one limited area on Government land, which was accessible for testing and was considered to have some archaeological potential (Area P3U2C1) (see Figure 7.8.4a). Results of the preliminary field testing are presented in Appendix J. Based on the negative findings of the preliminary archaeological survey, it is recommended that, for future purposes of impact assessment, this specific site should be considered to have little or no archaeological potential. However, in the event of future development proposals for the untested portions of this area, further archaeological survey may be necessary in order to establish the archaeological potential.</p>	<p>The development layout is unknown at this planning stage. This proposed development area is identified as having some archaeological potential; however the extent of the impacts is subject to future development layout. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
3.10. Hung Lung Hang Residential Area			
Near Kong Nga Po and Hung Lung Hang	Some archaeological potential	<p>The proposed site is located mainly on Pleistocene terraced alluvium and debris flow deposits.</p> <p>The area is currently occupied by rural settlements, agricultural fields, open storage and vehicle parking. The proposed zoning is intended primarily for the preservation of the character of the rural areas. Uses or developments compatible with the rural landscape, such as passive recreation uses and a selected range of rural uses, may be allowed on application to the Town Planning Board, with a view to upgrading or improving the area or providing support to the local communities. It is anticipated that the proposed upgrading of the current open storage and workshops, development/uses such as passive recreation uses, provision of landscape buffer and eating places etc will not cause impacts on underground deposits. However, part of this area is located on private lots, testing of the entire area prior to land resumption is not feasible under this current study.</p> <p>A preliminary field evaluation was carried out in one limited area on Government land, which was accessible for testing and was considered to have some archaeological potential (Area P3U3C1) (see Figure 7.8.4b). Results of the preliminary field testing are presented in Appendix J. Based on the negative findings of the preliminary archaeological survey, it is recommended that, for future purposes of impact assessment, this specific site should be considered to have little or no archaeological potential.</p>	<p>The development uses and layouts are unknown at this planning stage. This proposed development area is identified as having some archaeological potential; however the extent of the impacts is subject to future development uses and its layouts.</p> <p>It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
3.11 * Recreational Area near Fung Wong Wu			
<p>Area between Shenzhen River and Ping Yuen River/ near Ta Kwu Ling Village, and north-east of Lei Uk, western part of Ta Kwu Ling (near Kaw Liu Village,</p> <p>*The proposed recreation area will also extend into Planning Area 4.</p>	<p>Some archaeological potential</p>	<p>The proposed site is situated mainly on Pleistocene terraced alluvium with elevations between +5.5 to +7.5 mPD. The area surrounding Ping Yuen River consists mainly of Holocene alluvium. The middle part of the site is located on a hillock comprising of undivided coarse ash crystal tuff of Tai Mo Shan Formation. Pleistocene debris flow deposits can be found surrounding this hillock. The western part of the area near Shenzhen River is situated mainly on Pleistocene terraced alluvium, Small areas of Holocene alluvium are recorded along watercourses and Pleistocene debris flow deposits surround hillocks, which consist of coarse ash crystal tuff of Tai Mo Shan Formation. Several historical villages are located in close proximity to this proposed site and no previous testing was carried out in this area. The area is currently occupied by settlements, agricultural fields and temporary structures. The proposed REC zone is intended for residential and recreational purposes. Depending on the final development layout plan, potential archaeological deposits may be damaged as a result of proposed works which involve groundworks. However, the entire site is located on private lots and testing of the area prior to land resumption is not feasible under this current study.</p>	<p>The development uses and layouts are unknown at this planning stage. This proposed development area is identified as having some archaeological potential; however the extent of the impacts is subject to future development uses and its layouts. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>
4. Planning Area 4			
4.1. Tong Fong Village Zone			
<p>Tong Fong</p>	<p>Some archaeological potential</p>	<p>The village is situated on Pleistocene terraced alluvium, Holocene alluvium and debris flow deposits. Tong Fong is a traditional historical village with the potential for buried historical deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.</p>	<p>It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.</p>
4.2. Kan Tau Wai Village Zone			
<p>Kan Tau Wai</p>	<p>Some archaeological potential</p>	<p>The village is situated on Pleistocene terraced alluvium. Kan Tau Wai is a traditional historical village with the potential for buried historical deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.</p>	<p>It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.</p>

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
4.3. Tsung Yuen Ha Village Zone			
Tsung Yuen Ha	Some archaeological potential	The village is situated on Pleistocene terraced alluvium and debris flow deposits. Tsung Yuen Ha is a traditional historical village with the potential for buried historical deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.
4.4. Heung Yuen Wai & Ha Heung Yuen Village Zone			
Heung Yuen Wai & Ha Heung Yuen	Some archaeological potential	The villages are situated on Pleistocene terraced alluvium and debris flow deposits. Heung Yuen Wai and Ha Heung Yuen are traditional historical villages with the potential for buried historical deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.
4.5. Chuk Yuen Resettlement Village Zone			
Chuk Yuen	Some archaeological potential	The village is situated on Pleistocene terraced alluvium and debris flow deposits. An Heritage Impact Assessment (HIA) was conducted for the Liantang/ Heung Yuen Wai BCP project in 2009 (CEDD 2009). According to this 2009 HIA report, no impacts on archaeological resources are anticipated from the development work based on the fact that the majority of the works will involve filling rather than groundworks. However, the report also stated that in the case of the identification of significant archaeological material during groundworks, the contractor should stop all groundworks and informed the AMO immediately.	No further action is required as stated in the Liantang/ Heung Yuen Wai BCP HIA report.

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
4.6. Recreational Area in Pak Fu Shan			
<p>Northern Part: To the north of Lin Ma Hang Road between Pak Fu Shan to Wang Lek</p>	<p>Some archaeological potential</p>	<p>The area is situated on Pleistocene terraced alluvium, Holocene alluvium and debris flow deposits.</p> <p>The proposed REC zone might consist of a horse riding school and associated staff accommodation. Depending on the final development layout plans, potential archaeological deposits may be damaged as a result of proposed development which involves groundworks.</p> <p>However, most of this area is located on private lots and testing of the entire area prior to land resumption is not feasible under this current study. As stated in the archaeological proposal, only government land was therefore proposed for field evaluation for this study. The government land within this Recreational Area in Pak Fu Shan was subdivided into two areas (Figure 7.8.4c):</p> <p>Area A: evaluated as having very low potential and no further action is recommended.</p> <p>Area B: evaluated as having very low potential except for Areas B1 (P4U2B1) and B2 (P4U2B2):</p> <p>A preliminary field evaluation was carried out in two limited areas on Government land, which were accessible for testing and were considered to have some archaeological potential (Areas P4U2B1 and P4U2B2). Results of the preliminary field testing are presented in Appendix J. Based on the evidence for historical and prehistoric deposits in the tested areas, it is suggested that, for future purposes of impact assessment, the tested sites should be considered to have some archaeological potential. Further testing would therefore be necessary should development of this area be planned.</p> <p>For those areas located in private land, field survey cannot be justified at this stage as no definitive information regarding impacts from development works is available. Therefore, further archaeological survey may be required in order to establish the archaeological potential of such blocks of private land should they be affected by future development proposals.</p>	<p>The development layout is unknown at this planning stage. This proposed development area is identified as having some archaeological potential; however the extent of the impacts is subject to future development uses and its layouts.</p> <p>It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
Southern Part: Mainly located to the south of Lin Ma Hang Road from Pak Fu Shan to Wang Lek area	Some archaeological potential	<p>The area comprises Pleistocene terraced alluvium, Holocene alluvium and Pleistocene debris flow deposits.</p> <p>Several historical villages such as Tsung Yuen Ha, Heung Yuen Wai and Ha Heung Yuen are located in close proximity to this area. No previous testing was carried out in this area.</p> <p>The proposed REC zone (southern part) is intended for residential and recreational purposes. Depending on the final development layout plans, potential archaeological deposits may be damaged as a result of any proposal which involves groundworks.</p> <p>However, the area is located entirely on private lots and testing of the area prior to land resumption is therefore not feasible under this current study.</p>	<p>The development layout is unknown at this planning stage. This proposed development area is identified as having some archaeological potential; however the extent of the impacts is subject to future development uses and its layouts.</p> <p>It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage.</p> <p>As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>
5. Planning Area 5			
5.1. Lin Ma Hang Village Zone			
Lin Ma Hang	Some archaeological potential	<p>The village is situated on Pleistocene terraced alluvium and debris flow deposits and has the potential to contain archaeological deposits.</p> <p>However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.</p>	<p>It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.</p>
5.2. San Kwai Tin Village Zone			
San Kwai Tin	Some archaeological potential	<p>The village is situated on Pleistocene terraced alluvium and debris flow deposits and has the potential to contain archaeological deposits.</p> <p>However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.</p>	<p>It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.</p>
5.3. Adaptive reuse of King Sau Public School			
Lin Ma Hang	No archaeological potential	<p>Only refurbishment and redecoration works will be involved. There is no construction of utilities and drainage/sewerage pipes for the adaptive reuse of the school building at this planning stage. No impacts on underground deposits are anticipated from the proposed work.</p>	<p>No further action is needed</p>

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
6. Planning Area 6			
6.1. Shan Tsui Village Zone			
Shan Tsui	Some archaeological potential	The village is situated on debris flow deposits, but as it is an historical village there is the potential for associated historical archaeological deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.
6.2. Tam Shui Hang Village Zone (including Sheung Tam Shui Hang and Ha Tam Shui Hang)			
Sheung Tam Shui Hang and Ha Tam Shui Hang	Some archaeological potential	The villages are situated on debris flow deposits, however as they are both historical villages, there is the potential for associated historical archaeological deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.
6.3. San Tsuen Village Zone			
San Tsuen	Some archaeological potential	The village is situated on debris flow deposits and solid geology of undivided fine ash to coarse ash tuffs, tuff breccias and tuffite. The Sha Tau Kok Archaeological Site is situated in the village zone. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential.
6.4. Tong To Village Zone			
Tong To	Some archaeological potential	The village is situated on debris flow deposits, but as it is an historical village, there is the potential for associated historical archaeological deposits. However, this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and no impacts from this current Study are anticipated. As well, the entire area is located on private lots.	It is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. However, the implementation will depend on the villager initiatives.
6.5. Adaptive reuse of Kwan Ah Public School			
Sheung Tam Shui Hang	No archaeological potential	Only refurbishment and redecoration works will be involved. There is no construction of utilities and drainage/sewerage pipes for the adaptive reuse of the school building at this planning stage. No impacts on underground deposits are anticipated from the proposed work.	No further action is required

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
6.6. Recreational Area near Tong To Ping Tsuen in Sha Tau Kok			
<p>Area near Tong To Ping Tsuen and area located to the north of the hillock behind Wu Shek Kok</p>	<p>Some archaeological potential</p>	<p>The area is situated mainly on Pleistocene terraced alluvium and small areas of Pleistocene debris flow deposits, except for areas around rivercourses and lower-lying areas, which are situated on Holocene alluvium.</p> <p>Several known archaeological sites and historical villages are located in close proximity to this area and no previous testing has been carried out.</p> <p>The area is currently occupied by settlements, agricultural fields, ponds and temporary structures. Subject to future development plans, the proposed REC zone is intended for residential and recreational purposes. Depending on the final development layout plans, potential archaeological deposits may be damaged as a result of any development proposal which involves groundworks.</p> <p>However, almost the entire site is located on private lots and testing of the area prior to land resumption is not feasible under this current study.</p>	<p>The development layout is unknown at this planning stage. This proposed development area is identified as having some archaeological potential; however the extent of the impacts is subject to future development uses and its layouts.</p> <p>It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage.</p> <p>As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>
*7. Proposed Cycle Track Network (Figure 6.2.4)			
7.1. Proposed Bicycle Track for Closed Area (Chau Tau to Ng Tung River)			
<p>From Chau Tau, through Hoo Hok Wai to Ng Tung River</p>	<p>Some archaeological potential</p>	<p>Most of the proposed alignments are located next to existing ponds or Ng Tung River, with low archaeological potential. Some areas are situated on alluvial deposits or debris flow deposits at the base of hillocks (e.g. area near Tak Yuet Lau and Chau Tau) with some archaeological potential. Subject to specifications for the proposed works, potential buried archaeological deposits in these areas may be impacted.</p>	<p>The proposed cycling track will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage.</p> <p>As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
7.2. Proposed Bicycle Track for Closed Area (Ping Che Road to Lin Ma Hang)			
From Ping Che Road to Wang Lek	Some archaeological potential	<p>Potential archaeological deposits may be impacted by the proposed works. The alignment is largely situated on a combination of colluvial deposits and alluvium along the base of a series of hillocks. There are also traditional villages with the potential for buried historical deposits. In addition, there is limited disturbance from utilities.</p> <p>A small section of the proposed alignment near Wang Lek was tested in 2006 for the Secondary Boundary Fence project. There were no archaeological findings in the field walking, 25 auger hole tests, and eight test pits. No further mitigation measures were recommended along this section (HKIA 2006).</p>	<p>The proposed cycling track will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>
*8. Proposed Improvement Works on Road Network (Figure 6.2.1)			
8.1. Single 2 Lanes Carriageway (7.3m) 2 Way			
Kong Nga Po Road	Low archaeological potential	<p>Potential archaeological deposits may be impacted by the proposed works. However, the area is situated mainly on solid geology of undivided phyllite, metasilstone with metasandstone and graphite schist, and a small area of debris flow deposits. The landform of some areas was severely altered as a result of borrow area activities</p>	<p>The proposed road improvement scheme will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
Lin Ma Hang Road (North of Lo Shue Ling to Ta Kwu Ling Village)	Some archaeological potential	Potential archaeological deposits may be impacted by the proposed works. Some areas are situated on terrace alluvium or base of a hillock with limited disturbance from utilities and no previous archaeological testing.	The proposed road improvement scheme will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.
8.2. Single 2 Lanes Carriageway (7.3m) 2 Way with Cycle Track			
Lin Ma Hang Road (Ping Che Road to Wang Lek)	Some archaeological potential	Potential archaeological deposits may be impacted by the proposed works. The alignment is largely situated on a combination of colluvial deposits and alluvium along the base of a series of hillocks. There are also traditional villages with the potential for buried historical deposits. In addition, there is limited disturbance from utilities. A small section of the proposed road alignment near Wang Lek was tested in 2006 for the Secondary Boundary Fence project. There were no archaeological findings in the field walking, 25 auger hole tests, and eight test pits. No further mitigation measures were recommended along this section (HKIA 2006).	The proposed road improvement scheme will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
8.3. Single Track Access Road (3.5m) 2 Way with Passing Bay			
Muk Wu	Some archaeological potential	Potential archaeological deposits may be impacted by the proposed works. The alignment is largely situated on a combination of colluvial deposits and terrace alluvium along the base of a series of hillocks. Muk Wu is also a traditional village with the potential for buried historical deposits. In addition, there is limited disturbance from utilities.	The proposed road improvement scheme will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.
Between Chuk Yuen and Kau Liu Tsuen	Some archaeological potential	Potential archaeological deposits may be impacted by the proposed works. The alignment is largely situated on a combination of colluvial deposits and terrace alluvium along the base of a series of hillocks. In addition, there is limited disturbance from utilities.	The proposed road improvement scheme will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
Ha Heung Yuen	Some archaeological potential	Potential archaeological deposits may be impacted by the proposed works. The alignment is largely situated on terrace alluvium along the base of a series of hillocks. Ha Heung Yuen is also a traditional village with the potential for buried historical deposits. In addition, there is limited disturbance from utilities and no previous archaeological investigation was carried out in this area.	The proposed road improvement scheme will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.
Shan Tsui	Some archaeological potential	Potential archaeological deposits may be impacted by the proposed works. The alignment is located in close proximity to Sha Tau Kok San Tsuen Archaeological Site. It is largely situated on a combination of colluvial deposits and terrace alluvium along the base of a hillock. Shan Tsui is also traditional village with the potential for buried historical deposits. In addition, there is limited disturbance from utilities.	The proposed road improvement scheme will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
Border Road (from Lok Ma Chau to Ping Hang)	Very low archaeological potential	Subject to specifications for the proposed works, potential archaeological deposits may be impacted by the proposed works. The alignment is located entirely along the existing Border Road and its raised causeway on former wetland/marine mud surrounding by ponds and has therefore very low archaeological potential.	The proposed road improvement scheme will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.
8.4. Single 4 lanes carriageway (14.6m) 2 way			
Man Kam To Road (between Kong Nga Po and San Uk Ling)	Low archaeological potential	Potential archaeological deposits may be impacted by the proposed works. However, the potential for finding <i>in situ</i> archaeological materials along the existing Man Kam To Road is low due to extensive disturbance from previous groundworks.	The proposed road improvement scheme will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
*9. Proposed Heritage Trail (refer to Figures 4.107 & 4.108)			
9.1. Proposed Heritage Trail			
Muk Wu to Ping Yuen River	Some archaeological potential	<p>In general, there is some potential for the area of the two traditional historical villages of Muk Wu and Muk Wu Nga Yiu. There is no potential for the section located at Ping Yuen River.</p> <p>Considering that the heritage trail generally involves minor paving work only, impacts on buried archaeological deposits are usually low.</p>	<p>The proposed heritage trail will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works.</p> <p>Should the proposed development works require groundworks, the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage.</p> <p>As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>
Ping Yuen River to Tong Fong	Some archaeological potential	<p>In general, the proposed alignment is situated on alluvial deposits with limited information on archaeological potential. In addition, archaeological materials were retrieved from Tong Fong during the 2005 archaeological watching brief carried out for the sewerage project (AAL 2005).</p> <p>Considering that the heritage trail generally involves minor paving work only, impacts on buried archaeological deposits are usually low.</p>	<p>The proposed heritage trail will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works.</p> <p>Should the proposed development works require groundworks, the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage.</p> <p>As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
Chow Tin, Fung Wong Wu and Lei Uk area	Some archaeological potential	In general, the area is situated on alluvial deposits with limited information on archaeological potential. Considering that the heritage trail generally involves minor paving work only, impacts on buried archaeological deposits are usually low.	The proposed heritage trail will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. Should the proposed development works require groundworks, the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.
Tsung Yuen Ha and Ha Heung Yuen	Some archaeological potential	In general, the area is situated on alluvial deposits with limited information on archaeological potential. In addition, archaeological materials were retrieved from Tsung Yuen Ha during the 2005 archaeological watching brief carried out for the sewerage project (AAL 2005). Considering that the heritage trail generally involves minor paving work only, impacts on buried archaeological deposits are usually low.	The proposed heritage trail will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works. Should the proposed development works require groundworks, the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage. As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.

Areas of impact	Archaeological potential	Preliminary Assessment of potential and Evaluation of Impacts	Preliminary Recommendations
Pak Fu Shan to Lin Ma Hang (along Lin Ma Hang Road)	Some archaeological potential	<p>The proposed alignment at Wang Lek was tested in 2006 for the Secondary Boundary Fence project. There were no archaeological findings in the field walking, 25 auger hole tests, and eight test pits. No further mitigation measures were recommended along this section (HKIA 2006).</p> <p>For other sections situated on alluvial deposits or area located within historical villages, there is limited information on archaeological potential.</p> <p>Considering that the heritage trail generally involves minor paving work only, impacts on buried archaeological deposits are usually low.</p>	<p>The proposed heritage trail will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works.</p> <p>Should the proposed development works require groundworks, the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage.</p> <p>As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>
*10. Proposed Hiking Trail (refer to Figures 4.101 to 4.106)			
10.1. Proposed Hiking Trails			
From Lok Ma Chau to Sha Tau Kok	Some archaeological potential	<p>Most of the proposed hiking trails are located along steep slopes of rocky mountainous areas with very low archaeological potential.</p> <p>For the section of proposed alignment located at Wang Lek, it was investigated in 2006 for the Secondary Boundary Fence project. There were no archaeological findings in the field walking, 25 auger hole tests, and eight test pits. No further mitigation measures were recommended along this section (HKIA 2006).</p> <p>But there are potential for buried archaeological deposits in areas located within or in close proximity to known archaeological sites (e.g. Sha Tau Kok San Tsuen Archaeological Site). Some areas are also situated on alluvial deposits with limited information on archaeological potential (e.g. area to the west of Tsung Yuen Ha).</p> <p>Considering that hiking trail generally involves minor paving work only, impacts on buried archaeological deposits are usually low.</p>	<p>The proposed hiking trail will be implemented under government project and subject to detailed investigation in next stage to work out the finalised alignment and detailed design for the proposed works.</p> <p>Should the proposed development works require groundworks, the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the next stage.</p> <p>As well, such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.</p>
<p>* NB: For the above proposed road network, cycle tracks, hiking trails and heritage trails, since the alignments are not finalised and no detailed design for the construction works is available at this stage, the assessment and recommendations are preliminary.</p>			

7.8.4.1 Planning Area 1 (Mai Po to Lok Ma Chau)

The proposed development in Planning Area 1 is dominated by green belt and conservation area, which will have no impacts on buried archaeological deposits and no mitigation

measures are required. As well, no impacts are anticipated for the proposed village zone at Lok Ma Chau as this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth).

A pole-mounted design for the bungalows will be adopted to mitigate impacts on the ground cover. Although there will be direct impacts on buried archaeological deposits as a result of the proposed construction work for the eco-lodge at Tse Koo Hang, the area is evaluated as having no archaeological potential as it is situated on hilly terrain.

Although the majority of the proposed cycle track and hiking trails are situated along existing roads which will have existing impacts on the potential deposits from the road construction in the past, the potential for archaeological material cannot be ruled out. The proposed cycle track and hiking trails will be implemented under government projects. The finalised alignment and detailed design for the proposed development works are still subject to the findings of detailed investigations to be carried out in the next stage. It is recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required prior to the proposed works in the next stage to confirm the archaeological potential and to further evaluate the impacts of any groundworks required by the cycle track and hiking trails.

7.8.4.2 Planning Area 2 (Lok Ma Chau to Ng Tung River)

The northern part of Planning Area 2 (i.e. Hoo Hok Wai and Ta Sha Lok) are evaluated as having no archaeological potential as they are largely situated on marine mud, fill or are occupied by ponds. Therefore, no mitigation measures are recommended in such areas.

Similar to Planning Area 1, this Planning Area 2 is dominated by proposed green belt and conservation area, with no impacts on potential archaeological deposits. No mitigation measures are required. As well, no impacts are anticipated for the proposed village zone at Liu Pok as this area is zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth). However, it is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. The implementation will depend on the villager initiatives.

Only refurbishment and decoration work are proposed for the Lung Kai School, no impacts on underground deposits are anticipated and hence no mitigation measures are required.

Although the majority of the proposed cycle track and hiking trails are situated along existing roads which will have existing impacts on the potential deposits from the road construction in the past, the potential for archaeological material cannot be ruled out. The proposed cycle track and hiking trails will be implemented under government projects. The finalised alignment and detailed design for the proposed development works are still subject to the findings of detailed investigations to be carried out in the next stage. It is recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required prior to the proposed works in the next stage to confirm the archaeological potential and to further evaluate the impacts of any groundworks required by the cycle track and hiking trails.

7.8.4.3 Planning Area 3 (Ng Tung River to Ping Che Road)

There is only one known archaeological site (Muk Wu Nga Yiu Kilns) and several non-listed sites (Yuen Leng Tsai, Tong Fong and Tsung Yuen Ha) in this Planning Area. Nonetheless, the archaeological potential is generally high as there has been little disturbance to potential deposits in the past and only limited archaeological investigations have been conducted within the Planning Area. The areas of high potential are located around the historical villages, on the lower hill slopes, and around the bases of hillocks scattered throughout the Study Area.

A large part of this Planning Area is reserved for green belt and conservation area which will have no impacts on buried archaeological deposits and no mitigation measures are required. There are several village zones located in this Planning Area including Muk Wu, Muk Wu Nga Yiu, Chow Tin, Fung Wong Wu, and San Uk Ling. No impacts are anticipated as these areas are zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth). However, it is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential (i.e. Muk Wu, Muk Wu Nga Yiu, Chow Tin and Fung Wong Wu). The implementation will depend on the villager initiatives.

Man Kam To Development Corridor and Hung Lung Hang Residential Area are proposed in this planning area. Some areas are situated on alluvial deposits with limited information from archaeological investigation. Potential archaeological deposits may be damaged as a result of the proposed development if groundworks are involved. As stated in the archaeological proposal, only government land was proposed for field evaluation for this project. A preliminary field evaluation was carried out in selected areas on Government land, which were accessible for testing and were considered to have some archaeological potential (i.e. Area P3U2C1 near Man Kam To Road and P3U3C1 near Hung Lung Hang). Based on the negative findings of the preliminary archaeological survey, it is recommended that, for future purposes of impact assessment, these two tested areas should be considered to have little or no archaeological potential. Part of these areas is located on private lots and testing prior to land resumption is not feasible under this current study. As well, due to access issue, no testing was available for Area A of Man Kam To Development Corridor and Area A1 of Hung Lung Hang Residential Area, which are both located on Government land and evaluated as having some potential. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage. Such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.

The proposed Recreational Area near Fong Wong Wu in Ta Kwu Ling (the entire Recreational Area including the portion in Planning Area 4) is intended for residential and recreational purposes. Depending on the final development layout plan, potential archaeological deposits may be damaged as a result of proposed works which involve groundworks. However, the entire site is located on private lots and testing of the area prior to land resumption is not feasible under this current project. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage. Such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.

Sandy Ridge Cemetery is situated in a mountainous and rocky area with thin soil cover. In addition, the proposed crematorium and columbarium are located within the boundary of the existing Sandy Ridge Cemetery. Although there will be direct impacts as a result of the proposed construction works, the area is evaluated as having no archaeological potential, and therefore, no mitigation measures are recommended.

Although the majority of the proposed road alignments, hiking trails and heritage trails are situated along existing roads which will have existing impacts on the potential deposits from the road construction in the past, the potential for archaeological material cannot be ruled out. The proposed road alignments, hiking trails and heritage trails will be implemented under government projects. The finalised alignment and detailed design for the proposed development works are still subject to the findings of detailed investigations to be carried out in the next stage. It is recommended that the future project proponent shall consult with

AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required prior to the proposed works in the next stage to confirm the archaeological potential and to further evaluate the impacts of any groundworks required by road improvement works, hiking trails and heritage trails.

7.8.4.4 Planning Area 4 (Ping Che Road/ Ta Kwa Ling to Wang Lek)

There is only one known archaeological site (Tong To Shan Archaeological Site) and several non-listed sites (Tong Fong and Tsung Yuen Ha) located within or in close proximity to this Planning Area. Nonetheless, the archaeological potential is generally high as there has been little disturbance to potential deposits in the past and only limited archaeological investigations have been conducted within the Planning Area. The areas of high potential are located around the historical villages, on the lower hill slopes, and around the bases of hillocks scattered throughout the Planning Area.

This Planning Area 4 is dominated by proposed green belt and conservation area, which will have no impacts on buried archaeological deposits and no mitigation measures are required. As well, no impacts are anticipated for the proposed village zones located at Tsung Yuen Ha, Ha Heung Yuen, and Heung Yuen Wai as these areas are zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth) and for Chuk Yuen village resettlement area which was proposed under another project - Liantang /Heung Yuen Wai BCP. However, it is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. The implementation will depend on the villager initiatives. The Preliminary Environmental Review for the Resettlement Area for the Resite of Chuk Yuen Village for Agreement No CE 45/2008 (CE) has indicated that no impacts on archaeological resources are anticipated from the development work in the Chuk Yuen Village Resettlement Area. Recreational area is proposed between Pak Fu Shan and Wang Lek. Some areas are situated on alluvial deposits with limited information from archaeological investigation. Potential archaeological deposits may be impacted as a result of the proposed works. As stated in the archaeological proposal, only government land was proposed for field evaluation for this project. A preliminary field evaluation was carried out in selected areas on Government land, which were accessible for testing and were considered to have some archaeological potential (i.e. Areas P4U2B1 and P4U2B2 in the northern part of this proposed Recreation Zone). Based on the evidence for historical and prehistoric deposits in the tested areas, it is suggested that, for future purposes of impact assessment, the area should be considered to have some archaeological potential. Further testing would therefore be necessary should development of this area be planned. Moreover, most of this proposed recreational area is located on private lots and testing prior to land resumption is therefore not feasible under this current study. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage. Such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.

Although the majority of the proposed road alignments, cycle track, hiking trails and heritage trails are situated along existing roads which will have existing impacts on the potential deposits from the road construction in the past, the potential for archaeological material cannot be ruled out. The proposed road alignments, cycle track, hiking trails and heritage trails will be implemented under government projects. The finalised alignment and detailed design for the proposed development works are still subject to the findings of detailed investigations to be carried out in the next stage. It is recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required prior to the proposed works in the next stage to confirm the archaeological potential and to further evaluate the impacts of any groundworks required by road improvement works, cycle track, hiking trails and heritage

trails. It should be noted that the proposed upgrading to the existing access road at Chuk Yuen Village Resettlement Area has been included in the Preliminary Environmental Review for the Resettlement Area for the Resite of Chuk Yuen Village for Agreement No CE 45/2008 (CE), and archaeological deposits are not expected in the area.

7.8.4.5 Planning Area 5 (Wang Lek to San Kwai Tin)

The Tong To Shan Archaeological Site is located to the south of Lin Ma Hang. The archaeological potential in this Planning Area is generally high as there has been little disturbance to potential deposits in the past. In addition, previous archaeological investigations carried out in this area are limited, and most of the project Study Area has not been tested.

However, this Planning Area is dominated by proposed green belt, Country Park, conservation or agricultural areas. No impacts on potential archaeological deposits are anticipated and no mitigation measures are required. As well, no impacts are anticipated for the proposed village zones located at Lin Ma Hang and San Kwai Tin as these areas are zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth). However, it is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. The implementation will depend on the villager initiatives.

Only refurbishment and decoration work are proposed for the King Sau Public School, no impacts on underground deposits are anticipated and hence no mitigation measures are required.

Although the majority of the proposed road alignments, cycle track, hiking trails and heritage trails are situated along existing roads which will have existing impacts on the potential deposits from the road construction in the past, the potential for archaeological material cannot be ruled out. The proposed road alignments, cycle track, hiking trails and heritage trails will be implemented under government projects. The finalised alignment and detailed design for the proposed development works are still subject to the findings of detailed investigations to be carried out in the next stage. It is recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required prior to the proposed works in the next stage to confirm the archaeological potential and to further evaluate the impacts of any groundworks required by road alignments, cycle track, hiking trails and heritage trails.

7.8.4.6 Planning Area 6 (San Kwai Tin to Sha Tau Kok)

The presence of several known archaeological sites (namely Sha Tau Kok San Tsuen Archaeological Site, Sha Tau Kok Shek Kiu Tau Archaeological Site, Pok Tau Ha Old Lime Kiln and Sha Tau Kok Old Stone Lime Kilns) highlights the high archaeological potential of this Study Area. The presence of both prehistoric and historical archaeological materials and cultural layers was confirmed by previous archaeological investigations. As this Planning Area is relatively undeveloped, the potential for undisturbed archaeological deposits is high.

There are several village zones located in this Planning Area including Shan Tsui, Tam Shui Han, San Tsuen and Tong To. No impacts are anticipated as these areas are zoned as 'Village' compatible to the existing uses (i.e. village expansion as a result of natural growth). However, it is recommended that archaeological investigation of the building sites be undertaken with the owners' permission prior to village house construction in areas of archaeological potential. The implementation is subject to the villager initiative.

No impacts on potential archaeological deposits are anticipated for the proposed green belt, Country Park, agricultural or conservation areas and no mitigation measures are required.

The proposed Recreation Area in Tong To Ping Tsuen is situated in an area of archaeological potential. Several known archaeological sites with similar geological and topographical settings are located in its close proximity. It is therefore recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required in the submission of Section 16 planning application for this zone in the next stage. Such requirements should be laid down as a condition in the statutory town plans to alert the future project proponent to include such impact assessment in the early planning stage.

Although the majority of the proposed road alignments and hiking trails are situated along existing roads which will have existing impacts on the potential deposits from the road construction in the past, the potential for archaeological material cannot be ruled out. The proposed road alignments and hiking trails will be implemented under government projects. The finalised alignment and detailed design for the proposed development works are still subject to the findings of detailed investigations to be carried out in the next stage. It is recommended that the future project proponent shall consult with AMO to confirm if an Archaeological Impact Assessment (AIA) - including detailed archaeological field evaluation is required prior to the proposed works in the next stage to confirm the archaeological potential and to further evaluate the impacts of any groundworks required by road alignments and hiking trails.

7.8.5 Identification and Evaluation of Built Heritage impact

The majority of built heritage resources in the closed border area is found in the historical villages and will be located within village zones. As such impacts to the resources will be from small scale village development. There are no infrastructure projects in the proposed development plans that will impact within these zones. The New Territories Exempted Houses (NTEH) development and any development proposal in the village should follow the existing land administrative procedure and any proposal affecting Declared Monuments, Graded Buildings and Proposed Graded Buildings should be addressed to the Antiquities and Monuments Office for comments.

The following impact assessment is undertaken for each of the draft development planning areas. Areas zoned as green belts and for agriculture will not have any impacts on built heritage resources and as mentioned above the resources situated in village zones will not be impacted by any proposed developments. A preliminary impact assessment for the proposed improvement to the existing road network, proposed hiking and heritage trails and cycle track is also included.

7.8.5.1 Planning Area 1 (Mai Po to Lok Ma Chau)

The majority of this Planning Area will be zoned as green belt and conservation areas and there will be no impact to any existing resources in these areas. The area to the northwest of San Tin consists of ponds and as such has little or no built heritage potential.

The proposed ecolodge is located at Tse Koo Hang. The development will be low impact and it is unlikely that any built heritage resources would be located within the proposed development area. However, as there is the potential for historical graves to be present in the proposed development area, the future project proponent shall consult with AMO to confirm if a BHIA is required as part of the development of the ecolodge site in next stage.

7.8.5.2 Planning Area 2 (Lok Ma Chau to Ng Tung River)

The area at Hoo Hok Wai (HHW) and Ta Sha Lok consists of ponds with low potential for built heritage resources. The future project proponent shall consult with AMO to confirm if a BHIA is required to identify any historical graves that may be located in the Study Area.

7.8.5.3 Planning Area 3 (Ng Tung River to Ping Che Road)

This planning area is situated on solid geology, as opposed to recent reclamation, i.e. it has the potential to contain resources that were built before 1950 such as historical graves, and the areas do have the potential for containing built heritage resources. The area to the

northwest of the study area contains the existing Sandy Ridge cemetery and the future planned use is also for burial purposes. As such the development of the area will not have any impacts on built heritage resources.

Another area proposed for Development Corridor runs to the southeast of Man Kam To Road towards Kong Nga Po. There are no historical villages in this area, but there is potential for isolated features such as historical graves and shrines to be located here. Any proposed developments in this area have the potential for containing such resources and the future project proponent shall consult with AMO to confirm if a BHIA is required in next stage.

The Hung Lung Hang Residential Area situated to the southeast of Kong Na Po is currently agricultural and the proposed developments are for rural use. The development in this area is intended to enhance and preserve the existing rural and agricultural character of the area and no adverse impacts to built heritage resources, however isolated graves or shrines are also expected to arise in this zoned area.

Finally, a section of this planning area at Ta Kwu Ling has been proposed to be zoned for recreational purposes. There are three historical villages in the vicinity; Kan Tau Wai and Fung Wong Wu (which contains the *Ng and the Yeung Ancestral Halls (both proposed Grade 3)*). The area has the potential to contain built heritage resources, such as historical graves and shrines associated with the villages. Even though the proposed developments will be low impact, the future project proponent shall consult with AMO to confirm if a BHIA is required in next stage to ensure that no built heritage resources are damaged or destroyed.

7.8.5.4 Planning Area 4 (Ping Che Road/ Ta Kwu Ling to Wang Lek)

The majority of this planning area will be zoned as green belt and conservation areas and villages. As such, no impacts to built heritage resources will occur in these areas. The main development in this area is the proposed Heung Yuen Wai BCP which will be studied under separate EIA. The two remaining areas in this RDP are located along both sides of Lin Ma Hang Road near Pak Fu Shan and near the Ping Yuen River. There are two historical villages in the area around the Ping Yuen River; Kan Tau Wai and Tong Fong (which contains the Wing Kit Study Hall also proposed Grade 3).. The area to the north of Lin Ma Hang Road is known to contain modern graves and has the potential to contain historical graves. The proposed recreational developments will be low impact, but the future project proponent shall consult with AMO to confirm if a BHIA is required in next stage to ensure that no built heritage resources are damaged or destroyed.

7.8.5.5 Planning Area 5 (Wang Lek to San Kwai Tin)

There are no planned development zones in this planning area and no impacts to built heritage resources will arise.

7.8.5.6 Planning Area 6 (San Kwai Tin to Sha Tau Kok)

The majority of this Planning Area will be zoned as Country Park, green belt, agriculture, conservation area or village zone. A small section containing an existing sewage treatment plant is located to the south of Ha Tam Shui Hang, but will not impact on any built heritage resources. One section of this area has been proposed to be zoned for recreational development at Sha Tau Kok. There is one historical village in the area, Tong To Tsuen. Although this is not an intensive style of development, there is the potential for isolated built heritage resources, such as historical graves to be damaged by this type of proposed development. The future project proponent shall consult with AMO to confirm if a BHIA is required for the proposed trails to ensure that no isolated resources such as historical graves are damaged during the construction works

7.8.5.7 Adaptive Reuse of Disused Schools

The following schools have been highlighted for adaptive reuse; Lung Kai Public School at Ma Tso Lung (Holiday camp/ recreation facility), Sam Wo Public School near Muk Wu Nga

Yiu (Administration Centre for Agrici-tourism, organic agriculture activities), King Sau Public School at Lin Ma Hang (Museum/ exhibition Centre) and Kwan Ah Public School at Ha Tam Shui Hang (small scale holiday camp). BHIA for the adaptive reuse of the former schools will not be required. However, subject to consultation with AMO, the redevelopment proposals for the adaptive reuse of the schools might require Heritage Impact Assessments (HIA) as defined in the Development Bureau Technical Circular No. 6/2009, including conservation management plans to be undertaken by the project proponent.

7.8.5.8 Proposed Cycle Tracks/ Heritage Trails and Hiking Trails

The proposed tracks and trails will utilize existing road and trail corridors in order to minimize impacts. The development of the network will be low impact. The future project proponent shall consult with AMO to confirm if a BHIA is required in next stage for the proposed trails to ensure that no isolated resources such as historical graves are damaged during the construction works, the BHIA should also be used to maximise the beneficial impacts to built heritage resources in the vicinity of the proposed trails.

7.8.5.9 Proposed Road Improvements

The proposed road improvements are all located along existing roads. As the road improvement works will be confined to existing networks, the potential impacts are expected to be minor in nature. There is potential for historical graves and shrines to be situated in close proximity to existing roads and the future project proponent shall consult with AMO to confirm if a BHIA is required for the proposed road improvement projects in next stage.

7.8.6 Conclusion

The preliminary impact assessment has identified areas of archaeological potential that may be adversely impacted by the proposed development works. It has also included recommendations for further assessment in the next stage.

The development plans for the closed border area will for the most part benefit built heritage resources. The impacts that may arise from the proposed developments are minor in nature. The inclusion of BHIA for projects identified as having the potential to impact built heritage resources (such as the improvement to the road network, hiking trails and cycle tracks) will ensure that mitigation measures can be implemented and that no unacceptable impacts will arise.

7.9 Summary of Planning Control Framework, Implementation Schedule of Environmental Submission Requirements

This section provides a summary of the specific environmental issues and planning control framework, as well as the implementation schedule for environmental mitigation measures and submission requirements of the RDP in each of their respective development stage.

It should be noted that this Study is a broad brush assessment only and when individual project is implemented, detailed studies and/or assessments shall be carried out by the respective project proponent(s) to evaluate and confirm adequacy and technical feasibility of the recommended environmental mitigation measures and infrastructure facilities. Some of these environmental mitigation measures and infrastructure facilities should also be implemented as recommended prior to population intake of the proposed developments.

7.9.1 Eco-lodge

The eco-lodge site is proposed with a planning intention for the provision of sustainable-based tourism in the form of an eco-lodge that does not have any adverse impact on the local environment and adopts best practice principles in design, construction and operation. It promotes education in terms of the surrounding natural and ecological environment and provides direct financial benefits to the local environment and residents. The dominant use should be for low intensity eco-tourism, although ancillary could include dining facilities and recreation facilities (pool, sauna, day spa, yoga room, interpretive areas, bird watching posts etc) as long as the dominant use remains low intensity eco-tourism.

The Eco-lodge is located within the WBA under the TPB Guidelines for Application for Developments within Deep Bay Area Under Section 16 of the Town Planning Ordinance (TPB PG-NO. 12B) (the TPB Guidelines). The applicant shall submit the planning application with supporting technical assessments for Departmental Comments and for the approval of the TPB. An Ecological Impact Assessment including 12-month survey is required, which shall ensure appropriate siting, appropriate design of the lodges and adequate mitigation to avoid impact on the important wetland habitats. As there is the potential for historical graves to be present in the proposed development area, the future project proponent shall consult with AMO to confirm if a BHIA is required as part of the submission. Consultation with AMO should be made for any future development within this zoning.

7.9.2 Adaptive reuse of schools

7.9.2.1 General

Adaptive re-use of the schools is subject to private initiative, and might not require planning approval as it is under “G/IC” zone and relevant GIC uses are always permitted. Only applications to LandsD would be required. The recommended mitigation measures are advisory only. Upon receipt of the formal application, relevant departments’ views should be sought, including EPD. Subject to further consultation with AMO, a HIA as defined in the Development Bureau Technical Circular No. 6/2009 might be required as part of the proposal. Relevant bureau’s support on the re-development proposals for adaptive use of the former school should also be sought.

7.9.2.2 Adaptive reuse of Ex-Lung Kai Public School

The Explanatory Statement of future statutory plan shall state that the Ex-Lung Kai Public School would be subject to potential lead, dust and fixed noise impact from Lo Wu Classification Range and helicopter noise impacts from Lo Wu Classification Range Helipad, and appropriate mitigation measures such as fixed windows and central air conditioning including mechanical ventilation shall be provided to minimise such impacts. Necessary consideration for the incorporation of metal and dust filters is required during design stage of the project to ascertain the indoor air quality is not compromised. The future project applicant shall carry out a detailed environmental assessment to mitigate any adverse air quality impact due to lead, dust and noise emissions arising from the existing Lo Wu Classification Range. Possibility of relocating or enclosing the shooting range shall be explored and considered by relevant government departments in future to eliminate these impacts to the maximum practicable extent. This shall be coordinated by relevant departments and resolved prior to the land release. Attention shall be drawn to the Hong Kong Police Force on any at source mitigation proposal. In addition, with the opening of the Closed Area and increasing accessibility from improved road infrastructure, the reliance on helicopter transport to the Closed Area is expected to reduce from the already infrequent usage currently. The need for the helipad is still uncertain. In future, the possibility of relocating the helipad could be explored and considered by the relevant departments taking into account the latest planning context and operational requirements.

7.9.2.3 Adaptive reuse of Ex-King Sau Public School

The Explanatory Statement of the future statutory plan shall explicitly state that the Ex-King Sau Public School would be subject to adverse helicopter noise impacts from Kong Shan Helipad and appropriate mitigation measures such as fixed windows and central air conditioning including mechanical ventilation shall be provided to minimise such impacts. Also, in future, the possibility of relocating the helipad shall be explored and considered by the relevant departments taking into account the latest planning context and operational requirements.

7.9.3 Kong Nga Po Comprehensive Development Area

The planning approval mechanism is also considered a practical means to address the potential environmental impacts. It has been recommended that future zoning of the

proposed development contain all potential uses within Column 2 of the Statutory Notes (as per the “CDA” zones) such that any development may only be permitted with conditions subject to TPB approval(s). The applicant shall submit a Master Layout Plan with supporting technical assessments for Departmental Comments and for the approval of the TPB. A planning brief shall include all the development requirements and conditions to tackle the potential environmental problems, including but not limited to the following:

- Consideration to the development layout and design shall always be given to impact avoidance as a top priority.
- Potential noise impacts from nearby roads and the Kong Nga Po shooting range shall be addressed through proper building disposition, orientation, and design e.g. self-protective building design, use of noise tolerant buildings (such as club house) to screen the sensitive uses from the noise; building orientation to avoid the sensitive facades facing the shooting range and the major roads, a proper acoustic barrier, etc.
- Potential air quality impact due to lead and dust emission on the sensitive uses should be avoided to the maximum practicable extent through proper master layout design such as setback distance.

Upon expiry of the waiver under the STT and STW to the operators of the livestock farms within the Closed Area, LandsD shall, in considering the grant/renewal of a waiver to the operators in future, seek advice and take into account the latest land use intention in the area. For livestock farms governed by STT, it is in theory terminable by exercising the termination clause under their respective tenancy agreements. Appropriate measures/ incentives/ compensation package for voluntary cessation/ removal of such farms operation should be in place to encourage phasing out of such uses in the area. In addition, possibility of relocating or enclosing the Kong Nga Po shooting range should be explored in future to eliminate the impacts to the maximum practicable extent. This shall be coordinated by relevant government departments and resolved prior to the land release. Attention shall be drawn to the Hong Kong Police Force on any at source mitigation proposal. It should be noted that all environmental nuisance/issues such as livestock farms and shooting ranges shall be tackled before population intake of the proposed uses.

7.9.4 Hung Lung Hang Residential Area

Similar to Kong Nga Po Comprehensive Development Area, upon expiry of the waiver under the STT and STW to the operators of the livestock farms within the Closed Area, LandsD shall, in considering the grant/renewal of a waiver to the operators in future, seek advice and take into account the latest land use intention in the area. Potential road traffic noise impacts shall be addressed through proper building disposition, orientation, and design e.g. self-protective building design, use of noise tolerant buildings to screen the sensitive uses from the noise; building orientation to avoid the sensitive facades facing the major roads, proper noise barriers, etc. All environmental nuisance/issues shall be tackled before population intake of the proposed uses.

The explanatory statement and the Notes of the statutory town plans should also specify that the proposed development area is identified as having some archaeological and heritage resource potential, and the future proponent shall consult with AMO to confirm if an AIA including detailed archaeological field evaluation and a BHIA is required. All future uses in this area will require planning approval.

7.9.5 Man Kam To Development Corridor

The proposed Man Kam To Development Corridor is recommended to be included within a zone whereby the potential uses within the PHI Consultation Zone of the SSWTW are contained under Column 2 of the Statutory Notes such that any development may only be permitted with conditions subject to TPB approval(s) while only some less-intensive uses outside the consultation zone are recommended as Column 1. The explanatory statement and the Notes of the statutory town plans should specify that any net population increase

within the consultation zone is subject to PHI hazard and is not desirable; and that a quantitative risk assessment shall be conducted for any development that falls within the consultation zone with an aim to limiting population growth. It should also specify that the proposed development area is identified as having some archaeological and heritage resource potential and the future proponent shall consult with AMO to confirm if an AIA including detailed archaeological field evaluation and a BHIA is required.

The applicant shall submit the planning application with supporting technical assessments for the approval of TPB. Approval of the hazard assessment should be obtained before submission of the planning application to TPB for any future development in case it will result in population increase within consultation zone.

Besides, upon expiry of the waiver under the STT and STW to the operators of the livestock farms within the Closed Area, LandsD shall, in considering the grant/renewal of a waiver to the operators in future, seek advice and take into account the latest land use intention in the area.

7.9.6 Recreational Area in Pak Fu Shan

The horse riding school is considered as worst case planning scenario for the proposed recreational area in Pak Fu Shan. Potential nuisance could be avoided by proper layout and development design. The environmental impacts shall be addressed by the following measures and planning control.

- Undertake the same operational practice and mitigation measures adopted in the 2008 Olympic Equestrian Event for the proposed horse stable:
 - Temperature and humidity should be maintained at about 22°C and 70% inside the stable boxes throughout the seasons
 - Sheet cover and water spraying system should be installed at the waste storage area to control odour emission.
 - The new stable should be designed to a higher standard of full enclosure construction and equipped with activated carbon filter of minimum 90% odour removal efficiency at the exhaust. In addition, properly enclosed containers should also be provided for the stockpiling of stable waste
- Sufficient buffer distance from the horse stable should be adopted to avoid odour impacts. All sensitive uses including also residential uses (ancillary to other recreation uses and subject to planning approval) should not be sited within the recommended buffer area. This can be implemented through section 16 submissions for all proposed sensitive developments, e.g. residential use, private club.
- Sewerage provision for the stable complex shall consist of two systems: the low flow interceptor system and the foul water system. This system shall be designed with an attenuation tank and pumping station to ensure that the low flow run-off will be discharged to public sewer in a controlled manner during periods of low flow condition.
- Any potential odour nuisance due to Shenzhen River on this development area should be avoided by proper layout and development design.
- Adequate setback distances from the Pak Fu Shan Operational Base Helipad and Pak Fu Shan Camp Helipad, and the Lin Ma Hang Road shall also be allowed to avoid potential noise impacts. All sensitive uses including also residential uses (ancillary to other recreation uses and subject to planning approval) should not be sited within the recommended buffer area. This can be implemented through Section 16 submissions for all proposed sensitive developments, e.g. residential use, private club.
- The explanatory statement and the Notes of the statutory town plans should specify that the proposed development area is identified as having some archaeological and

heritage resource potential, and the future proponent shall consult with AMO to confirm if an AIA including detailed archaeological field evaluation and a BHIA is required.

If an animal waste composting plant is proposed, it will be a Designated Project under the EIAO. A statutory EIA is required to assess and confirm its potential environmental impact and recommended mitigation measures.

7.9.7 Recreational Area near Fung Wong Wu

Potential environmental nuisance could be avoided by proper layout design and development planning. Sufficient setback distance should be allowed between Luofang Sewage Treatment Plant and all sensitive uses of the planned Recreational Area near Fung Wong Wu including also residential uses (ancillary to other recreation uses and subject to planning approval) to avoid potential odour impact. Any potential odour nuisance due to Shenzhen River on this development area shall also be avoided by proper layout and development design. Besides, adequate setback distances from Lin Ma Hang Road, Ping Che Road and Liantang Highway should be allowed to avoid adverse road traffic noise impacts. All sensitive uses including residential uses (ancillary to other recreation uses and subject to planning approval) should not be sited within these recommended buffer areas. The explanatory statement and the Notes of the statutory town plans should also specify that this proposed development area is identified as having some archaeological and heritage resource potential, and the future proponent shall consult with AMO to confirm if an AIA including detailed archaeological field evaluation and a BHIA is required. All future uses in this area will require planning approval of Section 16 submission.

In addition, barrier next to the outbound kiosks (i.e. the southern kiosks) at lower floor of Liantang / Heung Yuen Wai BCP is required, in order to protect the proposed Recreational Area near Fung Wong Wu. This shall however be subject to detailed assessment under the EIA of Liantang/ Heung Yuen Wai BCP.

7.9.8 Recreational Area near Tong To Ping Tsuen

Similarly, potential environmental nuisance could be avoided by proper layout design and development planning. Sufficient setback distance from the nearby roads should be adopted. All sensitive uses including also residential uses (ancillary to other recreation uses and subject to planning approval) should not be sited within the recommended buffer area. The explanatory statement and the Notes of the statutory town plans should also specify that this proposed development area is identified as having some archaeological and heritage resource potential, and the future proponent shall consult with AMO to confirm if an AIA including detailed archaeological field evaluation and a BHIA is required. All future uses in this area will require planning approval of Section 16 submission. Consultation with AMO and EPD should be made for any future development within this zoning.

7.9.9 Village Development

It should be noted that the Lok Ma Chau and San Uk Ling Village Zones are not proposal of new landuse. It only reflects the existing zoning, i.e. Village Type Development (V) of the statutory OZP S/YL-ST/8 – San Tin and OZP S/NE-FTA/10 Fu Tei Au & Sha Ling respectively for which the houses (New Territories Exempted House only) are always permitted under Column I.

The explanatory statement in S/YL-ST/8 – San Tin has already specified that the areas along Castle Peak Road and adjacent to San Tin Highway would be subject to traffic noise impact. Any proposed development near these roads should be provided with adequate mitigation measures to minimise such impacts, such as self-protective building design, building disposition and orientation, barrier, setback distance etc.

The explanatory statement in OZP S/NE-FTA/10 has also specified that the western part of San Uk Ling Village is subject to adverse traffic noise impact generated by the cross-boundary traffic along Man Kam To Road. In addition, since the western edge of the village will be required for the proposed extension of the Man Kam To VHA, future village house

development near the road should be avoided and suitable noise mitigation measures such as self-protective building design, noise barrier, etc would be required.

Other proposed village development including Liu Pok, Muk Wu Nga Yiu, Muk Wu, Chow Tin, Fung Wong Wu, Tong Fong, Kan Tau Wai, Tsung Yuen Ha, Heung Yuen Wai and Ha Heung Yuen, San Kwai Tin, Lin Ma Hang, Shan Tsui, Sheung Tam Shui Hang, Ha Tam Shui Hang, Muk Min Tau, Nga Yiu Tau, Tsiu Hang, San Tsuen, Tong To etc. may also be subject to adverse traffic noise impact. The explanatory statements in the future statutory OZP shall follow the same practices as the existing OZPs such as OZP S/NE-FTA/10 Fu Tei Au & Sha Ling to specify that the future village house development near the major noise sources should be avoided and suitable noise mitigation measures such as self-protective building design, noise barrier would be required. This will provide a guideline for relevant Government to vet small house applications through Lands Department.

The Lin Ma Hang village area would be subject to infrequent and short duration impact from helicopter noise from Kong Shan Helipad; and the village areas in Sha Tau Kok would be subject to both fixed noise impact from Sha Tau Kok BCP and infrequent and short duration impact from helicopter noise from Sha Tau Kok helipad. It is recommended that such environmental concerns and considerations shall also be explicitly stated in the explanatory statement of the future statutory plans for which the houses (New Territories Exempted House only) are always permitted under Column I. However, with the opening of the Closed Area and increasing accessibility from improved road infrastructure, the reliance on helicopter transport to the Closed Area is expected to reduce from the already infrequent usage. The need for the helipad is still uncertain. In future, the possibility of relocating these two helipads shall be explored and considered by the relevant departments taking into account the latest planning context and operational requirements. It is recommended to extend the current 8m high noise barrier by 150m next to Shan Tsui village to fully screen the entire Sha Tau Kok BCP to protect all concerned proposed village zones nearby.

In order to avoid any LFG hazard, all proposed developments, including also proposed village zones, should be recommended outside the LFG Consultation Zone of the NENT Landfill and its Extension. Nonetheless, parts of the proposed village zones of Ha Heung Yuen and Heung Yuen Wai fall within the 250m LFG Consultation Zone to reflect the existing village houses. Should any new developments be built in-between the existing village houses within the consultation zone, suitable building protection design measures should be provided including:

- Gas-resistant polymeric membranes which can be incorporated into the floor or wall construction as a continuous sealed layer. Membranes should be able to demonstrate low gas permeability and resistant to possible chemical attack and may incorporate aluminium wafers to improve performance.
- Annulus around any service entry points shall be effectively blocked by means of sealant, collars or puddle flanges as appropriate.

The LFG mitigation measures would be advisory and its implementation shall be subject to village initiatives. Mitigation measures should be forwarded to the Lands Department and relevant government departments for consideration of future applications for small house grants. These provisions should also be implemented for any other structures within the consultation zone. The potential landfill gas risks associated with developments within the consultation zone should also be considered by relevant government authorities for licensing applications under column 1 uses where there is no planning control (e.g. eating places, schools on ground floor of NTEH). It is recommended that the prevailing practice/measures for village house development within the LFG Consultation Zone of the NENT Landfill and its Extension adopted for small house applications and licensing applications for Column 1 uses of NTEH (e.g. the existing Wo Keng Shan Tsuen which is

only at about 100m from the landfill site boundary according to the approved NENT landfill extension EIA) shall be followed.

Village house construction at Tsung Yuen Ha, Heung Yuen Wai, Ha Heung Yuen, Lin Ma Hang, Tong To, Muk Min Tau and Sheung/Ha Tam Shui Hang would have direct and indirect impacts to existing streams of high ecological values; and should be avoided in riparian corridor either side of the stream course and ensure no modification of existing natural streams. It should be acknowledged that the boundaries for indigenous villages have been designated to reflect the existing village environs and have been calculated in ensuring that there is adequate land available for village development as per the 10 year small-house demand. The private land ownership of the area next to the stream should also be respected. In this regard, an administrative buffer would appear to be able to protect the stream from the direct and indirect impacts of village house development. LandsD administrative guidelines on Small House development within 15m of natural stream should therefore be applied. Any application lodged for a NTEH within a distance of 20m from the stream course should be referred to AFCD, and reference to EPD ProPECC PN 5/93.

The New Territories Exempted Houses (NTEH) development and any development proposal in the village should follow the existing land administrative procedure and any proposal affecting Declared Monuments, Graded Buildings and Proposed Graded Buildings should be addressed to the Antiquities and Monuments Office for comments.

7.9.10 Proposed Crematorium at Sandy Ridge

The existing Sandy Ridge Cemetery is recommended to be zoned for Cemetery Uses to reflect the existing designation and functions of the site. The design and emission limits of the proposed crematorium should need to comply with those stated in “A Guidance Note on the Best Practicable Means for Incinerators (Crematoria) BPM 12/2 (06). Adequate setback in accordance with the current proposed landuse framework shall be maintained or justified otherwise in accordance with HKPSG and TM-EIAO as appropriate. It should also be noted that the proposed crematorium is a Designated Project under Schedule 2, Part I (Item N.4) of EIAO. A statutory EIA is required to assess and confirm its potential environmental impact and recommended mitigation measures.

7.9.11 Implementation Schedule

A summary of the implementation schedule of environmental mitigation measures and environmental submission is given in **Table 7.9.1** below. The implementation agents for some proposed works are yet to be confirmed. The recommended mitigation measures and sewerage infrastructure shall be in place prior to the population intake of the respective developments and for road projects, it shall be implemented together with the road improvement works.

Table 7.9.1 Implementation schedule of environmental mitigation measures and environmental submission

Fig Ref.	Planning Control, Environmental Submission and Mitigation Measures	Implementation Agent	Future Investigation Stage
<i>Eco-lodge</i>			
4.11	Application for Developments within Deep Bay Area Under Section 16 of the Town Planning Ordinance (TPB PG-NO. 12B) (the TPB Guidelines) is required. Detailed environmental studies including Ecological Impact Assessment should be conducted as part of submission. The future project proponent shall also consult with AMO to confirm if BHIA is required.	Future project applicant	Section 16 application

Fig Ref.	Planning Control, Environmental Submission and Mitigation Measures	Implementation Agent	Future Investigation Stage
<i>Adaptive reuse of All Ex- Schools</i>			
4.27 4.43 4.75 & 4.91	Subject to further consultation with AMO, a HIA, as defined in the Development Bureau Technical Circular No. 6/2009 might be required as part of the proposal. Relevant bureau's support on the re-development proposals for adaptive use of the former schools should be sought.	Future project applicant	Application to LandSD
<i>Adaptive reuse of Ex-Lung Kai Public School</i>			
4.27	Appropriate mitigation measures such as fixed windows and central air conditioning together with metal and dust filters shall be considered. The recommended mitigation measures are advisory only. LandsD shall consider and seek advice from EPD during the process of application.	Future project applicant	Application to LandSD
	Possibility of relocating or enclosing the shooting range shall be explored to eliminate the impacts to the maximum practicable extent. This shall be coordinated by relevant government departments and resolved prior to the land release. Possibility of relocating the helipad shall also be explored and considered by the relevant departments taking into account the latest planning context and operational requirements.	Attention shall also be drawn to Hong Kong Police Force if relocation or enclosing the shooting range and to GFS if relocation of the helipad is considered by relevant government departments.	-
<i>Adaptive reuse of Ex-King Sau Public School</i>			
4.75	Appropriate mitigation measures such as fixed windows and central air conditioning shall be considered. The recommended mitigation measures are advisory only. LandsD shall consider and seek advice from EPD during the process of application.	Future project applicant	Application to LandSD
	The possibility of relocating the Kong Shan helipad to eliminate the noise impacts to the maximum practicable extent shall be further explored by relevant government departments.	Attention shall also be drawn to GFS if relocation of the helipad is proposed.	-
<i>Kong Nga Po Comprehensive Development Area</i>			
4.43	All potential uses will be within Column 2 of the Statutory Notes (as per the "CDA" zones) such that any development may only be permitted with conditions subject to TPB approval(s). The applicant shall submit a Master Layout Plan with supporting technical assessments for Departmental Comments and for the approval of the TPB. A planning brief shall include all the development requirements and conditions to tackle the potential environmental problems, including setback distance, proper building disposition, orientation, and design e.g. self-protective building design, use of noise tolerant buildings, proper barrier, etc. to mitigate the road traffic noise impact and fixed noise impact arising from the Kong Nga Po shooting range.	Future project applicant	Section 16 application

Fig Ref.	Planning Control, Environmental Submission and Mitigation Measures	Implementation Agent	Future Investigation Stage
	The possibility of relocating or enclosing the Kong Nga Po shooting range to eliminate the environmental impacts to the maximum practicable extent shall be further explored by relevant government departments.	Attention shall also be drawn to Hong Kong Police Force if relocation or enclosing the shooting range is proposed.	-
	Upon expiry of the waiver under the STT and STW to the operators of the livestock farms, LandsD shall, in considering the grant/renewal of a waiver to the operators in future, seek advice and take into account the latest land use intention in the area.	Lands Department	Livestock farms license renewal application
<i>Hung Lung Hang Residential Area next to Kong Nga Po</i>			
4.43	The future project proponent shall consult with AMO to confirm if AIA (including detailed archaeological field evaluation if required) and BHIA are required for submission of Section 16 planning application. Consultation with AMO should be made for any future development within this zoning.	Future project applicant	Section 16 application
	Upon expiry of the waiver under the STT and STW to the operators of the livestock farms, LandsD shall, in considering the grant/renewal of a waiver to the operators in future, seek advice and take into account the latest land use intention in the area.	Lands Department	Livestock farms license renewal application
<i>Man Kam To Development Corridor</i>			
4.43	The proposed Man Kam To Development Corridor is recommended to be included within a zone whereby the potential uses within the consultation zone of the SSWTW are contained under Column 2 of the Statutory Notes such that any development may only be permitted with conditions subject to TPB approval(s) while only some less-intensive uses outside the consultation zone are recommended as Column 1. Any development may only be permitted with conditions subject to TPB approval(s) to ensure that all development with population increase within the PHI Consultation Zone of Sheung Shui Water Treatment Works (SSWTW) is subject to a quantitative risk assessment. Detailed environmental assessment studies are required for submission of Section 16 planning application. The future project proponent shall also consult with AMO to confirm if an AIA (including detailed archaeological field evaluation if required) and BHIA are required.	Future project applicant	Section 16 application
	Upon expiry of the waiver under the STT and STW to the operators of the livestock farms, LandsD shall, in considering the grant/renewal of a waiver to the operators in future, seek advice and take into account the latest land use intention in the area.	Lands Department	Livestock farms license renewal application

Fig Ref.	Planning Control, Environmental Submission and Mitigation Measures	Implementation Agent	Future Investigation Stage
<i>Recreational area in Pak Fu Shan</i>			
4.59	<p>The environmental impacts shall be addressed by the following appropriate measures and planning control.</p> <ul style="list-style-type: none"> • Undertake same operation practice and mitigation measures adopted in the 2008 Olympic Equestrian Event (see above for details) • Adequate setback distance from the horse stable, Shenzhen River, Lin Ma Hang Road and Pak Fu Shan Operational Base Helipad and Pak Fu Shan Camp Helipad should be allowed in the future development layout plan to avoid potential odour nuisance and noise impacts. All sensitive uses including also residential uses (ancillary to other recreation uses and subject to planning approval) should not be sited within the recommended buffer area. • Sewerage provision for the stable complex shall consist of two systems: the low flow interceptor system and the foul water system. This system shall be designed with an attenuation tank and pumping station to ensure that the low flow run-off will be discharged to public sewer in a controlled manner during periods of low flow condition. • The future project proponent shall consult with AMO to confirm if AIA (including detailed archaeological field evaluation if required) and BHIA are required. Consultation with AMO should be made for any future development within this zoning. 	Future project applicant	Section 16 application for residential use
	If animal waste composting plant is proposed, it will be a Designated Project under the EIAO. A statutory EIA is required to assess and confirm its potential environmental impact and recommended mitigation measures.	Future project applicant	EIA and Investigation stage or preliminary design stage
<i>Recreational area near Fung Wong Wu</i>			
4.43 & 4.59	<p>The environmental impacts shall be addressed by the following appropriate measures and planning control.</p> <ul style="list-style-type: none"> • Adequate setback distance between Luofang Sewage Treatment Plant and any proposed sensitive uses within the recreational area should be allowed in the future development layout plan. Any potential odour nuisance due to Shenzhen River should also be avoided by proper layout and development design. • Adequate setback distance from Lin Ma Hang Road, Ping Che Road and Liantang Highway should be adopted to avoid potential noise impacts. All sensitive uses including also residential uses (ancillary to other recreation uses and subject to planning approval) should not be sited within the recommended buffer area. • The future project proponent shall consult with AMO to confirm if AIA (including detailed archaeological field evaluation if required) and BHIA are required. Consultation with AMO should be made for any future development within this zoning. 	Future project applicant	Section 16 application for residential use

Fig Ref.	Planning Control, Environmental Submission and Mitigation Measures	Implementation Agent	Future Investigation Stage
	Barrier next to the outbound kiosks (i.e. the southern kiosks) at lower floor of Liantang / Heung Yuen Wai BCP is required in order to protect the proposed Recreational Area near Fung Wong Wu from potential fixed noise impact from BCP. The proposed mitigation measures shall be subject to detailed assessment under the EIA of Liantang/ Heung Yuen Wai BCP.	CEDD	EIA and Investigation stage or preliminary design stage of Liantang/ Heung Yuen Wai BCP
<i>Recreational area near Tong To Ping Tsuen</i>			
4.91	<p>The environmental impacts shall be addressed by the following appropriate measures and planning control.</p> <ul style="list-style-type: none"> • Sufficient setback distance from the nearby roads should be adopted. All sensitive uses including also residential uses (ancillary to other recreation uses and subject to planning approval) should not be sited within the recommended buffer area. • The future project proponent shall consult with AMO to confirm if AIA (including detailed archaeological field evaluation if required) and BHIA are required. Consultation with AMO should be made for any future development within this zoning. 	Future project applicant	Section 16 application for residential use
<i>Village Development</i>			
4.27, 4.43, 4.59, 4.75 & 4.91	<p>The explanatory statements in the future statutory OZP shall follow the same practices as the existing OZPs such as OZP S/NE-FTA/10 Fu Tei Au & Sha Ling to specify that the future village house development near the major noise sources should be avoided and suitable noise mitigation measures such as self-protective building design, noise barrier would be required. This will provide a guideline for relevant Government to vet small house applications through Lands Department.</p> <p>Archaeological investigation of the building sites in areas of archaeological potential is recommended prior to village house construction. The implementation however will depend on the villager initiatives.</p> <p>The New Territories Exempted Houses (NTEH) development and any development proposal in the villages should follow the existing land administrative procedure and any proposal affecting Declared Monuments, Graded Buildings and Proposed Graded Buildings should be addressed to the Antiquities and Monuments Office for comments.</p>	Villager initiatives, Lands Department	Small house applications
4.59, 4.75 & 4.91	<p>Village house construction at Tsung Yuen Ha, Heung Yuen Wai, Ha Heung Yuen, Lin Ma Hang, Tong To, Muk Min Tau and Sheung/Ha Tam Shui Hang could have direct and indirect impacts to existing streams of high ecological values; this should be avoided by protection of the riparian zone and no modification of existing natural streams. Any application lodged for a NTEH within a distance of 20m from the stream should be referred to AFCD, and reference to EPD ProPECC PN 5/93.</p>	Lands Department, AFCD	Small house applications

Fig Ref.	Planning Control, Environmental Submission and Mitigation Measures	Implementation Agent	Future Investigation Stage
4.59	All areas designated for new village type development in Heung Yuen Wai and Ha Heung Yuen village zones should be provided outside the NENT Landfill consultation zone. However, should any new developments be built in-between the existing village houses within the consultation zone, suitable building protection design measures should be provided including incorporation of gas-resistant polymeric membranes into the floor or wall construction, blocking annulus around any service entry points by means of sealant, collars or puddle flanges as appropriate. The LFG mitigation measures would be advisory and its implementation shall be subject to village initiatives. Mitigation measures should be forwarded to the Lands Department and relevant government departments for consideration of future applications for small house grants. These provisions should also be implemented for any other structures within the consultation zone. The potential landfill gas risks associated with developments within the consultation zone should also be considered by relevant government authorities for licensing applications under column 1 uses where there is no planning control (e.g. eating places, schools on ground floor of NTEH).	Villager initiatives, Lands Department and EPD	Small house applications, Licensing applications under column 1 uses e.g. eating places, schools on ground floor of NTEH
4.91	Current 8m high noise barrier next to Shan Tsui village shall be extended by 150m to fully screen the entire Sha Tau Kok BCP to protect all concerned proposed village zones nearby.	To be confirmed	Detailed investigation stage
<i>Proposed Crematorium at Sandy Ridge</i>			
74.43	Design and emission limits should need to comply with those stated in "A Guidance Note on the Best Practicable Means for Incinerators (Crematoria) BPM 12/2 (06). The proposed crematorium is a Designated Project under the EIAO. A statutory EIA is required to assess and confirm its potential environmental impact and recommended mitigation measures.	To be confirmed	EIA and Investigation stage or preliminary design stage
<i>Road Improvement</i>			
4.11, 4.27, 4.43, 4.59, 4.75 & 4.91	At source noise mitigation measures including low noise surfacing materials on Man Kam To Road, Kong Nga Po Road, Lin Ma Hang Road, Ping Che Road, Sha Tau Kok Road and Sha Ho Road, and various types and sections of roadside noise barriers shall be adopted to protect the village zones and proposed developments, as well as to ensure the traffic noise impact on the existing sensitive receivers due to a road improvement project/work would only be insignificant. Detailed assessment shall be carried out by the respective proponent, and the recommended mitigation measures shall be evaluated and confirmed subject to detailed investigation, including engineering practicability, land resumption, traffic engineering, cost and social implication, etc. Besides, supporting facilities should be located in ecologically non-sensitive areas. For road improvement work at Muk Wu, ecological Impact Assessment shall be conducted by future project proponent to assess impacts and mitigation in detail. The future project proponent shall consult with AMO to confirm if an archaeological impact assessment and BHIA are required as part of the submission to confirm the archaeological potential and built heritage resources, and to further evaluate the impacts.	To be confirmed	EIA and Investigation stage or preliminary design stage

Fig Ref.	Planning Control, Environmental Submission and Mitigation Measures	Implementation Agent	Future Investigation Stage
<i>Proposed Cycle Track, Hiking Trail, Heritage Trail</i>			
4.11, 4.27, 4.43, 4.59, 4.75 & 4.91	Should the proposed works require development groundworks, the future project proponent shall consult with AMO to confirm if an archaeological impact assessment and BHIA are required as part of the submission to confirm the archaeological potential and built heritage resources, and to further evaluate the impacts. Besides, supporting facilities should also be located in ecologically non-sensitive areas.	To be confirmed	EIA and Investigation stage or preliminary design stage
<i>Proposed Sewerage Infrastructure</i>			
6.3.7–6.3.12	Detailed assessment shall be carried out by the respective proponent to determine the most preferred options of the proposed sewerage infrastructure and evaluate the associated environmental impacts. The future project proponent shall consult with AMO to confirm if an archaeological impact assessment and BHIA are required as part of the submission to confirm the archaeological potential and built heritage resources, and to further evaluate the impacts.	To be confirmed	EIA, Investigation stage or preliminary design stage

Note: There may be more proposed developments to be identified as Designated Projects under the EIAO and the statutory EIAO processes are required to be followed.

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莫稚：〈沙頭角新村遺址發掘報告〉，〈香港考古學會會刊〉第十五卷（2002年）。