路政署
HIGHWAYS DEPARTMENT
主要工程管理處
MAJOR WORKS PROJECT MANAGEMENT OFFICE

Highways Department
Major Works Project Management Office

Agreement No.CE58/2000
Design and Construction Assignment for
Widening of Tolo Highway / Fanling Highway
Between Island House Interchange and Fanling

Supplementary Agreement No. 3

Environmental Review Report

November 2008

Hyder Consulting ARUP BLACK & VEATCH

Hyder-Arup-Black & Veatch Joint Venture

HIGHWAYS DEPARTMENT
MAJOR WORKS PROJECT MANAGEMENT OFFICE

AGREEMENT NO. CE58/2000
DESIGN AND CONSTRUCTION ASSIGNMENT FOR WIDENING OF TOLO HIGHWAY / FANLING HIGHWAY BETWEEN ISLAND HOUSE INTERCHANGE AND FANLING

SUPPLEMENTARY AGREEMENT NO. 3

ENVIRONMENTAL REVIEW REPORT

6	11/2008	Environmental Review Report	VC	AW	JK	AB
REV.	DATE	DESCRIPTION	BY	CHK'D	REV'D	APP'D
Hyder-Arup-Black & Veatch Joint Venture			DOCUMENT NO. EA00798/R62/6			REV. 6

Environmental Review Report

Contents

1. Introduction

1.1 Preamble

Tolo Highway and Fanling Highway are expressways in the North East New Territories connecting Sha Tin, Tai Po and Fanling. These highways form a vital part of the strategic Route 9, which links Hong Kong Island to the border of Shenzhen. At present, this section of Route 9 is dual 3-lane carriageway. However, at several major interchanges along this section of Route 9, the highway is only dual-2 lane. Severe congestion is a frequent occurrence during peak periods, particularly in the Kowloon bound direction.

The North East New Territories (NENT) Development Strategy Review indicated that by 2006, the forecast traffic demand in the southbound direction of the Tolo Highway and Fanling Highway between Island House Interchange and Fanling would exceed their design capacities. Moreover, the v/c ratios of several major interchanges along the Tolo Highway and Fanling Highway would also significantly exceed 1.2.

In order to alleviate the current traffic congestion problems and to cope with the increasing transport demands to and from the urban areas and also cross boundary traffic, the Tolo Highway and Fanling Highway would have to be widened to a dual 4-lane carriageway in phases by the end of 2013. Widening of a 5.4km long section of Tolo Highway between Sha Tin and Tai Po commenced in March 1999 and was completed in 2003.

The section of Tolo Highway and Fanling Highway between Island House Interchange and Fanling is about 8.7km long (See drawing Appendix A-1 enclosed in Appendix A). A Preliminary Project Feasibility Study (PPFS) for the Project was completed in March 1998. The PPFS identified the project constraints, proposed a preliminary development option and recommended further investigations and studies. The Project was included in Category C of the Public Works Programme as Item No. 6720TH on 7 July 1998.

On 12 February 1999 Highways Department, Major Works Project Management Office commissioned the Consultants to undertake the Investigation and Preliminary Design Assignment under Agreement No. CE 73/98 for Widening of Tolo Highway/ Fanling Highway between Island House Interchange and Fanling.

The project is a designated project under the Environmental Impact Assessment (EIA) Ordinance (Cap.499) under Section A.1 of Schedule 2 and will require an environmental permit. An Environmental Impact Assessment (EIA) Report (hereinafter named as “the Approved EIA Report”) was completed and approved under the EIA Ordinance (EIAO) on 14 July 2000 (Register Number: EIA-043/2000).

Hyder-Arup-Black & Veatch Joint Venture (HABVJV) was appointed in March 2001 to undertake the Design and Construction Assignment for Widening of Tolo Highway/Fanling highway between Island House interchange and Fanling under agreement No. CE 58/2000.

In November 2002, a Working Paper – “EIA Re-visit for Proposed Design Changes, Air Quality and Noise Aspects” was submitted to the EPD, regarding the change of barrier design at Tai Hang and Wo Hop Shek. The working paper concluded that the changes would not cause a material change to the previous approved EIA in terms of compliance with the air quality and noise criteria of the technical memorandum for the EIA process.

Under the Consultancy Supplementary Agreement No. 3, the HABVJV shall carry out an environmental review taking into account the latest traffic forecast, reasonable cost consideration of noise barriers and interfacing between other projects. The review is presented in this Environmental Review Report (ERR).

1.2 The ERR Study Area

The Approved EIA Report states that "The boundary of the Study Area for the purpose of this EIA shall be 500m from either side and along the full stretch of the proposed alignment, except that, for noise impact and water impact assessment, the Study Area shall be generally defined by a distance of 300m from the proposed road alignment. Sensitive receivers in relation to the visual impact assessment and ecological impact assessment shall be assessed regardless of the distance from the proposed road alignment. As far as this ERR is concerned, these study boundaries remain unchanged. A location plan of the Project is given in Appendix A-1.

The study boundaries described above are measured from the edge of kerbs or hard shoulders whichever are applicable.

1.3 Objectives of the Environmental Review

As stated in Clause 6.2.2.8 of the Supplementary Brief No.3, the objective of this ERR was to identify and quantify various potential changes in environmental impacts and required mitigation measures arising from the construction and operation of the project in the Approved EIA Report. The ERR reviews the potential environmental impact according to the current project design and timeframe, and recommends necessary mitigation measures to avoid/minimize the potential environmental impacts.

The ERR Study incorporated the design of the environmental mitigation measures recommended in the Approved EIA Report and the Working Paper for EIA Re-visit in 2002, following their review and evaluation. Mitigation measures required to address identified impacts will become part of the Design Memorandum for implementation.

Before the commencement of the project, an Environmental Permit (EP) is required. This ERR serves as a technical supporting document for the EP application Part E of Form 4 under EIAO Section 10(1).

1.4 Structure of the Environmental Review Report

After this introductory section, the remainder of this ERR is arranged as follows:

Section 2 - presents a brief description of the Project;

Section 3 - presents the relevant environmental standards and guidelines for air quality, construction and operation noise, water quality, waste management ecology, and heritage aspects of the Study;

Section 4 - review the air quality impact assessment;

Section 5 - review the noise impact assessment;

Section 6 - review the water quality impact assessment;

Section 7 - review the waste management and disposal;

Section 8 - review the ecological impacts;

Section 9 – review the landscape and visual impact assessment

Section 10 – review the cultural heritage impact; and

Section 11 – conclusions

2. Project Description

2.1 Introduction

This ERR is a deliverable under the Design and Construction Assignment for the widening of a 4.7km section of Tolo Highway (from Island House Interchange to Lam Kam Interchange) and a 4.0 km section of Fanling Highway (from Lam Kam Interchange to Wo Hop Shek Interchange), from dual 3-lane to dual 4-lane. The assignment comprises:

- all civil works (including highways, traffic, geotechnical, drainage, structural, environmental and landscaping works) for the widening of these sections of Tolo Highway and Fanling Highway;
- Provision of Traffic Control and Surveillance System from Ma Liu Shui Interchange at Sha Tin to Wo Hop Shek Interchange at Fanling.

2.2 Proposed Alignment and Constraints

The proposed road alignment (hereafter named as “the Proposed Design”) is to largely follow the design in the Approved EIA Report (hereafter named as “the EIA Design”).

Along Tolo Highway, the widened road section will be provided adjacent to the existing southbound carriageway in order to preserve the natural terrain adjacent to the northbound carriageway, except at isolated locations where the widening works have to be shifted to the northbound side to avoid existing facilities.

The proposed road alignment has a hard shoulder with full width of 3.3m at both sides of the carriageway, except at specific locations where 1m marginal strip or reduced hard shoulder of 2.5m was adopted.

Near Tai Kwong Yuen Section (Ch 2+800 to 3+600), the existing carriageway will serve the future southbound traffic in this option, while the new carriageway will be constructed to serve the northbound traffic, i.e., in contrast to the original scheme of using the existing carriageway to serve the northbound traffic. The concept of this option is to acquire “no extra land” at Tai Kwong Yuen.

The new northbound carriageway will cut through the two existing slopes, accompanied by abundant site formation. The new northbound carriageway will be close to the boundary of the private land lot Pun Chun Yuen.

There are some other small parts of the project which are subject to minor changes in road alignment. These locations are highlighted in Appendix A-4 of this report.

Along Fanling Highway, the widening works will be carried out adjacent to the northbound carriageway due to the proximity of existing East Rail track of Mass Transit Railway (MTRC) and the Dongjiang (DJ) watermain near the southbound carriageway, except that the widening works will be shifted to the southbound side at Kiu Tau to avoid a grave.

2.2.1 Tolo Highway (Island House Interchange to Lam Kam Interchange)

The alignment of the existing and “to be widened” Tolo Highway has been largely dictated by the hilly terrain. The road level ascends from Island House Interchange along increasing chainage to

clear the highest road level of about +64.0 mPD at Ch 3+100, before descending down again to Lam Kam Interchange at about +20mPD. In order to avoid further cutting into the existing hills, most of the widening has to be executed on the southbound carriageway.

In line with this approach, most of the existing mainline bridges will be used by the widened northbound highway; with duplicate bridges planned for construction for the future southbound carriageway.

2.2.2 Fanling Highway (Lam Kam Road Interchange to Wo Hop Shek Interchange)

In contrast, Fanling Highway is traversing through the existing river plains that are in majority flatlands. The constraints are mainly related to the available clearance from existing infrastructure and properties, including

- The East Rail between Tai Hang and Nam Wah Po (Ch 6+000 to 7+000);
- The existing Dongjiang watermains running beside the East Rail along Fanling Highway;
- The Ma Wat River which will be mostly replaced by artificial open channel currently being built by DSD under Contract No. DC/2004/06 running close to the southbound verge, between Kau Lung Hang and Ho Ka Yuen (Ch 7+200 to 8+500);
- The existing bridges at Kiu Tau and Wo Hop Shek across Fanling Highway, which have piers located on the existing central median;
- A prominent grave at Kiu Tau; and
- Existing private properties at the villages of Tai Hang and Nam Wa Po, to the west of the existing Fanling Highway.

Since the Tai Wo Service Roads East and West are running parallel to Fanling Highway with generally very little separation, they will inevitably be affected.

Between Nam Wa Po and Kiu Tau, some noise barriers are proposed along the central median of Fanling Highway, and these will require local widening of the median to enhance sightlines. This would require more space for the proposed road widening works, and the layout has to be examined and proposed.

Retrofitting of Noise Barriers on Fanling Highway (East Rail Fanling Station to Wo Hing Road Section) project is scheduled to commence in 2009 and shall be completed in 2011 (see Appendix G for correspondence with HyD and their project General Layout). The proposed Retrofitting works has been incorporated into the environmental assessment.

2.3 Proposed Changes Since the Approval of EIA Report

Due to the engineering constraints as described in Section 2.2, changes in alignment and central barriers in the EIA Design are required. A walk-through survey was carried out and it was observed that some of the sensitive receivers stated in the Approved EIA Report were abandoned due to the DSD Project Contract No. DC/2004/06 “Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po.

The corresponding mitigation measures for these abandoned sensitive receivers therefore not be required. According to the latest assessment results, it was observed that some of the mitigation measures in the EIA Design could be optimised. Therefore, the corresponding mitigation measures in these areas were reduced in the Proposed Design of this ERR.

The proposed changes since the Approved EIA report are listed in Table 2-1 and detailed environmental assessment will be included in the following chapters:-

Table 2-1 Proposed Changes Since the Approval of Approved EIA Report

Locations	Proposed Change	Appendix Illustration
Sensitive Receivers	*Replaced NSR / New NSR*	
SR52, 2/F only	SR52N	A-3a
SR83	SR83N	A-3b
SR11	SR11A, SR11B	A-3b
SR86	SR86N	A-3b
SR10	SR1012, SR1015	A-3c
SR7	SR7N	A-3c
-	SR1013 (New NSR)	A-3d
-	SR22N (New NSR)	A-3d
-	SR1082 (New NSR)	A-3d
SR 81	SR 81N	A-3e
	N1 (New NSR)	A-3f
	N4 (New NSR)	A-3f
	N8 (New NSR)	A-3f
Road Section	*Proposed Alignment Change*	
Near 0+500, Slip road from SB to Tai Po Road Yuen Chau Tsai	Change of slip road alignment	A-4 Fig A
Near 3+000 to 3+600, Tai Kwong Yuen	Whole alignment shift to Southwest	A-4 Fig B
Near 3+650, Slip road from Tai Po Tai Wo Road to SB	Change of bridge curvature and intersection	A-4 Fig C
Near Ch 5300 Hong Long Yuen Junction	The junction has additional lanes and more traffic islands provided.	A-4 Fig D
Near Ch 7750-8050	Modification of road alignment at Tai Wo Service Road East.	A-4 Fig E
Near Chainage 8650	Modification on Layout of Wo Hop Shek Interchange	A-4 Fig F
Mitigation Measures	*Proposed Change in Noise Barrier Design*	
Wang Fuk Court, Yuen Chau Tsai and Ha Wong Yi Au	Ch 200-550: NB: V6 change to V7	A-5 (Figure A)

Locations	Proposed Change	Appendix Illustration
	CB: V6 change to V8 Ch 550- 580 SB C1 extended V2 type barrier on approach to Yuen Shin Road amended	
Lam Kam Railway Bridge near The Paragon	NB: V4 change to V3 SB C1 change to V8	A-5 (Figure B)
The Paragon	Ch 810-1030: CB: V8 change to C1Y Ch 720 - 920 SB: C1 change to V8	A-5 (Figure C)
Uptown Plaza	Ch 900-1300: CB: V8 change to C1a Ch 1100-1250 NB: V3 change to V4 SB: C1 change to V8	A-5 (Figure C)
Shan Tong New Village, King Nga Court and Wan Tau Tong Estate	Ch 1250- 1600 NB: C2 change in C1 Ch 1250-1600: CB: V6 and V8 change to C1Y	A-5 (Figure D)
Tak Nga Court	Ch 1650-1700: CB: V8 change to C1a Slip road from Tat Wan Road to SB: Extend C1 to Ch 1700 Ch 1650-1850 - Central Median: V8 change to C1a SB on-slip: extension of C1 Noise barriers	A-5 (Figure D)
Near Ting Wai Monastery and Ma Wo	Ch 2300-2500 Southbound: V3 change to V4	A-5 (Figure D1)
Ma Wo	Ch 2800-2900 NB: V4 change to V6 Ch 2700-2800 SB V3 change to V4	A-5 (Figure E)
Pun Chun Yuen	Ch 3200-3350 NB: V2 change to V4	A-5 (Figure E)
Shek Kwu Lung, Kam Shek New Village	Ch 3400-3500: SB: V5 change to V4	A-5 (Figure F)

Locations	Proposed Change	Appendix Illustration
	Tai Po Tai Wo Road: additional V2 barriers	
Parc Versailles	Ch 3500-3800: SB: V5 change to V3 Ch 3800-3900: SB: V6 change to V4 Ch 3900-4050: SB: V5 change to V3	A-5 (Figure F)
Wai Tau Tsuen	Ch 5250-5600: CB: deleted NB: V5 change to V6 Ch 5750-5800 Tai Wo Service Road West (Near SR80) – V3 change to V4 Additional C2 at island of Wai Tau Tsuen	A-5 (Figure G)
Hong Lok Yuen, Tai Wo, Yuen Leng	Additional V7 underneath bridge Additional C2 along verge of Tai Wo Service Road West Ch 5250-5620 Northbound: Change V5 to V6 Change V5 to V7 along verge of TWSRW Near Wai Tau Tsuen Ch 5750-5800 Northbound: Change V3 to V4 Ch 6100-6200 Northbound: V7 change to V8 Ch 6200-6300 Northbound: V3 change to V4.5 Ch 5800-6450 Central median: Deleted Ch 5750-6300 Southbound: V3 Change to V4 / V5 Ch 6450-6660 Northbound change 4.5m to 6m : Ch 6300-6350 southbound change 3m to 5m : Ch 6350-6400 southbound change 3m to 7m : Ch 6400-6550 southbound change to 8m: Ch 6450-6600 verge of TWSEW Change V4.5 to V6Ch 6450-7000 Central Median: Deleted Ch 6950-7030 verge of TWSRW: V3 Change to V5	A-5 (Figures H, H2 Ia and Ib)

Locations	Proposed Change	Appendix Illustration
	Ch 7000-7250 Northbound: V8 Change to C1 Ch 6550-6750 Southbound: V5 Change to V6 Ch 6750-7100 Southbound: Change to V7 Ch 7000-7150 Central Median: V6 Change to C2a	
Kiu Tau	Ch7300-7350 NB: Add V8	A-5 (Figure I(2))
Kiu Tau	Ch 7400-7900 CB: deleted SB: C2 change to V6 from Ch 7400-7650 SB: V6, V4 deleted from Ch 7600-7900 Ch 7850-7950 TWSRE: add V6	A-5 (Figure J)
Tong Hang	Ch 7900-8450 CB: V6, V4 deleted SB: V4 deleted from Ch 7900-8550 Ch 7850-7950 SB: Add V6	A-5 (Figure K)

Notes:
NB - Northbound Verge
SB - Southbound Verge
CB - Central Median

2.4 Construction Activities

Construction of the Project will be carried out between 2009 and 2013. The preliminary construction programme assumed for the assessment of environmental impacts is shown in Appendix B. Since at this stage there are uncertainties over the way individual contractors will programme elements of the work, the programme has adopted the worst case scenario and assumed that certain activities will be carried out concurrently. Assessed impacts are therefore always conservative.

2.5 Traffic Forecasts

For the purpose of this ERR, traffic flows for the year 2028 have been forecast for all major roads within 500 m of Tolo Highway / Fanling Highway and are included in Appendix C. The forecast traffic data without taking into account the future contributions from other development has been accepted by TD.

3. Review of Environmental Legislation

3.1 Introduction

This section presents a summary of current environmental legislations that are relevant for the assessment of potential environmental impacts associated with the proposed project.

3.2 Environmental Impact Assessment Ordinance

The EIA Study Brief No. ESB-004/1998, which was prepared by the EPD based on the Technical Memorandum on Environmental Impact Assessment (EIA-TM) (Environmental Impact Assessment Ordinance (EIAO), Cap 499, S16) is applicable to the Approved EIA Report and it is still valid in this ERR. The proposed road alignment has a hard shoulder full width of 3.3m at both sides of the carriageway, except at specific locations where 1m marginal strip or reduced hard shoulder of 2.5m was adopted in Tolo Highway (Island House Interchange to Lam Kam Interchange).

3.3 Air Quality

The environmental legislations as stated in the approved EIA Report regarding air quality impact assessment are still applicable to this ERR. The relevant legislations and guidelines are as follows:

The Air Pollution Control Ordinance, Cap 311 (APCO) provides the statutory authority for controlling air pollutants from a variety of stationary and mobile sources, including fugitive dust emissions from construction sites. It encompasses a number of Air Quality Objectives (AQOs) which stipulate concentrations for a range of pollutants including Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Respirable Suspended Particulates (RSP) and Total Suspended Particulates (TSP).

3.3.1 Air Quality Objectives (AQOs)

The Hong Kong Air Quality Objectives (AQOs) stipulate the statutory limits for a number of pollutants and the maximum allowable number of exceedances over specified periods. The AQOs are given in Table 3-1.

Table 3-1 Hong Kong Air Quality Objectives (AQOs)

	Concentration (μg/m³) [1] Averaging Time				
Pollutant	**1 Hour[2]**	**8 Hours[3]**	**24 Hours[3]**	**3 Months[4]**	**1 Year[4]**
Sulphur Dioxide (SO_2)	800	-	350	-	80
Total Suspended Particulates (TSP)	-	-	260	-	80
Respirable Suspended Particulates (RSP)[5]	-	-	180	-	55
Nitrogen Dioxide (NO_2)	300	-	150	-	80

	Concentration (μg/m³) (1) Averaging Time				
Pollutant	**1 Hour(2)**	**8 Hours(3)**	**24 Hours(3)**	**3 Months(4)**	**1 Year(4)**
Carbon Monoxide (CO)	30000	10000	-	-	-
Photochemical Oxidants (as ozone(6))	240	-	-	-	-
Lead	-	-	-	1.5	-

Notes :

(1) Measured at 298 K and 101.325 kPa (1 atm).

(2) Not to be exceeded more than three times per year.

(3) Not to be exceeded more than once per year.

(4) Arithmetic means.

(5) Respirable suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 10 micrometers or less.

(6) Photochemical oxidants are determined by measurement of ozone only.

3.3.2 Construction Phase

In addition to AQOs, the EIA-TM stipulates that dust levels at the site boundary comply with a limit of 500μg/m^3 per hour, in order to prevent unmitigated dust impacts from construction activities.

The Air Pollution Control (Construction Dust) Regulation defines Notifiable and Regulatory construction works, and requires that advance notice be given to EPD of any Notifiable works. Notifiable and Regulatory works shall be carried out in accordance with the dust control and suppression measures provided in the Schedule.

Under the APCO, premises which emit noxious or offensive emissions as specified in the First Schedule of the Air Pollution Control (Specified Processes) Regulations are required to have an APCO licence. If there are Specified Processes associated with the works such as a Concrete Batching Plant, an APCO licence is therefore required.

The Air Pollution Control (Open Burning) Regulation prohibits open burning of construction waste, tyres and cables for metal salvage, and controls other open burning activities by permit system.

3.3.3 Operational Phase

All air quality mitigation measures shall be designed to meet the Hong Kong AQOs (Table 3-1).

3.4 Noise

The environmental legislation as stated in the approved EIA Report regarding noise assessment is still applicable to this ERR. The relevant legislations and guidelines are repeated as follows:

3.4.1 Construction Noise

The control of construction noise during restricted periods (anytime for percussive piling) is carried out under the Noise Control Ordinance (NCO) and three subsidiary Technical Memoranda (TMs) covering noise from Percussive Piling (PP-TM), Construction Work Other Than Percussive Piling (GW-TM) and Construction Work in Designated Areas (DA-TM). The TMs establish the permitted noise levels for construction work depending upon working hours and the existing noise climate.

There are some factors affecting the assessment results of a Construction Noise Permit (CNP) application, such as the assigning of Area Sensitivity Rating, Acceptable Noise Levels etc. The Noise Control Authority would decide these at the time of assessment of such an application based on the contemporary situations/conditions. It should be noted that the situations/conditions around the sites may change from time to time.

The NCO criteria of the control of noise from Power Mechanical Equipment (PME) at a particular noise sensitive receiver (NSR) is based on this Area Sensitivity Rating (ASR), which "ranks" the background noise conditions with respect to the type of area in which the NSR is located. Table 3-2 shows the ASR selection criteria as stated in GW-TM.

Table 3-2 Area Sensitivity Rating Criteria

Type of area containing the NSR	**Degree to which NSR is affected by IF (4)**		
	Not Affected (1)	**Indirectly Affected (2)**	**Directly Affected (3)**
Rural area, including country parks or village type developments	A	B	B
Low density residential area consisting of low rise or isolated high-rise developments	A	B	C
Urban area	B	C	C
Area other than those above	B	B	C

Notes:

(1) Affected means that the NSR is at such a location that the noise generated by the influencing factors (4) (IF) is not noticeable at the NSR.

(2) Indirectly Affected means that the NSR is at such a location that the noise generated by the IF, whilst noticeable at the NSR, is not a dominant feature of the noise climate of the NSR.

(3) Directly Affected manes that the NSR is in such a location that the noise generated by the IF is readily noticeable at the NSR and is a dominant feature of the noise climate of the NSR.

(4) Ifs are defined as industrial areas, major roads or the area within the boundary of Hong Kong International Airport.

Construction activities during restricted hours and on Sunday and public holidays, are controlled by the NCO. Works requiring the use of Power Mechanical Equipment during these times must be carried out under the provisions of a CNP. As such, they must achieve the required Basic Noise Level (BNL) as shown in Table 3-3 below.

Table 3-3 Basic Noise Levels in $L_{eq(30min)}$dB(A)

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

The BNL is corrected using the TM, methodology to produce the Acceptable Noise Level (ANL), which will be used in the CNP approval process. A CNP is required by the regulations of the NCO for the use of all PME during restricted hours. The procedures set out in GW-TM, PP-TM, DA-TM are used by EPD to determine whether or not a CNP should be issued. CNPs will not automatically be granted and will be assessed on a tailor made basis by EPD.

In Table 1B of the EIA-TM, noise standards for daytime construction activities are proposed at a limit of $L_{eq(30min)}$ 75dB(A) for all domestic premises including temporary housing accommodation, hotels and hostels. For schools, a daytime noise level of $L_{eq(30min)}$ 70dB(A), lowered to 65dB(A) during examination periods is recommended.

Subsidiary regulations of the NCO including the Noise Control (Hand Held Percussive Breakers) and Noise Control (Air Compressors) Regulations. These require compliance with relevant noise emission standards and the fixing of noise emission labels to hand-held percussive breakers and air compressors. Whilst these requirements are not directly relevant to the construction noise impact assessment, contractors must ensure that compliance with these regulations are met during the construction phase of a project.

Percussive piling is only permitted when a CNP has been granted by the Noise Control Authority. PP-TM sets out the permitted hours of operation of percussive piling and Acceptable Noise Level (ANL) requirements, which are dependent on the architectural characteristics of the NSR. The ANL criteria for percussive piling are presented in Table 3-4. ANLs for hospitals, schools, clinics, courts of law and other particularly sensitive receivers are 10dB(A) below the figures quoted in Table 3-4.

Table 3-4 Acceptable Noise Levels for Percussive Piling

Architectural Characteristics of NSR	ANL, dB(A)
No windows or other openings	100
With central air conditioning system	90
With windows or other openings but without central air conditioning system	85

3.4.2 Operational Phase

All noise mitigation measures shall be designed to meet the HKPSG traffic noise criteria of L_{10}, Peak Hour 70dB(A) for residential developments and L_{10}, Peak Hour 65dB(A) for schools. Design calculations shall be in accordance with the EPD Guideline for Traffic Noise Assessment Report for New Road Projects and based on the UK Department of Transport procedure “Calculation of Road Traffic Noise 1988” (CRTN).

Road traffic noise levels at the openable windows of buildings are specified in the EIA-TM and the relevant criteria are shown in Table 3-5.

Table 3-5 Road Traffic Noise Standards for Planning Purposes

Uses	**Road Traffic Noise $L_{10\ (1\ hour)}$ dB(A)**
Domestic Premises	70
Hotel and Hostels	70
Offices	70
Educational institutions	65

3.5 Water Quality

The environmental legislation as stated in the Approved EIA Report regarding water quality is still applicable to this ERR. The relevant legislations and guidelines are repeated as follows:

The major assessment criteria relating to the protection of water quality are stipulated in the Water Pollution Control Ordinance (Cap.358), which has been established since 1980. This legislation allows Water Control Zones (WCZs) to be established, in which objectives are set for quality. The project is located within the catchment of the Tolo Harbour and Channel Water Control Zone (WCZ), which was gazetted in 1987. The WCZ is subdivided into three subzones: the harbour subzone, the buffer subzone and the channel subzone. Inland watercourses within the WCZ are also divided into various subzones for Shing Mun, Tai Po and Lam Tsuen catchment. Water Quality Objectives (WQOs) have been set for each subzone and the subzones relevant to this study are the inland water control subzones Tai Po River (TP) and Lam Tsuen River (LT). WQOs for selected parameters are listed in Table 3-6.

Table 3-6 Water Quality Objectives for the Tolo Harbour and Channel Water Control Zone

Water Quality Objective	**Part or Parts of Zone**
	Tolo Harbour and Channel Waters
A. AESTHETIC APPEARANCE	
Wastes discharges shall not cause waters of the subzone to contain substances that-	
Settle to form objectionable deposits;	Whole zone
Float as debris, scum, oil or other matter to form nuisances;	Whole zone
Produce objectionable colour, odour, taste or turbidity;	Whole zone
Injure or are toxic or produce adverse physiological responses in humans, animals or plants; or	Whole zone
Are conducive to undesirable aquatic or a nuisance to aquatic life	Whole zone

Water Quality Objective	**Part or Parts of Zone**
	Tolo Harbour and Channel Waters
BACTERIA Waste discharges hall not cause the level of Escherichia coil to exceed 1000 per 100 ml in waters of the subzone, levels to be calculated as a running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days (or 14 and 42 days). Waste discharges hall not cause the level of Escherichia coil to exceed 0 per 100 ml in waters of the subzone, levels to be calculated as a running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days (or 14 and 42 days).	
COLOUR Waste discharges shall not cause the colour of water of the subzone to exceed 50 Hazen units at any time. Waste discharges shall not cause the colour of waters of the subzone to exceed 30 Hazen units at any time.	TP(B), TP(C) LT(C), LT(D), TP(A)
pH Waste discharges shall not cause the pH of waters of the subzone to exceed the range of 6.0 to 9.0 at any time Waste discharges shall not cause the pH of waters of the subzone to exceed the range of 6.5 to 8.5 at any time	LT(C), LT(D), TP(A), TP(B), TP(C)
TEMPERATURE Waste discharges shall not cause the natural daily temperature range in waters of the subzone to be extended by greater than + 2.0 degrees Celsius at any location or time.	Whole zone
SUSPENDED SOLIDS Waste discharges shall not cause the annual median of suspended solids in waters of the subzone to exceed 25 mg per litre. Waste discharges shall not cause the annual median of suspended solids in waters of the subzone to exceed 20 mg per litre.	LT(C), LT(D), TP(A), TP(B), TP(C)
DISSOLVED OXYGEN Waste discharges shall not cause the level of dissolved oxygen in waters if the subzone to be less than 4mg per litre or 40% saturation (at 15 degree Celsius) at any time.	Whole zone
5-DAY BIOCHEMICAL OXYGEN DEMAND Waste discharges shall not cause the 5-days biochemical oxygen demand in waters of the subzone to exceed 5 mg per litre at any time. Waste discharges shall not cause the 5-days biochemical oxygen demand in waters of the subzone to exceed 3mg per litre at any time.	TP(B), TP(C) LT(C), LT(D), TP(A)

Water Quality Objective	**Part or Parts of Zone**
	Tolo Harbour and Channel Waters
CHEMICAL OXYGEN DEMAND Waste discharges shall not cause the chemical oxygen demand in waters of the subzone to exceed 30mg per litre at any time. Waste discharges shall not cause the chemical oxygen demand in waters of the subzone to exceed 15 mg per litre at any time.	TP(B), TP(C) LT(C), LT(D), TP(A)
AMMONIACAL NITROGEN Waste discharges shall not cause the ammoniacal nitrogen in waters of the subzone to exceed 0.5mg per litre at any time.	Whole zone
TOXINS Waste discharges shall not cause the toxins in water of the subzone to attain such a level as to produce significant toxic effects in humans, fish or any other aquatic organism, with due regard to biologically cumulative effects in food chains and to toxicant interactions with each other.	Whole zone

3.5.1 Marine Waters

Protection of existing or potential beneficial uses from the effects of implementing the Project is a key concern. Beneficial uses of marine and coastal waters include the following sub-divisions:

- Areas of ecological or conservation values including marine conservation areas, existing or gazetted proposed marine parks and marine reserves, sites of special scientific interest (SSSI), existing or gazetted proposed country parks and special areas, wetlands, mangroves and important freshwater habitats;
- Areas for abstraction of water for potable water supply;
- Water abstraction for irrigation and agriculture;
- Fish spawning grounds, fish culture zones, shellfish harvesting/culture sit and brackish/freshwater fish ponds;
- Beaches and other recreational areas;
- Water abstraction for cooling, flushing and other industrial purposes; and
- Area for navigating/shipping including typhoon shelters, marinas and boat parks.

3.5.2 Surface Waters

The beneficial uses for surface water are defined in the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters as follows:

- Group A - Abstraction for portable water supply
- Group B - Irrigation

- Group C - pond fish culture
- Group D - General amenity and secondary contact recreation

The majority of inland waters within the Study Area are defined as Group D. During the construction phase, the criteria for the protection of water quality are stipulated in the Technical Memorandum TM on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters. The TM was issued under the WPCO and give guidance on the permissible effluent discharges based on the type of receiving waters (foul sewers, storm water drains, inland and coastal waters). The limits control the physical, chemical and bacterial quality of effluents.

Any person(s) discharging into the receiving waters should apply for a licence. In the absence of any licensing conditions at this stage, the TM standards can be adopted as reference. Relevant TM standards for Group D waters (generally encountered in the Study Area) for selected parameters are listed in Table 3-7.

For the discharge of surface water drainage into Foul Sewers Leading to Government Sewage Treatment Works the standards are given in Table 3-8.

In addition, all site run-off during the construction phase shall be controlled and treated to prevent high levels of suspended solids entering the surrounding waters in accordance with the EPD's Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN1/94).

Table 3-7 TM Standards for Discharges to Group D Water (all units in mg/l unless otherwise stated)

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

Table 3-8 Standards for effluent discharged in to foul sewers leading into Government sewage treatment plants (All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated)

Flow Rate m^3/day Determinant	≤10	>10 and ≤100	>100 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	5000 and ≤6000
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (^oC)	43	43	43	43	43	43	43	43	43	43	43	43	43
Suspended solids	1200	1000	900	800	800	800	800	800	800	800	800	800	800
Settleable solids	3000	2500	2200	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
BOD	1200	1000	900	800	800	800	800	800	800	800	800	800	800
COD	3000	2500	2200	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Oil & Grease	100	100	50	50	50	40	30	20	20	20	20	20	20
Iron	30	25	25	25	15	12.5	10	7.5	5	3.5	2.5	2	1.5
Boron	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Barium	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Mercury	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Copper	4	4	4	3	1.5	1.5	1	1	1	1	1	1	1
Nickel	4	3	3	2	1.5	1	1	0.8	0.7	0.7	0.6	0.6	0.6
Chromium	2	2	2	2	1	0.7	0.6	0.4	0.3	0.2	0.1	0.1	0.1
Zinc	5	5	4	3	1.5	1.5	1	1	1	1	1	1	1
Silver	4	3	3	2	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Other toxic metals	2.5	2.2	2	1.5	1	0.7	0.6	0.4	0.3	0.2	0.15	0.12	0.1

Flow Rate m^3/day Determinant	≤10	>10 and ≤100	>100 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	5000 and ≤6000
individually													
Total toxic metals	10	10	8	7	3	2	2	1.6	1.4	1.2	1.2	1.2	1
Cyanide	2	2	2	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.08	0.06
Phenols	1	1	1	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.1	0.1
Sulphide	10	10	10	10	5	5	4	2	2	2	1	1	1
Sulphate	1000	1000	1000	1000	1000	1000	1000	900	800	600	600	600	600
Total Nitrogen	200	200	200	200	200	200	200	100	100	100	100	100	100
Total Phosphorus	50	50	50	50	50	50	50	25	25	25	25	25	25
Surfactants (total)	200	150	50	40	30	25	25	25	25	25	25	25	25

3.5.3 Water Gathering Grounds

As part of the project area falls within WSD water gathering grounds, WSD conditions for working within gathering grounds, as listed below, shall be complied with:-

- Adequate measures shall be taken to ensure that no pollution or solution occurs to the gathering grounds.
- No earth, building materials, fuel, oil or toxic materials and other materials which may cause contamination to the gathering grounds are allowed to be stockpiled or stored on site.
- All surplus spoil shall be removed from gathering grounds as soon as possible.
- Temporary drains with silt traps shall be constructed at the boundary of the site prior to the commencement of any earthworks.
- Regular cleaning of the site traps shall be carried out to ensure that they function properly at all time.
- All excavated or filled surfaces which have the risk of erosion shall be protected from erosion at all time.
- Facilities for washing the wheels of vehicles before leaving the site shall provided.
- Any construction plant which causes pollution to the gathering grounds due to leakage of oil or fuel shall be removed off site immediately.
- Any soil contamination with fuel leaked from plant shall be removed off site and the void arising from removal of contaminated soil shall be replaced by suitable material to the approval of the Director of Water Supplies.
- Provision of temporary toilet facilities is to be subject to the approval of the Director of Water Supplies.
- All waterworks access roads must be maintained unobstructed at all time.
- Site formation plans shall be submitted to WSD for approval prior to commencement of work.
- No structure or temporary works shall be erected in the catchwaters without prior approval of WSD.
- The Contractor shall be responsible for cleaning frequently any waterworks roads and associated drainage works of mud and debris.
- The Contractor shall limit the gross weight of the vehicles imposed on the waterworks access to 5 tonnes and the axle load to 3 tonnes. He shall apply to WSD with details of his vehicles for using the access.
- The approval for using the access may be withdrawn on written notice to the Contractor by WSD at their absolute discretion.
- The Contractor shall recover immediately his vehicle which fell into the catchwater or stream bed or pay to Government on demand the cost of recovery that may be necessary through the occurrence of any incident caused by the Contractor.
- The Contractor shall carry out repair or reinstatement works to the satisfaction of WSD or pay to Government on demand the cost of repair and reinstatement to any waterworks installations that shall or may be necessary at any time as a result of damage caused by the Contractor or others under his charge.

- The Contractor shall enter and remain on and use the access at his own risk and he shall indemnify the Government of Hong Kong from all claims, costs, damages and expense arising from the use of the access.
- No chemicals, toxic materials, fertilizers or other materials which will cause contamination to the water gathering grounds shall be allowed to be use and stored on site.

3.6 Waste Management

The following legislation relates to the handling, treatment and disposal of wastes in Hong Kong:

- The Waste Disposal Ordinance (Cap 354);
- The Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);
- The Government Land Ordinance (Cap 28);
- The Public Health and Municipal Services Ordinance (Cap 132) – Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws; and
- Dumping At Sea Ordinance (Cap 466).

The Waste Disposal Ordinance (WDO) prohibits the unauthorised disposal of wastes. Construction waste is not directly defined in the WDO but is considered to fall within the category of "trade waste". Under the WDO, wastes can only be disposed of at sites licensed by the EPD.

Any chemical waste as defined in Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, shall be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Waste.

Disposal of chemical waste shall:

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

3.7 Ecology

In addition to Annex 8 and 16 of the EIAO-TM the Ecological Impact Assessment will need to consider the following Hong Kong regulatory and legislation requirements and international conventions.

Wild Animals Protection Ordinance (Cap 170) that contains provisions to protected wild animals enlisted, including most of the mammals, all birds, some reptiles and one species of butterfly.

Forests and Countryside Ordinance (Cap 96) hat includes general provisions to protect forest and plantation on Government land. It prohibits damage to forests and plantations, by lighting fire, cutting grass, removing earth, damaging parts of plants, felling and cutting of trees, etc.

Forestry Regulations (Cap 96 Subsidiary Legislation) contains a list of protected plants, preventing the selling, offering for sale, or possession of them. These include all species of wild orchids, camellias, rhododendrons, tree ferns and some other species. It provides the major instrument for protection of specific plant species in the countryside and basically all public land.

Country Parks Ordinance (Cap 208) together with its subsidiary legislation, that outlines the protection mechanism for the vast area of Country Parks and special areas in the Territory. The country Park Authority has the power to eradicate any use of land within the Country Park, which would "substantially reduce the enjoyment and amenities of the country park". The Ordinance and the subsidiary Country Parks and Special Areas Regulations cover a wide range of management mechanisms, to exert control over activities, prohibit and restrict entry, prohibit hunting or disturbance of wildlife; as well as removal or destruction to vegetation or interference with the soil, prohibiting and restricting the lighting of fires.

The Protection of Endangered Species of Animals and Plants Ordinance (Cap 586) gives effect to Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) in Hong Kong. The Ordinance requires a licence to be issued in advance by the Agriculture, Fisheries and Conservation Department (AFCD) for the import, introduction from the sea, export, re-export, and possession of specimens of scheduled species.

Hong Kong Planning Standards and Guidelines (HKPSG) is a Government guideline for the preparation of land use plans, and the planning of major development projects. Chapter 10 of the HKPSG addresses the principles of conservation in land use planning. Measures for the conservation of natural landscapes and habitats are briefly discussed in the guidelines. In terms of planning consideration of areas designated for conservation, such as Country Parks, Conservation Area, SSSI, etc., should be prevented from development whereas possible.

Bonn's Convention requires member states to provide strict protection for species listed in Appendix of the Convention, and management of Appendix II species. The Convention applies to Hong Kong, which became a party in 1985.

Rio Convention of Biodiversity is a treaty for the conservation of biological diversity and the sustainable use of its components. Contracting parties should identify, monitor and safeguard their biological and genetic resource, while developing national strategies for the conservation and sustainable use of biological diversity. EIAs of projects that may possibly cause adverse effects on biological diversity should be required. Hong Kong is currently not a signatory but the policy is that the Government will abide to the obligations of the Convention, the key notions being sustainable development and conservation of biodiversity.

CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

SSSIs are designated according to a site's special faunal, floral, ecological or geographical features. SSSIs are designated for protection under the Town Planning Ordinance.

Apart from the above, the following EIAO Guidance Notes with respect to ecology are also referenced to where necessary:

Some Observations on Ecological Assessment From the Environmental Impact Assessment Ordinance Perspective [GN 6/2002]

Ecological Baseline Survey for Ecological Assessment [GN 7/2002]

3.8 Cultural Heritage

A Cultural Heritage Impact Assessment for the Project has been conducted and approved according to the EIAO. Some historical buildings/structures and areas with archaeological interests

have been identified. The Approved EIA Report has stipulated the mitigation measures and recommendations for these identified items. It should be followed during the construction phase.

Site monitoring will be conducted during construction in the areas identified in the Approved EIA Report. Under the statutory requirement stipulated by the Antiquities and Monuments Ordinance (Cap. 53), the archaeologist should obtain a licence issued by the Antiquities Authority before undertaking any archaeological fieldwork in Hong Kong. After the completion of the site monitoring, the archaeologist is required to submit a full report to explain the findings of the monitoring work.

For archaeological aspect, the Antiquities and Monuments Ordinance (Cap. 53) has specified the requirements of discovery of antiquity/supposed antiquity in the course of work. It should be strictly followed to preserve the artifacts/supposed artifacts.

4. Review of Air Quality Impact

4.1 Introduction

The Approved EIA Report identified fugitive dust as the primary potential air pollutant likely to impact on air quality during the road widening works. However, through the proper implementation of the recommended mitigation measures, dust generation can be controlled and is not likely to exceed the acceptable criteria.

Quantitative assessment in the Approved EIA Report indicates that the traffic related air quality impacts would be insignificant.

The ERR focuses on the proposed changes of the Project from the Approved EIA Report. This includes the reviews on the assessment methodologies, approaches, results and findings of the approved EIA Report.

4.2 Description of Surrounding Environment

4.2.1 Site location

As there is no major alignment change in the proposed widening works, the project site coverage as described in the Approved EIA Report is still applicable in this ERR. The site falls within the Tolo/Fanling Highway from Island House Interchange to Wo Hop Shek Interchange.

4.2.2 Baseline Conditions

The Approved EIA Report contained the methodology to be used to identify suitable background concentrations for the modelling work. Background concentrations would be based on the results recorded under the long term monitoring programme being carried out by EPD.

In accordance with the Approved EIA report, the background levels of RSP and NO_2, which are the major air pollutants from vehicular emissions of concern, were adopted for the air quality modelling.

In accordance with latest relevant EPD guidelines and available information, annual averages for the years 2002-2006 of TSP, RSP and NO_2, which were recorded at the Tai Po air quality monitoring station, have been adopted to represent the background air quality levels in this ERR.

The background air quality adopted in this ERR and the Approved EIA Report are shown in Table 4-1.

Table 4-1 Background Air Pollutant Concentration

Pollutant	2006	2005	2004	2003	2002	2001	Annual Average (Background)		
							2001-2006 ERR	1998 EIA	AQO Limit
Total Suspended Particulates, TSP ($\mu g/m^3$)	66	61	N/A	71	61	68	65	68	80
Respirable Suspended Particulates, RSP ($\mu g/m^3$)	51	51	N/A	54	46	50	50	50	55
Nitrogen Dioxide, NO_2 ($\mu g/m^3$)	57	49	N/A	52	48	50	51	51	80

Source: Air Quality in Hong Kong 2002 to 2005 and Annual Air Quality Statistics 2006 (Preliminary), EPD, HKSAR

According to the above, the background RSP and NO_2 levels in this ERR are same as those in the Approved EIA Report while the background TSP level in this ERR are lower than that in the Approved EIA Report. The background concentrations of the pollutants of concern all meet the applicable AQOs.

4.2.3 Air Sensitive Receivers (ASRs)

As described in Section 4.3 of the Approved EIA Report, the spatial scope for the assessment is defined as 500m from either side of the alignment. This is in accordance with the EIA Study Brief ESB-004/1998.

Air sensitive receivers (ASR) are generally defined as indoor or outdoor places that rely on natural ventilation and are likely to be occupied or utilised for human activities, either temporarily or permanently.

If a building is provided with mechanical ventilation and air conditioning, the fresh air intake(s) of the building is regarded as the ASR. Typical ASRs therefore include residential buildings, commercial/industrial buildings, education institutions, places of worship, community centres, hospitals, clinics, shopping malls, playgrounds, etc.

A thorough review of all ASRs stated in the Approved EIA Report was conducted. In addition, the following latest Outline Zoning Plans were reviewed:

- Tai Po OZP S/TP/19 dated 18 November 2005
- Kau Lung Hang OZP S/NE-KLN/11 dated 27 October 2006
- Lam Tsuen OZP S/NE-LT/11 dated 10 November 2006
- Fanling/Sheung Shui OZP S/FSS/13 dated 31 March 2006

After the review it was concluded that most of the ASRs described in the Approved EIA Report are still applicable to this ERR, except

(a) SR7, 11, 7N, 11A, 11B

DSD Project Contract No. DC/2004/06 "Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po" will be completed before the commencement of this Project. SR7 and 11 near Tong Hang as stated in the Approved EIA Report, were/will be abandoned due to land resumption of DSD project. Three alternative ASRs were identified at Tong Hang in this ERR, i.e. SR7N, SR11A and SR11B respectively.

(b) SR22N

A new village house, where has a closer slant distance to Fanling Highway than SR22, were built in Wai Tau Tsuen.

For ease of reference, the same ASR identifications (as used in the approved EIA Report) have been applied in this ERR.

The representative ASRs as shown in Tables 4.3 to 4.6 of the Approved EIA Report within the Study Area are presented in Table 4-2 and shown in Appendix D-1.

Table 4-2 Representative Air Sensitive Receivers within Study Area

ASRs	Description	Easting	Northing	Separation Distance from Kerbside (m)	Assessment Height (mPD)
SR1	Avon Park	832816	838702	90	38.1
SR2	Fanling Gov't Sec Sch.	832959	838483	48	23.0
SR3	Dawning Views	832993	838637	65	32.5
SR7N	Tong Hang	833561	838697	84	20.3
SR9	Wo Hop Shek 2	833622	838357	28	23.6
SR11A	Kiu Tau	833983	837884	94	20.4
SR11B	Kiu Tau	834007	837908	117	19.5
SR17B	Tai Hang 3	833739	836634	14	25.7
SR20	Hong Lok Yuen 2	833730	836187	34	32.9
SR22	Wai Tau Tsuen 1	833311	835997	22	30.9
SR22N	Wai Tau Tsuen (New)	833306	835978	6	30.9
SR23	Wai Tau Tsuen 2	833295	835868	32	31.4
SR25	Kau Liu Ha 2	833011	835521	22	24.5
SR28	NW Shek Kwu Lung	833802	834667	17	23.9
SR29	Parc Versailles	833960	834769	96	25.5
SR31	Shek Kwu Lung 2	834198	834446	47	15.3
SR33	Shek Kwu Lung 3	834123	834155	26	32.2
SR34	Pun Chun Yuen	833952	834079	88	58.8
SR35	Buddhist Tai Kwong Middle School	834184	834144	54	47.4
SR36	Ma Wo 1	834428	833704	17	17

ASRs	Description	Easting	Northing	Separation Distance from Kerbside (m)	Assessment Height (mPD)
SR39	The Paragon	835904	833771	52	37.3
SR43	Wan Tau Tong Est – Wan Lam Hse 2	835365	833624	29	26.8
SR45	HK Teacher's Association Sec. Sch.	835532	833672	66	25.6
SR47	Wang Fuk Crt – Wang Cheong Hse 1	836216	834105	42	12.4
SR54	Riverrain Bayside	836343	833757	65	8.5
SR55	Dynasty View 2	834512	833565	53	57.3
SR56	Monastery at Ma Wo	834560	833482	16	45.2
SR57	King Nga Crt – King Yuet Hse 1	835187	833453	95	37.0
SR61	Tak Nga Crt 2	835143	833463	114	38.7
SR62	Ha Wun Yiu	834870	833294	41	32.3
SR64	Shan Tong New Village 1	835425	833404	27	44.3
SR66	PLK Tin Ka Ping Pri Sch.	835287	833553	119	29.6
SR68	Island House Park – Bicycle Track	836295	834237	40	8.6
SR69	Island House Park – Garden	836340	834282	85	9.0
SR70	Kwong Fuk Est – Kwong Lai Hse	836215	834287	42	12.5
SR71	Tai Po Waterfront Park	836351	834501	63	9.2
SR72	Tai Po Waterfront Park	836591	834530	68	10.0
SR73	Island House Conservation Studies Ctr	836473	834040	125	17.4
SR74	Yuen Chau Tsai – Tennis Crt	836409	834015	58	17.4
SR75	Wong Kong Shan	832918	838843	78	18.4
SR77	Yuen Leng 2	833988	837406	56	23.9
SR78	Dynasty View 3	834643	833476	75	53.3
SR100	KCRC Staff Quarter at Tai Po Kau	836803	833546	54	10.2

4.3 Review of Construction Phase Air Quality

4.3.1 Assessment Methodology

In accordance with the Approved EIA Report, a qualitative assessment for the construction phase air quality impact was carried out.

4.3.2 Identification of Air Quality Impacts

After comparing the latest alignment design to the EIA Design presented in the Approved EIA Report, it is concluded that there is no major alignment change apart from the noise barrier design. The potential sources of fugitive dust during construction phase identified in the Approved EIA Report are still applicable in this ERR.

Construction dust impacts may arise during the construction phase of the project. The potential sources of fugitive dust during the construction works include:

- Demolition work including breaking concrete;
- Earthworks, including excavation, soil stripping, re-grading;
- Site clearance, including removal of vegetation and topsoil;
- Unloading and handling of excavated materials;
- Truck movements on unpaved haul roads;
- Wind blown dust from stockpiled materials; and
- Deposition of dust from haulage trucks onto local roads.

In addition, gaseous emissions from construction vehicles and the operation of powered mechanical equipment (PME) are other potential sources of air quality impacts.

4.3.3 Evaluation of Potential Impacts

As there is no major alignment change to the Project, the findings of the construction dust impact as detailed in the Approved EIA Report are still applicable in this ERR.

Emissions from construction vehicles will be unlikely to result in any adverse impacts due to their limited number. Assuming regular maintenance of the PME, adequate on-site house keeping and good practice (i.e. shutting down the PME when not in use), the gaseous emissions from the PME is unlikely to result in any adverse impacts.

Therefore construction dust, rather than emissions, is considered to be the major potential air pollution source likely to be present during the construction phase of the Project.

In order to mitigate the potential dust emissions from construction works, the following measures are recommended:

The existing roads should be fully utilised to serve as access roads and haul roads during the construction phase. The number of construction vehicles approaching and leaving the construction sites should be limited. Therefore it is likely that there will only be a limited number of unpaved/access haul roads and truck movement on these unpaved haul roads will be minimal.

As such, the dust generation from construction vehicle movement (haul road traffic) is considered to be minimal.

The TSP levels caused by construction dust generation at the identified ASRs may exceed the hourly limit of 500 g/m^3 if unmitigated. With the implementation of dust control measures however, dust emissions will be effectively controlled and will comply with the AQO's.

Implementing the statutory dust control measures will further minimise the dust emissions during the construction phase. Accordingly, the overall construction dust impact of the project should be insignificant.

4.3.4 Dust Control Measures

Construction dust impacts should be controlled within the 1-hr TSP limit of 500 µg/m^3 and 24-hr TSP AQO 260 µg/m^3. The Contractor should follow the procedures and requirements given in the

Air Pollution Control (Construction Dust) Regulation and shall be responsible for the design and implementation of the recommended dust control and mitigation measures, which shall include, but not be limited to, the following:

Site Boundary and Entrance

- Vehicle washing facilities including a high pressure water jet shall be provided at every discernible or designated vehicle exit point; and
- The area at which vehicle washing takes place and the section of the road between the washing facilities and the exit point shall be paved with concrete, bituminous or hardcore material.

Access Haul Roads

- Each and every main haul road shall be paved with concrete, bituminous hardcore materials or metal plates, and kept clear of dusty materials; or
- Unpaved haul roads sprayed with water or a dust suppression chemical so as to keep the entire road surface wet.
- The portion of any road leading only to a construction site that is within 30 m of a discernible or designated vehicle entrance or exit shall be kept clear of dusty materials.

Cement and dry pulverized fuel ash (PFA)

- Every stock of more than 20 bags of cement or dry pulverized fuel ash shall be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides.

Exposed Earth

- Exposed earth should be properly treated by compaction, hydro-seeding, vegetation planting or seating with latex, vinyl, bitumen within six months after the last construction activity on the site or part of the site where the exposed earth lies.

Dusty Materials

- Cement, pulverized fuel ash or any other dusty materials collected by fabric filters or other air pollution control system or equipment shall be disposed of in totally enclosed containers.

Stockpiling of dusty materials

- Any stockpile of dusty material shall be either: (a) covered entirely by impervious sheeting; (b) placed in an area covered by a roof or cover and sheltered on three sides; or (c) sprayed with water or a dust suppression chemical so as to keep the entire surface area wet.

Loading, Unloading or Transfer of Dusty Materials

- Except for cement and pulverized fuel ash and cases where the moisture content of the dusty materials is a matter of concern, all dusty materials shall be sprayed with water or a dust suppression chemical immediately prior to any loading, unloading or transfer operation in order to keep the materials wet and to reduce chances of dust being released.
- A restriction on the height from which materials are dropped, as far as practicable, should be enforced in order to minimise the fugitive dust arising from unloading / loading.

Use of Vehicles

- Immediately before leaving a construction site, every vehicle shall be washed to remove any dusty materials from its body and wheels.

- Where a vehicle leaving a construction site is carrying a load of dusty materials, the load shall be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle.

Debris Handling

- Any debris should be covered entirely by impervious sheeting or stored in a debris collection area covered by a roof or cover and sheltered on three sides;
- Before debris is dumped into a chute, water should be sprayed so that it remains wet when it is dumped.

Site Clearance

- The working area for the uprooting of trees, shrubs, or vegetation or the removal of boulders, poles or pillars should be sprayed with water immediately before, during and immediately after the operation so as to keep surfaces wet.
- All demolished items shall be covered by impervious sheeting or placed in an area that is sheltered by means of a roof or cover and is enclosed on three sides within a day of the demolition.

4.4 Review of Operational Phase Air Quality

4.4.1 Air Quality Impact

Landuse within the vicinity of the project site is mainly residential. The major pollution sources within the study area are the vehicular emissions, NO_2 and RSP, from Tolo Highway and Fanling Highway.

The Approved EIA report evaluated 1-hr average NO_2 concentrations and 24-hr average RSP concentrations at the representative ASRs.

As the anticipated commissioning year during the study of the Approved EIA Report was 2005, the assessment was based on the Year 2020 AM peak hourly traffic flows. However, the commissioning year of the Project has been changed from 2005 to 2013 as compared to the Approved EIA Report.

As the vehicular emission assessment should normally be based on the worst scenario in terms of overall vehicular emissions within 15 years after commissioning of the Project, the assessment results in the Approved EIA Report should be reviewed based on the latest anticipated commissioning year of the Project.

Traffic forecasts have been reviewed based on the commissioning year of 2013. AM and PM peak hourly traffic forecasts for years 2028 have been modelled. All the traffic forecasts were endorsed by the Transport Department for the purpose of the Project. Details of the traffic data are presented in Appendix C.

Moreover, since the design of some of the noise barriers has been changed when compared to the EIA Design, any potential vehicular emissions due to the change of these barrier designs have also been reviewed.

Air quality modelling for vehicular emissions, 1-hr average NO_2 and 24-hr average RSP has been carried out based on the updated traffic forecast data for the Proposed Design of year 2028. This scenario aims to assess the vehicular emission impact due to the proposed changes to the barrier

designs. Detailed changes between the EIA Design and Proposed Design were described in Table 2-1.

4.4.2 Assessment Methodology

The air quality assessment under this ERR utilised the Gaussian dispersion model 'CALINE4', which was the same modelling tool used in the Approved EIA Report.

In the Approved EIA Report, 1-hr average NO_2 and 24-hr average RSP concentrations were identified as the parameters of concern for vehicular emission assessment. Thus, 1-hr average NO_2 and 24-hr average RSP concentrations at the representative ASRs have been predicted using air quality models in this ERR. The air quality model incorporates all existing and planned major roads and associated slip roads within a 500m radius from the project site boundary.

It is understood that the vehicle emission factors for Hong Kong traffic will decline with time due to improvements in vehicle engines, the increased use of catalytic converters and particulate traps, as well as improved fuel (i.e. LPG and low sulphur diesel) developed for achieving a more stringent EURO IV/V emission standards. In this ERR, the updated vehicular emissions are estimated based on EURO IV fleet average emission factors of air pollutants, available from EPD. When compared to EURO III fleet average emission factors as used in the Approved EIA Report, the overall fleet average emissions have declined. The fleet average emission factors adopted in this ERR is presented in Table 4-3.

Table 4-3 The Fleet Average Emission Factors for Year 2011 to 2028

Fleet Average Emission Factors (g/km/veh)	MC	PC	Taxi	PLB	LGV	HGV	Coach	Bus
NOx	0.37	0.54	0.49	1.10	0.97	3.46	4.96	6.15
RSP	0.03	0.03	0.01	0.07	0.09	0.36	0.33	0.45

As the future emission factors beyond Year 2011 were not available, the year 2011 fleet average emission factors of NO_x and RSP were used for estimating vehicular emission rates as a conservative approach. This approach was also adopted in the Approved EIA Report. Details of the calculation of the vehicular emission rates are given in Appendix D-2.

A sensitivity test of the traffic forecasts for year 2013, 2016, 2021, 2028 as presented in Appendix C indicates that the overall emission strength from the traffic fleets for the year 2028 AM peak is the highest compared to the others. It is therefore logical to assume year 2028 to be the worst scenario in terms of overall vehicular emissions of either NO_2 or RSP. For the same reason, the year 2028 AM peak traffic forecasts have been used for the dispersion modelling.

Meteorological parameters as adopted in the Approved EIA Report, which were in accordance with 'Guidelines on Choice of Models and Model Parameters' by EPD, were also adopted in this environmental review. The following summarises the meteorological parameters adopted in the air quality modelling:

- Wind direction: 360 deg with 1 deg resolution for NO_2 model run

  Worst-case wind angle for RSP model run
- Wind speed: 1 m/s
- Atmospheric stability class: D

- Mixing height: 500 m
- Wind direction standard deviation: 18 deg
- Ambient temperature: 25.5 deg
- Aerodynamic roughness: 1 m

The CALINE4 dispersion model determines the hourly NO_2 and RSP concentrations. For calculating NO_2 concentrations, the Ozone Limiting Method adopted in the approved EIA Report has also been adopted in the air quality modelling exercise in this ERR. This method is acceptable by EPD in accordance with the 'Guidelines on Choice of Models and Model Parameters' by EPD. The following parameters were input in the CALINE 4 dispersion models:

- Ambient ozone concentration (ppm) – 0.04 (Year 2002 – 2006 average ozone concentrations from Tai Po Air Monitoring Station)
- Nitrogen dioxide photolysis rate constant (1/second) – 0 (for the most conservative analysis)

The "NO_2" option of CALINE4 dispersion model has been used in the model. NOx emission factors were estimated based on the updated traffic forecast and EURO IV fleet average emission factors and were input into the models.

Due to an intrinsic limitation of the CALINE4 model, only 1-hr pollutant concentrations can be predicted.

In the Approved EIA Report, the 24-hr average RSP concentrations were predicted using daytime and nighttime models separately based on the 24 hour traffic flow breakdown figures. As there is no updated 24 hour traffic forecasts available, in order to estimate longer term maximum concentrations of air pollutants reference has been made to Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised, USEPA, October 1992. The 24-hr average RSP concentration has been estimated by multiplying the hourly maximum levels by 0.4. This approach was widely adopted for vehicular emission assessment in recent EIA studies such as EIA report for Repositioning and Long Term Operation Plan of Ocean Park (2006), EIA report for Hong Kong Convention and Exhibition Centre, Atrium Link Extension (2006), EIA report for Trunk Road T4 in Sha Tin (2004) and EIA report for Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange (2001) which were approved by EPD. Thus, it is considered that this approach is appropriate to be adopted in this ERR.

The effects of the proposed roadside noise barriers of the Project have been taken account into the air quality model. In the Approved EIA report, the EPD required the approach of raising the vehicle related air pollutant release height to the top of the barriers and this has been adopted in this assessment. It is considered that this represents a worst-case scenario and a conservative approach.

4.4.3 Assessment Results

As mentioned in Section 4.4.2, the vehicle emission factors for Hong Kong traffic are expected to decline with time, due to improvements in vehicle engines, the increased use of catalytic converters and particulate traps, as well as improved fuel. With the adoption of the updated EURO IV fleet average emission factors, the predicted pollutants concentrations at the representative ASRs in this ERR are, in general, lower to those in the Approved EIA Report.

Tables 4-4 and 4-5 present the predicted NO_2 and RSP concentrations that maybe expected at the representative ASRs. All these predictions are corrected for the background concentrations (i.e. 51μg/m^3 – annual average NO_2 concentration and 50μg/m^3 – annual average RSP concentration).

According to Table 4-4 and Table 4-5, both of the predicted 1-hr average NO_2 and 24-hr average RSP concentrations at all representative ASRs fully comply with their AQOs for Proposed Design. This indicates that there would be no adverse air quality impact due to the vehicular emissions based on the updated traffic forecast and the changes since the approval of EIA report.

The worst hit levels of hourly average NO_2 and daily average RSP were found at SR23 (31.4mpD) and SR28 (23.9mPD) respectively.

Concentration isopleths of air pollutants at worst hit levels were plotted and shown in Appendix D-3 (Figures D-1 to D-10). Background concentrations in Table 4-1 have been included in all concentration isopleths. No identified ASRs are located within the pollutant contours of exceeding the assessment criteria.

Table 4-4 Predicted 1-hr Average NO_2 Concentration

ASR	Worst Case		Predicted 1-hr Average NO_2 Concentration, μg/m^3	
	Elevation (mPD)	Floor Level	EIA Design (Data adopted in the EIA report, forecast year 2020)	Proposed Design (forecast year 2028)
SR1	38.1	1/F	150.7	126.2
SR2	23.0	1/F	177.3	145.0
SR3	32.5	1/F	179.2	145.0
SR7N	20.3	1/F	-	145.0
SR9	23.6	G/F	201.5	182.6
SR11A	19.0	G/F	-	163.8
SR11B	20.4	G/F	-	145.0
SR17B	25.7	G/F	242.9	201.4
SR20	32.9	G/F	151.4	126.2
SR22	30.9	G/F	259.1	220.3
SR22N	30.9	1/F	-	220.3
SR23	31.4	1/F	261.0	276.7
SR25	24.5	2/F	207.1	201.4
SR28	23.9	1/F	240.4	257.9
SR29	25.5	5/F	167.9	145.0
SR31	15.3	2/F	241.9	201.4
SR33	32.2	G/F	237.4	163.8
SR34	58.8	G/F	153.2	163.8
SR35	47.4	5/F	227.4	145.0
SR36	17.0	1/F	276.5	220.3
SR39	37.3	1/F	186.4	126.2

ASR	Worst Case		Predicted 1-hr Average NO_2 Concentration, µg/m³	
	Elevation (mPD)	Floor Level	EIA Design (Data adopted in the EIA report, forecast year 2020)	Proposed Design (forecast year 2028)
SR43	26.8	6/F	158.7	145.0
SR45	25.6	5/F	219.0	163.8
SR47	12.4	3/F	237.6	239.1
SR54	8.5	G/F	182.0	182.6
SR55	57.3	8/F	190.3	163.8
SR56	45.2	1/F	181.3	145.0
SR57	37.0	9/F	158.3	126.2
SR61	38.7	9/F	146.5	126.2
SR62	32.3	1/F	240.2	220.3
SR64	44.3	G/F	227.9	201.4
SR66	29.6	6/F	165.2	126.2
SR68	8.6	G/F	198.3	220.3
SR69	9.0	G/F	169.0	163.8
SR70	12.5	2/F	188.5	201.4
SR71	9.2	G/F	148.5	163.8
SR72	10.0	G/F	119.9	126.2
SR73	17.4	G/F	225.5	182.6
SR74	17.4	G/F	281.6	201.4
SR75	18.4	1/F	195.4	182.6
SR77	23.9	G/F	216.3	163.8
SR78	53.3	8/F	157.9	126.2
SR100	10.2	1/F	174.8	201.4

Table 4-5 Predicted 24-hr Average RSP Concentration

ASR	Worst Case		Predicted 24-hr Average RSP Concentration, µg/m³	
	Elevation (mPD)	Floor Level	EIA Design (Data adopted in the EIA report, forecast year 2020)	Proposed Design (forecast year 2028)
SR1	38.1	1/F	84.5	60.8
SR2	23.0	1/F	82.8	61.2
SR3	32.5	1/F	94.8	63.8
SR7N	20.3	1/F	-	64.0
SR9	23.6	G/F	102.5	72.2
SR11A	18.8	G/F	-	67.0

ASR	Worst Case		Predicted 24-hr Average RSP Concentration, μg/m³	
	Elevation (mPD)	Floor Level	EIA Design (Data adopted in the EIA report, forecast year 2020)	Proposed Design (forecast year 2028)
SR11B	19.0	G/F	-	66.2
SR17B	20.4	G/F	112.6	73.6
SR20	32.9	G/F	92.8	62.7
SR22	30.9	G/F	110.8	69.8
SR22N	30.9	1/F	-	69.8
SR23	31.4	1/F	147.8	77.3
SR25	24.5	2/F	103.1	64.8
SR28	23.9	1/F	142.1	90.9
SR29	25.5	5/F	86.2	69.7
SR31	15.3	2/F	96.2	70.0
SR33	32.2	G/F	122.3	79.4
SR34	58.8	G/F	89.1	72.0
SR35	47.4	5/F	109.3	73.6
SR36	17.0	1/F	146.8	77.8
SR39	37.3	1/F	99.0	69.8
SR43	26.8	6/F	83.6	72.4
SR45	25.6	5/F	99.2	78.4
SR47	12.4	3/F	108.3	79.7
SR54	8.5	G/F	86.2	68.3
SR55	57.3	8/F	98.9	68.9
SR56	45.2	1/F	99.7	72.4
SR57	37.0	9/F	82.0	72.9
SR61	38.7	9/F	76.5	70.6
SR62	32.3	1/F	126.5	86.8
SR64	44.3	G/F	120.1	82.6
SR66	29.6	6/F	81.2	71.9
SR68	8.6	G/F	93.9	71.1
SR69	9.0	G/F	86.9	66.3
SR70	12.5	2/F	90.7	71.5
SR71	9.2	G/F	78.9	63.5
SR72	10.0	G/F	73.0	59.4
SR73	17.4	G/F	105.9	67.0
SR74	17.4	G/F	118.5	70.9

ASR	Worst Case		Predicted 24-hr Average RSP Concentration, μg/m³	
	Elevation (mPD)	Floor Level	EIA Design (Data adopted in the EIA report, forecast year 2020)	Proposed Design (forecast year 2028)
SR75	18.4	1/F	94.5	64.0
SR77	23.9	G/F	111.1	71.6
SR78	53.3	8/F	88.8	69.6
SR100	10.2	1/F	92.8	74.6

4.5 Conclusion

A qualitative assessment on the construction dust impacts has identified that fugitive dust is the primary potential air pollutant during the road widening works. Established dust suppression techniques such as regular watering of haul roads, covering / dampening any stockpiles and dampening dusty materials before transportation, have been proposed. Through the proper implementation of the recommended mitigation measures, dust generation can be controlled and will not be expected to exceed the acceptable criteria.

Air quality modelling has been carried out to review the vehicular emission impact based on the updated traffic forecast and proposed changes in barrier designs (Proposed Design). The results indicate that there would be no adverse vehicular emission impact due to the proposed changes to the Project.

5 Noise Impact Review

5.1 Introduction

This section presents the methodologies adopted, findings and recommendations of the noise impact assessment for the Project to address changes after the approval of the earlier EIA Report. Quantitative noise modelling has been conducted based on updated traffic projections. This assessment has focused on the proposed changes in barrier design from those recommended in the approved EIA Report. This report mainly focuses on the proposed mitigation measures to ensure the compliance with the relevant traffic noise criteria.

5.2 Description of Surrounding Environment

5.2.1 Baseline Conditions

The baseline conditions described in the Approved EIA Report are still valid in this ERR. The dominant noise source in the vicinity of the study area is still road traffic noise. To a lesser degree, railway noise from the East Rail line also affects the study area, though noise impact relating to rail operations is outside the scope of this study.

5.2.2 Noise Sensitive Receivers

As described in the Approved EIA Report, the spatial scope of the noise assessment for both construction and operational phases is 300 metres from either side of the highway. In accordance with Annex 13 of EIA-TM, domestic premises (including temporary housing, educational institutions including kindergartens and nurseries, hospitals, medical clinics, homes for the aged, convalescent homes, places of public worship, libraries, court of laws, performing arts centres, auditoria, amphitheatres, hostels and country parks) are considered Noise Sensitive Receivers (NSRs).

A thorough review of all NSRs stated in the Approved EIA Report and the updated OZP was conducted. The OZPs review included: -

- Tai Po OZP S/TP/19 dated 18 November 2005
- Kau Lung Hang OZP S/NE-KLN/11 dated 27 October 2006
- Lam Tsuen OZP S/NE-LT/11 dated 10 November 2006
- Fanling/ Sheung Shui OZP S/FSS/13 dated 31 March 2006

All NSRs described in the Approved EIA Report were still applicable to this ERR, except for the following:

(a) SR7, 10, 11, 83 and 86

DSD Project Contract No. DC/2004/06 “Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po” will be completed before the commencement of this Project.

SR7, 10, 11, 83 and 86 near Tong Hang as stated in the Approved EIA Report, were/will be abandoned due to land resumption of DSD project. The abandoned NSRs have been replaced by 7 new NSRs, namely, 7N, 1012, 1015, 83N, 86N, 11A and 11B.

(b) SR22

A new village house (designated SR22N), which has a closer slant distance to Fanling Highway than the original SR22, has been built in Wai Tau Tsuen.

(c) SR52

The side building (original SR52) for Zonta White House should be a single storey. The main building for Zonta White House has been included as an additional NSR in this ERR (designated SR52N).

For ease of reference, the same NSR identifications used in the Approved EIA Report have been retained in this ERR. Locations of these NSRs are illustrated in Appendix A. Table 5-1 showed the changes of NSRs in this ERR.

Table 5-1 Changes of NSRs from the Approved EIA Report to this ERR

NSR in Approved EIA	New NSR in this ERR	Description
SR7	SR7N	SR7 was abandoned and replaced by SR7N.
SR10	SR1012, SR1015	SR10 was abandoned and replaced by SR1012 and 1015.
SR11	SR11A, SR11B	SR11 was abandoned and replaced by SR11A and 11B.
SR83	SR83A, SR83N	SR83 was abandoned and replaced by SR83A and SR83N.
SR86	SR86N	SR86 was abandoned and replaced by SR86N.
SR22	SR22N	New village house built closer to Fanling Highway than the original SR22
SR52, 2/F only	SR52N	SR52 should be single storey. The second storey of SR52 was therefore deleted and a new two-storey SR52N was added.
	SR1013	Newly identified NSR in Working Paper *EIA Re-visit for Proposed Design Changes, Air Quality and Noise Aspects*, which was approved by EPD in 2002.
-	SR1082	New Village House.
-	N1	A newly added assessment point in this ERR to assess the traffic noise impact due to the gap between high vertical barriers erected at the verge of Tai Wo Service Road West near Tai Hang
-	N4	A newly added assessment point in this ERR which is considered as the worst-affected NSR at Tai Wo Village
-	N8	A newly added assessment point in this ERR to assess the traffic noise impact due to the gap between vertical barriers erected at the verge Tai Wo Service Road West near Nam Wa Po

The selected NSRs are presented from Table 5-2 to Table 5-5.

Table 5-2 Selected Representative Noise Sensitive Receivers (NSRs) between Pak Wo Road and Hong Lok Yuen Road

Selected SR ID	Description	Land Use (1)	Easting (m)	Northing (m)	1st Level Assessment Elevation (mPD)	Sheet No. in Appendix A
SR1	Avon Park	R	832816	838702	38.1	5
SR2	Fanling Government Secondary School	Ed	832959	838483	23	5
SR3	Dawning Views 1	R	832993	838637	32.5	5
SR3A	Dawning Views 2	R	833003	838630	32.5	5
SR7N (5)	Tong Hang	R	833561	838697	20.1	5
SR8 (4)	Wo Hop Shek 1	R	833283	838482	15.5	5
SR9 (4)	Wo Hop Shek 2	R	833622	838357	23.6	5
SR1012 (5)	Tong Hang	R	833877	838418	23.8	5
SR1015 (5)	Tong Hang	R	833897	838393	22.5	5
SR11A(5)	Kiu Tau	R	833983	837884	20.4	5
SR11B(5)	Kiu Tau	R	834007	837908	19.5	5
SR86N	Tong Hang	R	833950	838014	18.4	5
SR12	Nam Wa Po 1	R	833801	837654	29.2	5
SR84	Nam Wa Po 2	R	833853	837518	19.7	5
SR85	Nam Wa Po 3	R	833869	837338	23.1	4
SR13	West Tai Wo	R	833795	836913	25	4
SR1013(2), (5)	West Tai Wo (New)	R	833801	836968	25	4
SR14	Tai Wo 1	R	833910	836947	27.7	4
SR87	Tai Wo 2	R	833959	837232	26.1	4
N4	Tai Wo 5	R	833822	837109	25.7	4
SR17 (3)	Tai Hang 1	R	833759	836655	25.7	4
SR17A (6)	Tai Hang 2	R	833751	836646	25.7	4
SR17B	Tai Hang 3	R	833739	836634	25.7	4
SR81(6)	Tai Hang 4	R	833727	836568	25.2	4
SR81N(2)	Tai Hang 5	R	833723	836593	25.2	4
SR82N	Tai Hang 6	R	836763	833756	24.2	4
N1	Tai Hang 7	R	833773	836838	24.1	4
SR1082 (5)	Tai Hang (New)	R	833764	836726	24.2	4
SR19	Hong Lok Yuen 1	R	833731	836197	32.9	4
SR20	Hong Lok Yuen 2	R	833730	836187	32.9	4

Selected SR ID	Description	Land Use (1)	Easting (m)	Northing (m)	1st Level Assessment Elevation (mPD)	Sheet No. in Appendix A
SR21	Hong Lok Yuen 3	R	833763	836313	33.9	4
SR22	Wai Tau Tsuen 1	R	833311	835997	28.2	4
SR22N	Wai Tau Tsuen (New)	R	833306	835978	28.2	4
SR80	Wai Tau Tsuen 3	R	833553	836309	26.2	4
SR88	Wai Tau Tsuen 4	R	833320	836046	27.6	4
SR89	Wai Tau Tsuen 5	R	833328	836103	28.1	4
SR90	Wai Tau Tsuen 6	R	833374	836166	25.7	4
SR75	Wong Kong Shan	R	832918	838843	15.7	5
SR76	Yuen Leng 1	R	834018	837549	22	5
SR77	Yuen Leng 2	R	833988	837406	23.9	5
SR83A	Yuen Leng	R	833959	837788	19.2	5
SR83N(5)	Yuen Leng 3	R	833988	837713	19.2	5
SR96 (2)	Village Zone near Hong Lok Yuen	R	833681	836045	33	4
SR97 (2)	Village Zone at Tai Wo 1	R	833919	836670	25	4
SR98 (2)	Village Zone at Tai Wo 2	R	833929	836801	23.8	4
SR107	Village House near Hong Lok Yuen	R	833675	836277	27.1	4
SR108	Tai Hang Village House	R	833602	836557	25.7	4
SR109	Village House near Nam Wa Po	R	833791	837238	22.5	4
N8	Village House near Nam Wa Po	R	833890	836909	24.4	4

Notes:

(1) Residential uses (R); Educational uses (Ed); Temple/Place of Worship (T)

(2) Planned NSR

(3) Selected for comparison purpose only. Will be demolished after commencement of the road widening works.

(4) Based on site observation, structures located closer to the highway are used for industrial activities. Hence SR8 and SR9 are chosen for assessment.

(5) Additional NSR in this ERR.

(6) Those NSRs are being decided whether they will be resumed or demolished after commencement of the road widening works. Noise mitigation measures are proposed to protect these NSR in case they are ultimately decided to be retained.

Table 5-3 Selected Representative Noise Sensitive Receivers (NSRs) between Hong Lok Yuen Road and Tai Po Tai Wo Road

Selected SR ID	Description	Land Use (1)	Easting (m)	Northing (m)	1st Level Assessment Elevation (mPD)	Sheet No. in Appendix A
SR23	Wai Tau Tsuen 2	R	833295	835868	28.7	3
SR24	Kau Liu Ha 1	R	833007	835534	19.1	3
SR25	Kau Liu Ha 2	R	833011	835521	19.1	3
SR26	Tai Po Garden	R	833886	834978	13.8	3
SR27	Mui Shu Hang	R	833717	834693	15.7	3
SR28	Northwest Shek Kwu Lung	R	833802	834667	21.2	3
SR29	Parc Versailles 1	R	833960	834769	11.5	3
SR29A	Parc Versailles 2	R	834057	834685	11.5	3

Notes:

(1) Residential uses (R); Educational uses (Ed); Temple/Place of Worship (T)

Table 5-4 Selected Representative Noise Sensitive Receivers (NSRs) between Tai Po Tai Wo Road and Tat Wan Road

Selected SR ID	Description	Land Use (1)	Easting (m)	Northing (m)	1st Level Assessment Elevation (mPD)	Sheet No. in Appendix A-
SR30A	Shek Kwu Lung 4	R	834088	834428	15.8	2
SR30B	Shek Kwu Lung 5	R	834059	834401	17.2	2
SR30C	Shek Kwu Lung 6	R	834017	834372	31.2	2
SR31	Shek Kwu Lung 2	R	834198	834446	9.9	2
SR33	Shek Kwu Lung 3	R	834123	834155	33.2	2
SR34	Pun Chun Yuen	R	833952	834079	58.8	2
SR35	Buddhist Tai Kwong Middle School	Ed	834184	834144	32.4	2
SR36	Ma Wo	R	834428	833704	43.2	2
SR38	Dynasty View 1	R	834479	833625	37.7	2
SR55	Dynasty View 2	R	834514	833555	37.7	2
SR56	Monastery at Ma Wo	T	834560	833482	42.5	2
SR78	Dynasty View 3	R	834643	833476	33.7	2
SR91(2)	New Residential (B) Zone near To Yuen Tung 1	R	834716	833415	40	2
SR92(2)	New Residential (B) Zone near To Yuen Tung 2	R	834770	833401	40	2

Selected SR ID	Description	Land Use (1)	Easting (m)	Northing (m)	1st Level Assessment Elevation (mPD)	Sheet No. in Appendix A-
SR95B	Tai Po Normal School Memorial School	Ed	834289	834295	16.6	2
SR103	Classical Garden	R	834808	833592	27.2	2
SR104	Village House near Ma Wo 1	R	834385	833504	81.2	2
SR105	Village House near Ma Wo 2	R	834256	833826	79.4	2
SR106	Village House near Shek Kwu Lung	R	833770	834463	39.2	3

Notes:

(1) Residential uses (R); Educational uses (Ed); Temple/Place of Worship (T)

(2) Planned NSR

As stated in the Approved EIA Report, two additional sensitive receivers (SR91 and SR92) were included for the operational noise impact assessment. The site formation development in this R(B) zone was on-going, but the final details were not yet available. Therefore the proposed locations of the planned NSRs, which best represent the worst case, have been chosen according to the following recommendations as by the Approved EIA Report:

- NSRs for "Village" zone should be assigned at the zone boundary closest to the highway
- NSRs for "Residential" zone should be assigned at 10 m setback from the zone boundary closest to the highway

Table 5-5 Selected Representative Noise Sensitive Receivers (NSRs) between Tat Wan Road and Island House Interchange

Selected SR ID	Description	Land Use	Easting (m)	Northing (m)	1st Level Assessment Elevation (mPD)	Sheet No. in Appendix A
SR39	The Paragon	R	835904	833771	37.3	1
SR40	Grand Palisades	R	835853	833633	59	1
SR41	Wong Shiu Chi Middle School	Ed	835728	833992	6.4	1
SR42	Wan Tau Tong Estate - Wan Lam House 1	R	835398	833644	12.8	1
SR43	Wan Tau Tong Estate - Wan Lam House 2	R	835365	833629	12.8	1
SR44	Wan Tau Tong Estate - Wan Loi House	R	835448	833702	12.8	1
SR45	HK Teacher's Association Secondary School	Ed	835530	833672	13.6	1
SR46	Uptown Plaza	R	835537	833772	30.3	1
SR47	Wang Fuk Court – Wang Cheong House 1	R	836216	834105	6.8	1

Selected SR ID	Description	Land Use	Easting (m)	Northing (m)	1st Level Assessment Elevation (mPD)	Sheet No. in Appendix A
SR48	Wang Fuk Court – Wang Cheong House 2	R	836213	834126	6.8	1
SR49	Wang Fuk Court – Wang Cheong House 3	R	836197	834106	6.8	1
SR50	Wang Fuk Court – Wang Tat House	R	836154	834102	6.8	1
SR51	Wang Fuk Court – Wang Shing House	R	836210	834164	6.8	1
SR52	Ha Wong Yi Au 1	R	836061	833848	29.2	1
SR52N (3)	Zonta White House Main Building	R	836057	833826	29.2	1
SR53	Ha Wong Yi Au 2	R	836215	833712	11	1
SR54	Riverrain Bayside	R	836343	833757	8.5	1
SR57	King Nga Court - King Yuet House 1	R	835187	833453	14.6	1
SR58	King Nga Court – King Yuet House 2	R	835208	833457	14.6	1
SR59N	King Nga Court – King Yan House	R	835252	833493	14.6	1
SR60	Tak Nga Court 1	R	835156	833458	16.3	1
SR61	Tak Nga Court 2	R	835143	833463	16.3	1
SR62	Ha Wun Yiu	R	834870	833294	29.6	1
SR63	Lai Chi Shan	R	835064	833211	22.4	1
SR64	Shan Tong New Village 1	R	835425	833404	44.3	1
SR65	Shan Tong New Village 2	R	835538	833460	41.8	1
SR66	P.L.K. Tin Ka Ping Primary School	Ed	835287	833553	14.6	1
SR67	Redland Garden	R	836715	833567	29.4	1
SR70	Kwong Fuk Estate - Kwong Lai House	R	836215	834287	9.7	1
SR73	Island House Conservation Studies Centre	Ed	836473	834040	17.2	1
SR79	Care Village	R	836431	833753	5.6	1
SR93	S.K.H. Mok Sau Tsang Secondary School	Ed	835573	833974	25.6	1
SR94	Choi Hin To Primary School	Ed	835183	833551	15.5	1
SR99 (2)	Ha Wong Yi Au 3	R	836158	833827	6.4	1
SR99A (2)	Ha Wong Yi Au 4	R	836185	833850	6.4	1
SR100	KCRC Staff Quarter at Tai Po Kau	R	836803	833546	10.2	1

Selected SR ID	Description	Land Use	Easting (m)	Northing (m)	1st Level Assessment Elevation (mPD)	Sheet No. in Appendix A
SR101	Chateau Royale	R	836328	833652	20.2	1

Notes:

(1) Residential uses (R); Educational uses (Ed); Temple/Place of Worship (T)

(2) Planned NSR

(3) Additional NSR in this ERR

5.3 Construction Phase Noise Impacts

Although there is a minor alignment change at Tai Kwong Yuen when comparing the Proposed Design to the EIA Design, the site boundary will be very similar between the two designs. Furthermore, the alignment change shifts the site boundary further away from NSRs, except SR34 (Pun Chun Yuen), which will further reduce the construction noise levels. Therefore, the construction methodologies and noise impact assessment, including the use of Powered Mechanical Equipment (PME), as proposed in the Approved EIA Report are still applicable in this ERR. The construction noise impacts on SR34 and all newly identified NSR were carried out separately in the following sections. The construction programme indicates that the PMEs will operate in four separate sections with no concurrent operation. The four sections are:

- Between Island House and Tat Wan Road
- Between Tat Wan Road and Tai Po Tai Wo Road
- Between Tai Po Tai Wo Road and Hong Lok Yuen Road
- Between Hong Lok Yuen Road and Pak Wo Road

The construction noise impact assessment adopted from the Approved EIA Report is summarized below.

5.3.1 Powered Mechanical Equipment

As proposed in the Approved EIA Report, silenced Powered Mechanical Equipments (PMEs) with lower sound power levels (SWLs) will be used. The SWLs of silenced PME available in Hong Kong were adopted in the noise calculations. The SWLs of proposed silenced PMEs are presented in Table 5-6. The proposed plant inventory in this Project adopted in the Approved EIA Report is given in Appendix E.

Table 5-6 Adopted SWLs of Silenced Equipment (Source: Approved EIA Report)

Plant	CNP ID Code	Maximum SWL, dB(A)	Silenced SWL, dB(A)
Bulldozer	CNP 030	115	113.9
Backhoe	CNP 081	112	98
Loader	CNP 081	112	98.5
Rock Driller	CNP 181	128	113
Concrete Cutter	BS 5228 Table C2#4	119	112
Lorry	CNP 141	112	105
Vibrating Hammer	BS 5228 Table C4#6	126	116
Piling Machine	CNP 166	100	-
Generator	CNP 101	108	97
Air Compressor	CNP 003	104	90
Lifting Crane	CNP 048	112	105
Bar Bender	CNP 021	90	-
Concrete Pump	CNP 047	109	105
Vibrating Poker	CNP 170	113	102
Paver	CNP 004	109	-
Compacting Plate	CNP 050	105	100
Compacting Roller	CNP 186	108	-

5.3.2 Mitigation Measures

Apart from the adoption of silenced PME, the Approved EIA Report also recommends additional mitigation measures such as reduction in plant numbers, erection of temporary noise barriers and application of good site practices during the construction phase.

In combination with the selection of silenced PME, limiting the equipment numbers would further reduce noise levels. To this end, the number of plant/equipment, where necessary, has been reduced to the minimum number with which the construction programme can still be met. The equipment reduction schedule implemented is as follows: reduce the number of equipment by 1 when the original equipment numbers are 3, 4, and 5, and reduce by 2 when the original equipment numbers are 6 or more. As stated in the Approved EIA Report and summarised in Appendix E, the percentage on-time of the equipment operation, where applicable, has also been reduced to the appropriate level specified in BS 5228. The prediction results show that the noise impacts have been further reduced. However, the predicted noise levels at some NSRs still exceed the acceptable levels.

Therefore, additional mitigation measures such as physical noise barriers were evaluated and are discussed in the Approved EIA Report.

Hoarding, if provided, will partially screen equipment-emitted noise from the nearby NSRs. The attenuation will be most effective if there are no gaps or openings in the hoarding. However, as hoarding locations cannot be clearly defined at this stage, the assessment has not taken into account any potential benefits from the screening effects of hoarding.

Purpose-built temporary noise barriers with heights varying between 2m and 7m are recommended to further reduce the construction noise levels. Their locations, corresponding heights and descriptions are given in Figures 5.6.1–5.6.5 of the Approved EIA Report. With these barriers in place, the predicted construction noise levels at most NSRs are found to be within acceptable levels except for two schools (SR41 and SR45) at which the predicted noise levels comply with the $L_{eq(30\ min)}$ 70 dB(A) criterion but exceed the $L_{eq(30\ min)}$ 65 dB(A) criterion (during examination period).

In addition, where practicable, traffic noise barriers could be constructed in an earlier stage of the construction programme in order to provide screening for the construction noise. As adopted in the Approved EIA Report, there were two types that can be considered: (a) those that are independent of the widening works, and (b) those that are dependent on the widening works. For type (a), early construction can be considered as long as it has no conflicts with other traffic diversions. For type (b) any related construction needs to tie in with the widening works. However, it may be possible to stipulate that the construction sequence should be arranged so as to allow the barriers to be built at the earliest opportunity.

Further to the abovementioned mitigation measures, the good site practice listed below should be implemented by the contractors in order to further mitigate any residual impacts. The noise mitigating effects were not easily quantifiable as they depend on the site and operating conditions. Good site practice is also easy to implement and does not impact upon the works schedule.

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction programme; and
- mobile plant, if any, should be sited as far away from NSRs as possible.

Other good site practice and noise management can considerably reduce the impact of construction site activities on nearby NSRs. The following measures should be followed throughout construction:

- machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from nearby NSRs;
- material stockpiles and other structures should be effectively utilized, where practicable, in screening noise from on-site construction activities.

The noise benefits of these techniques are difficult to quantify, and whilst they would provide some attenuation, they cannot be assumed to guarantee a high level of noise mitigation.

5.3.3 Impact Evaluation

In the Approved EIA report, the computer model “siteNoise”, which is based on the calculation

method for equivalent continuous sound level in British Standard 5228 (BS 5228), "Noise Control on Construction and Open Site", were used. The SWLs of the PMEs were listed in Table 5-6.

In accordance with Section 5.4.2 of the Approved EIA Report, the construction noise impacts (excluding percussive piling) was assessed for daytime works only, i.e., 0700 to 1900 hours on weekdays other than general holidays. The construction noise assessment criteria for 0700 to 1900 hours on any day not being a Sunday or public holiday (as presented in Section 3) are as follows:

- $L_{eq(30min)}$ 75 dB(A) for residential premises, and
- $L_{eq(30min)}$ 70 dB(A) for schools ($L_{eq(30min)}$ 65 dB(A) during examinations).

The construction noise assessment criterion for schools was targeted at $L_{eq(30min)}$ 65 dB(A). However, it is recognised that this target is only applicable during examination periods. Normally the construction noise criterion for classroom activities is $L_{eq(30min)}$ 70 dB(A). As examination periods are not anticipated to extend over long periods, appropriate construction activity planning and/or mitigation measures was recommended for school NSRs where exceedances of $L_{eq(30min)}$ 65 dB(A) have been predicted.

The construction noise modelling results as predicted in the Approved EIA Report were applicable and adopted in this ERR, for activities in four separate road sections. Appendix F-1 extracts the mitigated noise levels at each NSR from the Approved EIA report.

Quantitative noise impact assessment for newly identified NSRs was carried out through desktop calculations. As discussed above, the alignment change at Tai Kwong Yuen will shorten the notional distance at SR34 (Pun Chun Yuen), which might cause adverse construction noise impacts. Therefore, quantitative assessment at SR34 was also carried out. According to the assessment result, silenced equipment and plant reduction should be applied as the mitigation measures.

Apart from SR1013, 22N and 1082, all the newly identified NSRs replaced previously abandoned NSRs. Therefore, reference could be made from the prediction result in the Approved EIA Report. For SR1013, 22N and 1082, it is expected the noise level could be referenced from the nearest NSR.

The construction noise levels at these NSRs could be calculated by adjustment of notional distance since the plant inventory and mitigation measures of the Approved EIA Report were fully adopted in this ERR. Inverse Square Law for a point source in a free field was adopted and the equation is shown below:-

$$SPL' = SPL + 20 \log (D/D')$$

where SPL = sound pressure level at abandoned NSR

SPL' = sound pressure level at replaced NSR

D = distance between abandoned NSR & notional source

D' = distance between replaced NSR & notional source

According to the above equation, the construction noise levels at all newly identified NSRs were calculated and the calculation results are summarised in Table 5-7. Assessment results show that the predicted construction levels at these NSRs except for SR 1082, would be within the criterion of 75 dB(A).

The construction noise level of 79 dB(A) at SR1082 as shown in Table 5-7 was calculated based on the predicted construction noise level at SR82N (Table F4 in Appendix F-1 extracted from the Approved EIA Report), which was assumed to be located ~14m away from the Site. According to Figure 5.6.3 of the Approved EIA Report and the predicted construction noise level at SR82N, although a 3.5m high purpose-built temporary noise barrier has been recommended along the section of Tai Wo Service Road West near Tai Hang for protecting the NSRs along Tai Wo Service Road West at Tai Hang, screening correction of the temporary noise barrier was not considered at SR82N.

To mitigate the adverse construction noise impact on SR1082, which is a 3-storey village house, it is recommended to replace the original proposed 3.5m vertical barrier by a 7m vertical temporary barrier. A screening effect of at least 5 dB could then be applied for SR1082. As such, the predicted construction noise level at SR1082 would be 74 dB(A), which would be within the criterion of 75 dB(A).

Table 5-7 Calculations of Construction Noise Impact for Newly Identified NSRs

Abandoned NSR / Reference NSR	New NSR	Distance from Site for Abandoned/Reference NSR (m), D	Distance from Site for New NSR (m), D'	SPL at Abandoned NSRs (Adopted in Approved EIA Report), dB(A)	SPL' at New NSRs, dB(A)
SR52 (Ha Wong Yi Au), 2/F	SR52N (Ha Wong Yi Au)	65	85	70	67
SR83 (Yuen Leng)	SR83N (Yuen Leng 3)	45	50	72	71
SR11 (Kiu Tau)	SR11A (Kiu Tau)	12	45	72	61
SR11 (Kiu Tau)	SR11B (Kiu Tau)	12	75	72	56
SR86 (Tong Hang)	SR86N (Tong Hang)	15	15	74	74
SR10 (Tong Hang)	SR1012 (Tong Hang)	49	80	68	64
SR10 (Tong Hang)	SR1015 (Tong Hang)	49	82	68	64
SR7 (Tong Hang)	SR7N (Tong Hang)	42	130	70	60
SR34[(1)] (Pun Chun Yuen)	-	85	60	65	68
SR89 (Wai Tau Tsuen)	SR22N (Wai Tau Tsuen)	49	26	66	72
SR13 (West Tai Wo)	SR1013 (West Tai Wo)	5	8	75	71
SR82N (Tai Hang 5)	SR 1082 (Tai Hang (New))	14	6	72	79

Note (1) due to proposed alternative alignment at Tai Kwong Yuen

5.3.4 Residual Impacts

According to the Approved EIA Report, the predicted construction noise levels at all residential NSRs would be within the relevant criterion of 75 dB(A) after implementation of the proposed mitigation measures, such as silenced equipment, reducing the number of equipment, reducing the percentage on-time of using equipment and purpose built temporary noise barriers. For educational institutions, the predicted noise levels at Wong Shui Chi Middle School (SR41) would exceed the examination period criterion of 65 dB(A). The predicted noise levels at HK Teacher's Association Lee Heng Kwei Secondary School (SR45) would also exceed the non-examination period criterion of 70 dB(A) and the examination period criterion of 65 dB(A). These results are summarised in Table 5-8.

Table 5-8 Summary of Residual Impact at NSRs after Provision of all Practicable Direct Mitigation Measures

SR ID	Description	Noise Criteria* $L_{eq(30\ min)}$	Predicted Max. Noise Level $L_{eq(30\ min)}$ dB(A) and Exceedance Floors			
			Section between Island House and Tat Wan Road	Section between Tai Po Tai Wo Road and Hong Lok Yuen Road	Section between Tat Wan Road and Tai Po Tai Wo Road	Section between Hong Lok Yuen Road and Pak Wo Road
SR41	Wong Shiu Chi Middle School	65/ 70 dB(A)	-	-	68 (1-5/F)	-
SR45	HK Teacher's Assn Lee Heng Kwei Secondary School	65/ 70 dB(A)	-	69 (1-6/F)	70 (1-6/F)	75 (1-6/F)

During the EIA stage of studies, the school officers confirmed that Wong Shiu Chi Middle School (SR41) and HK Teacher's Association Lee Heng Kwei Secondary School (SR45) were on the list of the EPD's "Noise Abatement Program in Schools" (NAP), i.e., appropriate glazing and air conditioners were installed at the impacted facades and air conditioners are switched on during school hours. As noise insulation are already in place at these two schools (SR41 and SR45), the residual construction noise impacts will be adequately mitigated and therefore these schools will not be critically impacted by the project.

5.3.5 Cumulative Impacts

According to the Approved EIA Report, the assessment has already considered the cumulative noise impacts from all four sections of the construction. No other nearby construction activities or other major works projects will be carried out during the same construction period as the Project.

5.4 Operational Phase Noise Impacts

Road traffic will be the major source of noise impacts during the operational phase of the Project. This includes noise from traffic on the improved highways, as well as from existing roads. The same methodology and modelling tools used in the approved EIA Report have been adopted in this ERR.

5.4.1 Assessment Methodology

The traffic noise levels at the identified NSRs have been predicted using the computer model "RoadNoise" which implements the calculation method as prescribed in "Calculation of Road Traffic Noise (CRTN)" developed by the UK Department of Transport, Welsh Office in 1988. The assumptions of speed limits and road surfacing as stated in the approved EIA Report were generally adopted in this ERR.

In this ERR, traffic flow forecasts for the year 2028, i.e. the worst year within a 15 years after project completion in 2013, have been adopted. The traffic data of year 2028, which has been agreed by the Transport Department, is presented in Appendix C. According to the traffic data, the predicted traffic flows of the morning peak are higher than those of the afternoon peak. Therefore, the morning peak traffic data were used in the assessment to represent the worst-case scenario.

On the other hand, the scope of work at Island House Interchange has slightly been amended. Figure 5-1 shows the expected scope of work in Year 2000 while Figure 5-2 presents the most updated scope of work at Island House Interchange.

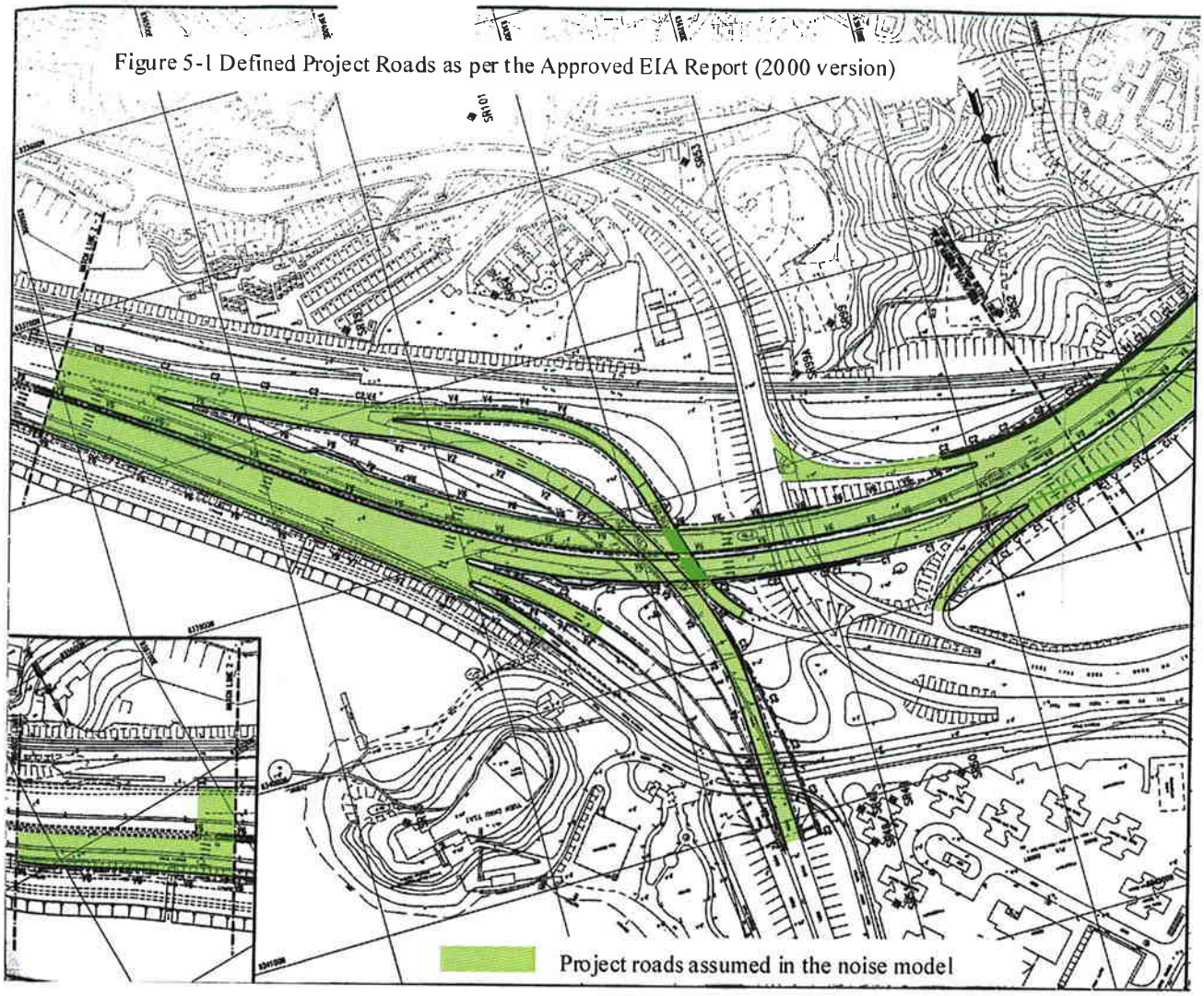
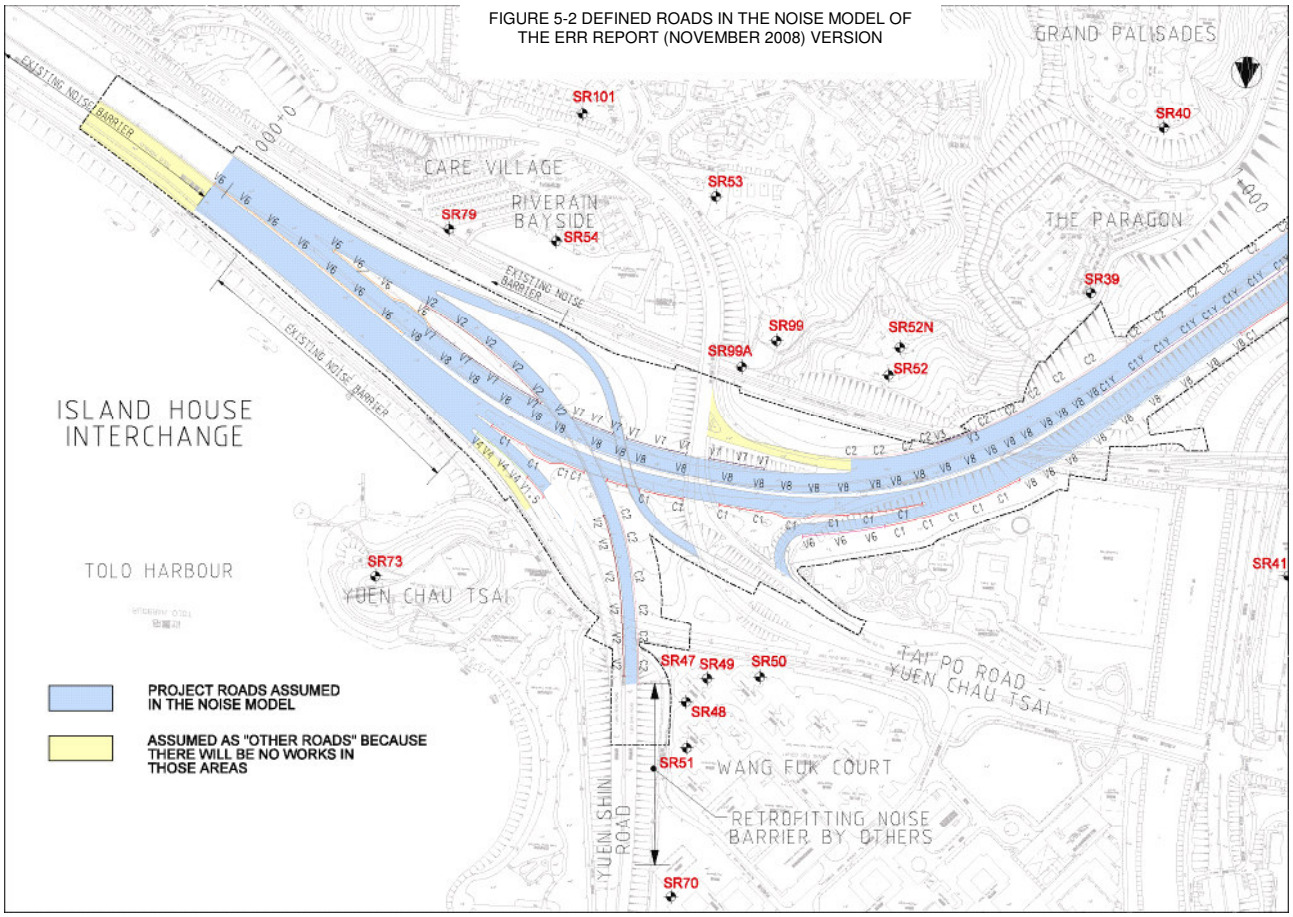


Figure 5-1 Defined Project Roads as per the Approved EIA Report (2000 version)

FIGURE 5-2 DEFINED ROADS IN THE NOISE MODEL OF THE ERR REPORT (NOVEMBER 2008) VERSION



According to the Study Brief of the EIA study, quantitative comparisons between the Noise Impact Assessment for 24 Hour Opening of Border Crossings study (NIA) and the survey data were required. However, the latest prediction year of NIA was 2006, which has already passed the reporting date of this ERR. A comparison was made between the traffic monitoring data of year 2006 and that predicted in the NIA to justify the traffic noise impact due to 24 Hour Opening of Border Crossing.

5.4.2 Mitigation Measures

The assessment criteria for designing mitigation measures stated in the approved EIA Report is still applicable to this ERR. The Technical Circular ETWB TC(W) No. 13/2003A “Guidelines and Procedures for Environmental Impact Assessment of Government Projects and Proposals – Planning for Provision of Noise Barriers” was also considered in this ERR.

Most of the mitigation measures as stated in the Approved EIA Report were adopted in this ERR, except for the amendment to the noise barrier arrangement as stated in Table 2-1. It should be noted that the change of noise barrier at Hong Lok Yuen, Tai Wo and Yuen Leng was proposed in the Working Paper - EIA Re-visit for Proposed Design Changes Air Quality and Noise Aspects, April 2002, which was approved by EPD.

5.4.3 Impact Evaluation

In order to compare the Proposed Design with that stated in the Approved EIA Report, one modelling scenario was simulated based on the alignment and noise barrier arrangement as stated in Appendix A-2, and the updated traffic data in Year 2028 as stated in Appendix C. According to HyD's letter ref.: (558X) in HMW 805TH/1/7/1 dated of 19 March 2007, the project "6805TH – Retrofitting of Noise Barriers on Fanling Highway (East Rail Fanling Station to Wo Hing road) will be completed before the commencement of operational phase of this Project. The noise barrier layout for the retrofitting projects was incorporated into the model. A copy of HyD's confirmation letter is attached in Appendix G.

The modelled results are presented in a split format so that the noise contributions from proposed road alignment (i.e. New Roads) and other existing roads within 300 meters spatial scope of the noise impact assessment can be identified.

Mitigation measures have been proposed based on the assessment criteria presented in Chapter 3 and the graphical presentation is shown in Appendix A. The approach for designing direct mitigation measures for the current Project is summarised in Flow Chart 1 and the modelling results for the Year 2028 are summarized in Table 5-9 and Appendix A.

Flow Chart 1 – Summary of the Approach for Direct Mitigation Measures Design

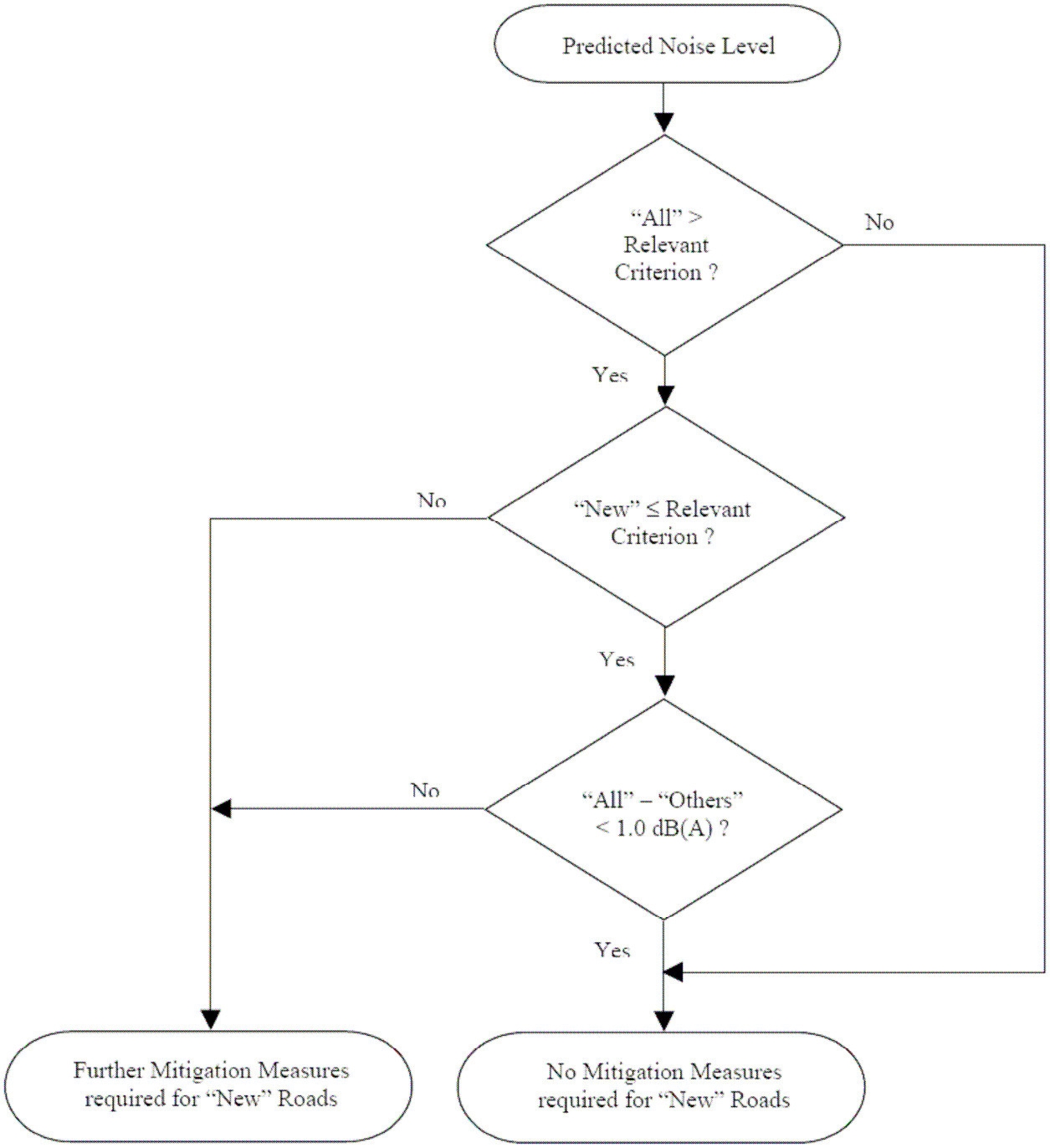


Table 5-9 Modelling Results of This ERR and Comparison with the Results Extracted from the Approved EIA Report

NSR ID	Floor	Level	Predicted $L_{10(1\text{-}hr)}$ Levels - EIA Design, dB(A) (extracted from the Approved EIA Report)			Predicted $L_{10(1\text{-}hr)}$ Levels Proposed Design with Traffic Forecast in Yr 2028, dB(A)			
		mPD	Project Roads	Other Roads	All	Project Roads	Other Roads	All	Contribu-tion from Project Road
SR1 (Avon Park)	1/F	38.1	60.2	77.2	77.3	54.5	67.2	67.4	0.2
	13/F	71.7	61.1	78.1	78.2	61.4	75.5	75.7	0.2
	25/F	105.3	61.4	77.4	77.5	61.9	75.2	75.4	0.2
SR2 (Fanling Government Secondary School)	1/F	23.0	55.1	69.6	69.8	49.4	71.5	71.5	0.0
SR3 (Dawning Views 1)	1/F	32.5	66.4	76.0	76.5	59.1	72.3	72.5	0.2
	14/F	68.9	67.3	78.4	78.7	68.1	76.1	76.7	0.6
	28/F	108.1	68.1	78.2	78.6	68.2	75.5	76.2	0.7
SR3A (Dawning Views 2)	1/F	32.5	66.7	77.3	77.7	59.3	76.0	76.1	0.1
	14/F	68.9	67.5	78.4	78.7	68.5	75.9	76.6	0.7
	28/F	108.1	68.3	78.2	78.6	68.6	75.0	75.9	0.9
SR7N (Tong Hang)	G/F	20.1	-	-	-	69.6	56.8	69.8	13.0
SR8 (Wop Hop Shek 1)	G/F	15.5	56.4	68.7	68.9	57.4	66.7	67.2	0.5
	1/F	18.2	57.6	68.7	69.0	58.3	68.1	68.5	0.4
SR9 (Wo Hop Shek 2)	G/F	23.6	65.0	72.2	73.0	65.1	62.7	67.1	4.4
	1/F	26.3	65.9	72.1	73.0	67.2	64.3	69.0	4.7
SR1012 (Tong Hang)	G/F	23.8	-	-	-	70.3	55.1	70.4	15.3
SR1015 (Tong Hang)	G/F	22.3	-	-	-	69.6	56.4	69.8	13.4
SR11A (Kiu Tau)	G/F	18.8	-	-	-	65.7	63.6	67.8	4.2
SR11B (Kiu Tau)	G/F	21.5	-	-	-	66.0	58.8	66.8	8.0
SR12 (Nam Wa Po 1)	G/F	29.2	67.2	63.9	68.9	65.0	68.0	69.8	1.8
	1/F	31.9	67.6	64.0	69.2	66.5	68.2	70.4	2.2
SR13 (West Tai Wo)	G/F	25.0	66.2	53.6	66.4	67.1	39.2	67.1	27.9
	2/F	30.4	70.1	53.6	70.2	70.0	39.6	70.0	30.4
SR1013 (West Tai Wo)	G/F	25	-	-	-	64.9	45.6	65.0	19.4
	2/F	30.4	-	-	-	69.8	45.8	69.8	24.0

NSR ID	Floor	Level	Predicted $L_{10(1\text{-}hr)}$ Levels - EIA Design, dB(A) (extracted from the Approved EIA Report)			Predicted $L_{10(1\text{-}hr)}$ Levels Proposed Design with Traffic Forecast in Yr 2028, dB(A)			
		mPD	Project Roads	Other Roads	All	Project Roads	Other Roads	All	Contribu-tion from Project Road
SR14 (Tai Wo 1)	G/F	27.7	66.5	66.2	69.4	66.4	46.0	66.4	20.4
	1/F	30.4	67.2	66.2	69.7	67.5	45.9	67.5	21.6
SR17B (Village houses of Tai Hang that might not be abandoned)	G/F	25.7	-	-	-	65.1	57.0	65.7	8.7
	2/F	31.1	-	-	-	70.1	57.8	70.3	12.5
SR17B (Tai Hang 3)	G/F	25.7	68.6	0.0	68.6	64.0	47.5	64.1	16.6
	2/F	31.1	70.3	0.0	70.3	69.4	55.2	69.6	14.4
SR19 (Hong Lok Yuen 1)	G/F	32.9	66.8	59.1	67.5	65.7	35.5	65.7	30.2
	2/F	38.3	67.6	59.2	68.2	68.7	37.6	68.7	31.1
SR20 (Hong Lok Yuen 2)	G/F	32.9	67.0	60.2	67.8	65.6	34.8	65.6	30.8
	2/F	38.3	67.7	60.3	68.4	68.5	37.1	68.5	31.4
SR21 (Hong Lok Yuen 3)	G/F	33.9	68.5	53.6	68.6	65.8	40.0	65.8	25.8
	2/F	39.3	69.8	54.5	69.9	68.5	42.6	68.5	25.9
SR22 (Wai Tau Tsuen 1)	G/F	28.2	68.9	57.9	69.2	69.6	60.4	70.1	9.7
	1/F	30.9	69.8	58.0	70.1	69.9	60.8	70.4	9.6
SR22N (Wai Tau Tsuen)	G/F	28.2	-	-	-	66.2	56.6	66.7	10.1
	1/F	30.9	-	-	-	66.9	56.7	67.3	10.6
SR23 (Wai Tau Tsuen)	G/F	28.7	64.3	54.8	64.8	66.0	63.8	68.0	4.2
	1/F	31.4	66.7	59.0	67.4	68.7	64.3	70.0	5.7
SR24 (Kau Liu Ha 1)	G/F	19.1	65.5	76.0	76.4	64.0	73.4	73.9	0.5
	2/F	24.5	66.8	77.5	77.9	64.8	73.4	74.0	0.6
SR25 (Kau Liu Ha 1)	G/F	19.1	65.5	78.4	78.6	63.9	74.6	75.0	0.4
	2/F	24.5	66.8	79.5	79.7	64.7	74.6	75.0	0.4
SR26 (Tai Po Garden)	G/F	13.8	61.9	78.6	78.7	61.9	74.5	74.7	0.2
	4/F	25.0	63.6	75.9	76.1	65.0	71.9	72.7	0.8
SR27 (Mui Shu Hang)	G/F	15.7	65.8	57.9	66.5	64.4	67.5	69.2	1.7
	1/F	18.4	66.5	58.6	67.2	65.3	67.8	69.7	1.9
SR28 (Northwest Shek Kwu Lung)	G/F	21.2	61.9	40.9	61.9	62.9	69.2	70.1	0.9
	1/F	23.9	62.9	41.7	62.9	64.0	69.3	70.4	1.1

NSR ID	Floor	Level	Predicted $L_{10(1\text{-}hr)}$ Levels - EIA Design, dB(A) (extracted from the Approved EIA Report)			Predicted $L_{10(1\text{-}hr)}$ Levels Proposed Design with Traffic Forecast in Yr 2028, dB(A)			
		mPD	Project Roads	Other Roads	All	Project Roads	Other Roads	All	Contribu-tion from Project Road
SR29 (Parc Versailles 1)	G/F	11.5	60.6	69.2	69.8	63.0	63.5	66.3	2.8
	5/F	25.5	63.4	69.4	70.4	66.1	66.5	69.3	2.8
SR29A (Parc Versailles 1)	G/F	11.5	59.7	69.0	69.5	61.2	64.6	66.2	1.6
	5/F	25.5	62.5	69.5	70.3	63.2	67.3	68.7	1.4
SR30A (Shek Kwu Lung 4)	G/F	15.8	56.9	69.1	69.4	59.3	52.0	60.0	8.0
	2/F	21.2	57.7	69.9	70.2	61.1	54.2	61.9	7.7
SR30B (Shek Kwu Lung 5)	G/F	17.2	61.4	48.2	61.6	62.7	44.1	62.8	18.7
	2/F	22.8	62.7	48.9	62.9	63.7	45.1	63.8	18.7
SR30C (Shek Kwu Lung 6)	G/F	31.2	63.0	47.8	63.1	65.0	38.9	65.0	26.1
	2/F	36.8	65.6	49.4	65.7	66.3	38.9	66.3	27.4
SR31 (Shek Kwu Lung 2)	G/F	9.9	58.8	73.7	73.8	58.8	56.5	60.8	4.3
	2/F	15.3	59.5	74.5	74.6	60.2	59.5	62.9	3.4
SR33 (Shek Kwu Lung 3)	G/F	33.2	61.2	45.8	61.3	63.4	23.5	63.4	39.9
SR34 (Pun Chun Yuen)	G/F	58.8	68.2	61.9	69.1	65.2	43.5	65.2	21.7
	1/F	61.5	69.7	61.8	70.4	70.4	46.6	70.4	23.8
SR35 (Buddhist Tai Kwong Middle School)	1/F	32.4	62.7	61.3	65.1	64.2	49.5	64.3	14.8
SR36 (Ma Wo)	G/F	43.2	65.1	51.4	65.3	62.4	7.8	62.4	54.6
	1/F	45.9	66.3	51.4	66.4	63.6	7.8	63.6	55.8
SR38 (Dynasty View 1)	1/F	37.7	63.0	47.9	63.1	59.5	7.8	59.5	51.7
	5/F	48.9	66.9	48.1	67.0	62.6	7.8	62.6	54.8
	8/F	57.3	69.6	48.2	69.6	65.3	7.8	65.3	57.5
SR39 (The Paragon)	1/F	37.3	63.5	59.8	65.0	63.5	54.4	64.0	9.6
	5/F	48.5	65.6	64.9	68.3	66.2	61.1	67.4	6.3
	9/F	59.7	67.0	66.7	69.9	69.3	63.1	70.2	7.1
SR40 (Grand Palisades)	1/F	59.0	64.5	64.6	67.6	63.2	64.7	67.0	2.3
	6/F	73.0	66.6	66.7	69.7	66.2	65.0	68.7	3.7
	10/F	84.2	67.1	67.2	70.2	68.4	65.2	70.1	4.9

NSR ID	Floor	Level	Predicted $L_{10(1\text{-}hr)}$ Levels - EIA Design, dB(A) (extracted from the Approved EIA Report)			Predicted $L_{10(1\text{-}hr)}$ Levels Proposed Design with Traffic Forecast in Yr 2028, dB(A)			
		mPD	Project Roads	Other Roads	All	Project Roads	Other Roads	All	Contribu-tion from Project Road
SR41 (Wong Shiu Chi Middle School)	1/F	6.4	52.5	76.7	76.7	52.7	77.7	77.7	0.0
	5/F	18.4	53.5	76.2	76.2	53.5	76.7	76.7	0.0
SR42 (Wan Tau Tong Estate – Wan Lam House 1)	1/F	12.8	50.4	58.6	59.2	51.9	52.7	55.3	2.6
	15/F	52.0	54.5	60.9	61.8	55.7	55.2	58.5	3.3
	31/F	96.8	59.2	61.0	63.2	59.5	58.1	61.9	3.8
SR43 (Wan Tau Tong Estate – Wan Lam House 2)	1/F	12.8	56.5	37.7	56.6	55.5	39.7	55.6	15.9
	15/F	52.0	59.2	50.2	59.7	58.5	49.1	59.0	9.9
	31/F	96.8	63.0	52.9	63.4	62.8	52.8	63.2	10.4
SR44 (Wan Tau Tong Estate – Wan Loi House)	1/F	12.8	54.5	65.2	65.6	54.7	63.0	63.6	0.6
	15/F	52.0	58.2	64.8	65.7	58.7	62.7	64.2	1.5
	31/F	96.8	63.1	64.0	66.6	62.7	62.2	65.5	3.3
SR45 (HK Teacher's Association Secondary School)	1/F	13.6	57.2	63.6	64.5	58.7	61.7	63.5	1.8
	6/F	28.6	59.5	63.6	65.0	60.7	61.5	64.1	2.6
SR46 (Uptown Plaza)	1/F	30.3	56.2	72.9	73.0	57.8	74.4	74.5	0.1
	13/F	63.9	60.1	71.4	71.7	60.8	72.1	72.4	0.3
	26/F	100.3	63.4	70.2	71.0	64.4	70.6	71.5	0.9
SR47 (Wang Fuk Court – Wang Cheong House 1)	1/F	6.8	55.7	73.1	73.2	58.7	72.2	72.4	0.2
	15/F	46.0	64.6	77.1	77.3	64.5	73.4	73.9	0.5
	31/F	90.8	67.7	75.4	76.1	65.8	72.4	73.3	0.9
SR48 (Wang Fuk Court – Wang Cheong House 2)	1/F	6.8	56.2	68.3	68.6	35.5	64.0	64.0	0.0
	15/F	46.0	65.4	76.7	77.0	41.7	69.6	69.6	0.0
	31/F	90.8	65.8	74.9	75.4	47.7	70.6	70.6	0.0
SR49 (Wang Fuk Court – Wang Cheong House 3)	1/F	6.8	55.8	74.2	74.3	59.7	75.7	75.8	0.1
	15/F	46.0	61.6	74.6	74.8	64.5	75.2	75.6	0.4
	31/F	90.8	65.9	73.0	73.8	67.6	73.8	74.7	0.9
SR50 (Wang Fuk Court – Wang Tat House)	1/F	6.8	56.9	76.5	76.5	61.3	78.1	78.2	0.1
	15/F	46.0	62.0	75.8	76.0	64.6	76.4	76.7	0.3
	31/F	90.8	65.5	74.0	74.6	68.0	74.4	75.3	0.9

NSR ID	Floor	Level	Predicted $L_{10(1\text{-}hr)}$ Levels - EIA Design, dB(A) (extracted from the Approved EIA Report)			Predicted $L_{10(1\text{-}hr)}$ Levels Proposed Design with Traffic Forecast in Yr 2028, dB(A)			
		mPD	Project Roads	Other Roads	All	Project Roads	Other Roads	All	Contribu-tion from Project Road
SR51 (Wang Fuk Court – Wang Shing House 3)	1/F	6.8	36.9	70.7	70.7	35.4	51.2	51.3	0.1
	15/F	46.0	49.2	76.9	76.9	59.0	69.4	69.8	0.4
	31/F	90.8	57.0	75.1	75.2	59.7	71.0	71.3	0.3
SR52 (Ha Wong Yi Au 1)	G/F	29.2	64.8	62.3	66.7	68.2	63.3	69.4	6.1
SR52N (Zonta White House Main Building)	G/F	29.2	-	-	-	62.2	55.0	63.0	8.0
	2/F	34.6	-	-	-	65.7	59.6	66.7	7.1
SR53 (Ha Wong Yi Au 2)	G/F	11.0	61.0	72.7	73.0	60.8	70.8	71.2	0.4
	1/F	13.7	62.7	73.7	74.0	62.6	72.3	72.7	0.4
SR54 (Riverrain Bayside)	G/F	8.5	64.4	62.3	66.5	63.3	59.9	64.9	5.0
	2/F	14.1	66.6	65.4	69.1	65.7	61.6	67.1	5.5
SR55 (Dynasty View 2)	1/F	37.7	61.9	0.0	61.9	58.7	54.4	60.1	5.7
	4/F	46.1	64.4	0.0	64.4	60.9	54.4	61.8	7.4
	8/F	57.3	68.4	0.0	68.4	64.6	54.4	65.0	10.6
SR56 (Monastery at Ma Wo)	G/F	42.5	64.0	13.4	64.0	61.5	7.8	61.5	53.7
	1/F	45.2	65.1	14.2	65.1	62.5	7.8	62.5	54.7
SR57 (King Nga Court – King Yuet House 1)	1/F	14.6	63.2	57.2	64.2	55.7	38	55.8	17.8
	18/F	62.2	66.1	58.5	66.8	61.3	48.9	61.5	12.6
	36/F	112.6	69.1	60.0	69.6	66.9	57.2	67.3	10.1
SR58 (King Nga Court – King Yuet House 2)	1/F	14.6	63.4	54.2	63.9	57.1	38.7	57.2	18.5
	18/F	62.2	66.2	57.6	66.8	62.8	50.4	63.0	12.6
	36/F	112.6	70.0	59.9	70.4	68.8	58.3	69.2	10.9
SR59N (King Nga Court – King Yan House)	1/F	14.6	61.4	45.0	61.5	57.2	39.2	57.3	18.1
	18/F	62.2	64.5	55.7	65.0	62.6	51.2	62.9	11.7
	36/F	112.6	69.4	58.6	69.7	68.9	57.7	69.2	11.5
SR60 (Tak Nga Court 1)	1/F	16.3	62.3	57.6	63.6	57.4	54.3	59.1	4.8
	17/F	61.1	65.0	58.2	65.8	62.1	54.9	62.9	8.0
	34/F	108.7	66.6	59.0	67.3	67.1	57.0	67.5	10.5

NSR ID	Floor	Level	Predicted $L_{10(1\text{-}hr)}$ Levels - EIA Design, dB(A) (extracted from the Approved EIA Report)			Predicted $L_{10(1\text{-}hr)}$ Levels Proposed Design with Traffic Forecast in Yr 2028, dB(A)			
		mPD	Project Roads	Other Roads	All	Project Roads	Other Roads	All	Contribu-tion from Project Road
SR61 (Tak Nga Court 2)	1/F	16.3	61.0	63.4	65.4	57.2	57.4	60.3	2.9
	17/F	61.1	63.9	63.3	66.6	62.0	61.4	64.7	3.3
	34/F	108.7	66.2	62.7	67.8	67.9	60.7	68.7	8.0
SR62 (Ha Wun Yiu)	G/F	29.6	61.1	51.4	61.5	61.8	33.6	61.8	28.2
	1/F	32.3	62.0	51.5	62.4	62.7	34.6	62.7	28.1
SR63 (Lai Chi Shan)	G/F	22.4	61.3	68.2	69.0	61.5	67.3	68.3	1.0
	1/F	25.1	61.9	69.4	70.1	62.0	67.4	68.5	1.1
SR64 (Shan Tong View Village 1)	G/F	44.3	65.4	65.7	68.6	65.4	67.9	69.8	1.9
	2/F	49.7	67.8	65.1	69.7	67.7	67.1	70.4	3.3
SR65 (Shan Tong View Village 2)	G/F	41.8	61.9	64.7	66.5	62.4	66.3	67.8	1.5
	2/F	47.2	64.9	64.8	67.9	65.3	66.3	68.8	2.5
SR66 (P.L.K. Tin Ka Ping Primary School)	1/F	14.6	58.4	39.4	58.5	55.3	39.3	55.4	16.1
	6/F	29.6	59.5	43.9	59.6	56.6	43.4	56.8	13.4
SR67 (Redland Garden)	1/F	29.4	61.2	67.2	68.2	59.3	71.0	71.3	0.3
	6/F	43.4	64.0	70.7	71.5	64.8	74.5	74.9	0.4
SR70 (Kwong Fuk Estate – Kwong Lai House)	1/F	9.7	55.9	77.1	77.1	47.6	56.1	56.7	0.6
	12/F	40.5	59.8	77.9	78.0	57.6	69.2	69.5	0.3
	23/F	71.3	62.5	76.4	76.6	60.8	71.4	71.8	0.4
SR73 (Island House Conservation Studies Centre)	G/F	17.2	62.5	69.6	70.4	64.0	70.6	71.5	0.9
	1/F	20.2	62.9	69.7	70.5	64.5	70.8	71.7	0.9
SR75 (Wong Kong Shan)	G/F	15.7	58.9	77.1	77.2	47.0	76.8	76.8	0.0
	1/F	18.4	59.0	77.1	77.2	47.8	76.9	76.9	0.0
SR76 (Yuen Leng 1)	G/F	22.0	64.4	68.6	70.0	63.9	66.9	68.7	1.8
	5/F	27.4	65.5	68.2	70.1	65.1	66.8	69.0	2.2
SR77 (Yuen Leng 2)	G/F	23.9	65.0	68.4	70.0	66.0	67.2	69.7	2.5
	2/F	29.3	66.6	67.9	70.3	67.9	66.7	70.4	3.7

NSR ID	Floor	Level	Predicted $L_{10(1\text{-}hr)}$ Levels - EIA Design, dB(A) (extracted from the Approved EIA Report)			Predicted $L_{10(1\text{-}hr)}$ Levels Proposed Design with Traffic Forecast in Yr 2028, dB(A)			
		mPD	Project Roads	Other Roads	All	Project Roads	Other Roads	All	Contribu-tion from Project Road
SR78 (Dynasty View 3)	1/F	33.7	59.8	24.8	59.8	58.2	11.8	58.2	46.4
	5/F	44.9	62.4	28.2	62.4	60.8	14.6	60.8	46.2
	8/F	53.3	64.6	31.7	64.6	63.2	19.0	63.2	44.2
SR79 (Care Village)	G/F	5.6	62.8	58.3	64.1	61.5	58.5	63.3	4.8
	2/F	11.0	65.2	60.8	66.5	63.3	60.2	65.0	4.8
SR80 (Wai Tau Tsuen 3)	G/F	26.2	65.6	43.4	65.6	62.6	7.8	62.6	54.8
	2/F	31.6	69.6	46.4	69.6	68.1	7.8	68.1	60.3
SR81 (Tai Hang 4) (May be demolished)	G/F	25.2	62.5	50.5	62.8	62.5	49.3	62.7	13.4
	2/F	30.6	69	50.9	69.1	68.8	50.0	68.9	18.9
SR81N	G/F	25.2	-	-	-	67.2	65.3	69.4	4.1
	2/F	30.6	-	-	-	68.9	65.0	70.4	5.4
SR82N (Tai Hang 5)	G/F	24.2	65.1	54.1	65.4	67.3	57.5	67.7	10.2
	2/F	29.6	67.3	54.1	67.5	68.8	57.6	69.1	11.5
SR1082 (Tai Hang (New))	G/F	24.2	-	-	-	62.1	56.6	63.2	6.6
	2/F	29.6	-	-	-	68.3	56.6	68.6	12.0
SR83A (Yuen Leng)	G/F	19.2	-	-	-	66.5	56.3	66.9	10.6
	2/F	24.6	-	-	-	68.2	57.5	68.6	11.1
SR83N (Yuen Leng 3)	G/F	19.2	-	-	-	64.5	55.0	65.0	10.0
	2/F	24.6	-	-	-	65.8	55.8	66.2	10.4
SR84 (Nam Wa Po 2)	G/F	19.7	63.6	62.7	66.2	62.7	70.4	71.1	0.7
	2/F	25.1	65.0	62.7	67.0	64.2	70.4	71.3	0.9
SR85 (Nam Wa Po 3)	G/F	23.1	66.0	49.3	66.1	64.9	33.6	64.9	31.3
	2/F	28.5	69.8	51.0	69.9	69.8	41.7	69.8	28.1
SR86N (Tong Hang)	G/F	18.4	-	-	-	69.6	55.4	69.8	14.4
	2/F	23.8	-	-	-	70.0	57.0	70.2	13.2
SR87 (Tai Wo 2)	G/F	26.1	65.6	67.8	69.8	66.0	63.5	67.9	4.4
	2/F	31.5	67.0	67.4	70.2	68.4	63.1	69.5	6.4

NSR ID	Floor	Level	Predicted $L_{10(1\text{-}hr)}$ Levels - EIA Design, dB(A) (extracted from the Approved EIA Report)			Predicted $L_{10(1\text{-}hr)}$ Levels Proposed Design with Traffic Forecast in Yr 2028, dB(A)			
		mPD	Project Roads	Other Roads	All	Project Roads	Other Roads	All	Contribu-tion from Project Road
SR88 (Wai Tau Tsuen 4)	G/F	28.8	67.0	62.8	68.4	67.4	57.1	67.8	10.7
	2/F	34.2	68.9	62.5	69.8	69.0	58.0	69.3	11.3
SR89 (Wai Tau Tsuen 5)	G/F	29.3	66.7	65.0	68.9	67.5	60.2	68.2	8.0
	2/F	34.7	67.8	65.0	69.6	68.7	60.2	69.3	9.1
SR90 (Wai Tau Tsuen 6)	G/F	26.9	65.9	58.2	66.6	65.4	56.9	66.0	9.1
	2/F	32.3	67.5	58.7	68.0	67.2	57.5	67.6	10.1
SR91 (New Residential (B) Zone near To Yuen Tung 1)	1/F	40.0	57.1	25.5	57.1	57.3	19.0	57.3	38.3
	4/F	48.4	59.0	30.1	59.0	60.0	22.4	60.0	37.6
	8/F	59.6	65.8	39.5	65.8	66.2	27.7	66.2	38.5
SR92 (New Residential (B) Zone near To Yuen Tung 2)	1/F	40.0	58.0	30.2	58.0	58.3	36.0	58.3	22.3
	4/F	48.4	59.3	33.4	59.3	60.8	38.0	60.8	22.8
	8/F	59.6	70.2	44.6	70.2	67.3	41.4	67.3	25.9
SR93 (S.K.H. Mok Sau Tsang Secondary School)	1/F	25.6	51.5	62.6	62.9	51.5	66.3	66.4	0.1
	6/F	40.6	53.2	64.2	64.5	52.3	66.9	67.0	0.1
SR94 (Choi Hin To Primary School)	1/F	15.5	55.6	58.8	60.5	52.1	53.7	56	2.3
	5/F	27.5	56.5	58.8	60.8	52.8	55.3	57.2	1.9
SR95B (Tai Po Normal School Memorial School)	G/F	16.6	59.6	77.5	77.6	58.9	67.7	68.2	0.5
SR96 (Village Zone near Wai Tau Tsuen)	G/F	33.0	68.3	61.1	69.1	68.3	60.9	69.0	8.1
	2/F	38.4	68.9	61.1	69.6	69.2	60.9	69.8	8.9
SR97 (Village Zone at Tai Wo 1)	G/F	25.0	65.5	51.9	65.7	64.7	39.8	64.7	24.9
	2/F	30.4	66.3	52.0	66.5	66.2	40.8	66.2	25.4
SR98 (Village Zone at Tai Wo 2)	G/F	23.8	65.2	48.6	65.3	64.4	41.5	64.4	22.9
	2/F	29.2	66.0	48.7	66.1	65.9	42.4	65.9	23.5
SR99 (Ha Wong Yi Au 3)	G/F	6.4	60.6	66.4	67.4	60.6	62.4	64.6	2.2
	2/F	11.8	63.2	69.1	70.1	63.6	65.8	67.8	2.0
SR99A (Ha Wong Yi Au 4)	G/F	6.4	64.1	73.4	73.9	62.7	63.2	66.0	2.8
	2/F	11.8	66.2	73.7	74.4	65.4	67.4	69.5	2.1

NSR ID	Floor	Level	Predicted $L_{10(1\text{-}hr)}$ Levels - EIA Design, dB(A) (extracted from the Approved EIA Report)			Predicted $L_{10(1\text{-}hr)}$ Levels Proposed Design with Traffic Forecast in Yr 2028, dB(A)			
		mPD	Project Roads	Other Roads	All	Project Roads	Other Roads	All	Contribu-tion from Project Road
SR100 KCRC Staff Quarter at Tai Po Kau	G/F	10.2	57.2	59.7	61.6	46.4	67.3	67.3	0.0
	3/F	19.2	58.8	66.4	67.1	49.8	69.7	69.7	0.0
	6/F	28.2	60.5	71.9	72.2	53.7	74.0	74.0	0.0
SR101 (Chateau Royale)	1/F	20.2	62.8	76.0	76.2	60.9	75.0	75.2	0.2
	2/F	25.8	63.9	75.6	75.9	62.3	74.7	74.9	0.2
SR103 (Classical Garden)	1/F	27.2	52.2	74.2	74.2	52.8	72.9	72.9	0.0
	4/F	35.6	53.8	72.8	72.9	53.7	71.6	71.7	0.1
	8/F	46.8	56.0	71.1	71.2	54.9	70.0	70.1	0.1
SR104 (Village House near Ma Wo 1)	G/F	81.2	69.7	47.0	69.7	68.9	44.7	68.9	24.2
SR105 (Village House near Ma Wo 2)	G/F	79.4	67.3	51.1	67.4	70.1	45.7	70.1	24.4
SR106 (Village House near Shek Kwu Lung)	G/F	39.2	67.3	50.4	67.4	70.1	51.1	70.2	19.1
SR107 (Village House near Hong Lok Yuen)	G/F	27.1	69.6	54.6	69.7	66.0	37.4	66.0	28.6
	1/F	29.8	70.3	54.7	70.4	67.3	38.6	67.3	28.7
SR108 (Tai Hang Village House)	G/F	25.7	62.6	53.8	63.1	63.7	56.3	64.4	8.1
	2/F	31.1	63.3	53.9	63.8	64.3	56.3	64.9	8.6
SR109 (Village House near Nam Wa Po)	G/F	22.5	63.8	49.8	64.0	65.5	53.6	65.8	12.2
N1 (Village House near Tai Hang 6)	G/F	24.1	-	-	-	66.9	27.6	66.9	39.3
	1/F	26.8	-	-	-	67.7	29.5	67.7	38.2
	2/F	29.5	-	-	-	68.7	31.6	68.7	37.1
N4 (Village House near Tai Wo Village 5)	G/F	25.7	-	-	-	68.3	45.0	68.3	23.3
	1/F	28.4	-	-	-	69.1	44.8	69.1	24.3
	2/F	31.1	-	-	-	70.3	44.6	70.3	25.7
N8 (Village House near Nam Wa Po)	G/F	24.4	-	-	-	67.9	50.5	68.0	17.5

5.4.4 Result Analysis

As shown in Table 5-9, either all the predicted $L_{10(1\text{-}hr)}$ levels at the NSRs will be within the criterion of 70dB(A) or the noise contribution from the project roads will be less than 1.0 dB. Therefore, with the implementation of the proposed mitigation measures, no adverse traffic noise impact arising from the Project on the NSRs is anticipated.

The predicted noise levels between EIA Design and Proposed Design are generally comparable, since the updated traffic data of Year 2028 is similar to those presented in the Approved EIA Report. However, some of the results showed that the predicted noise levels in Proposed Design will be less than those in the Approved EIA Report due to the following reasons: -

SR1, 2, 3, 3A

As discussed in the first paragraph of Section 5.4.3, retrofitting projects were included in the model input of Proposed Design, which were not included in the EIA Design. This has reduced the noise contribution from both the “project roads” and “other roads”. This has also reduced the size of the noise barriers required near the area.

SR9

Based on the updated traffic forecast of Year 2028, the traffic flow at Tai Wo Service Road West will be 29% less than that predicted in the Approved EIA Report, and so this has reduced the noise contribution of “other roads” by 7.8 to 9.5 dB(A).

SR26

Based on the updated traffic forecast of Year 2028, the traffic flow at Mui Shu Hang Road will be 77% less than that predicted in the Approved EIA Report, and so this has reduced the noise contribution of “other roads” by 4.0 to 4.1 dB(A).

SR30A, 31, 95B

Based on the updated traffic forecast of Year 2028, the traffic flow at Slip Road from Tolo Highway South Bound to Tai Po Tai Wo Road will be 31% less than that predicted in the Approved EIA Report, and so this has reduced the noise contribution of “other roads” by 9.8 to 17.2 dB(A).

SR53, 99, 99A, 101

Based on the updated traffic forecast of Year 2028, the traffic flow at Tai Po Road Yuen Chau Tsai will be 16% less than that predicted in the Approved EIA Report, and so this has reduced the noise contribution of “other roads” by 0.9 to 10.2 dB(A). Furthermore, the proposed noise barrier at North Bound Ch. 200-600 is to be upgraded by 1m, and this will enhance the noise reduction by “project roads”.

SR76, 77

Based on the updated traffic forecast of Year 2028, the traffic flow at Tai Wo Service Road East will be 40% less than that predicted in the Approved EIA Report, and so this has reduced the noise contribution of “other roads” by 1.2 to 1.7 dB(A).

SR94

The proposed central barrier at Ch. 1300-1650 was proposed to be upgraded to C1Y, and this will enhance the noise reduction by "project roads" at Tolo Highway and "other roads" at San Tong Road.

5.5 Noise Impact Assessment for the 24 Hour Opening of Border Crossing

In 1994, Highways Department (HyD) commissioned a Noise Impact Assessment for the 24 Hour Opening of the Border Crossings. The study recommended mitigation measures to alleviate the noise impacts due to the cross border traffic under the 24 hour opening of border crossings.

A specific assessment criterion was established, which is, to reduce the predicted year 2006 traffic noise levels, both $L_{10(2200\text{-}2300\ hr)}$ and $L_{10(0600\text{-}0700\ hr)}$ in dB(A), from the cross border traffic to a level equal to or more than 10 dB(A) below the prevailing noise levels.

A number of NSRs assessed in the 24 Hour Opening of the Border Crossings NIA fall within the current study area. According to the specific assessment criterion as stated above, the cross-border traffic flows of 2006 as predicted in the NIA study were adopted in the approved EIA report. These predicted data were applied to the noise model and the noise levels were predicted. However, as year 2006 has already passed, the predicted cross-border traffic flows in the NIA study are no longer up-to date.

According to the NIA study and the approved EIA Report, the predicted cross border traffic assumed both Lok Ma Chau and Man Kam To Border Crossing at 24-hours operation. However, there is no plan for 24-hours opening at Man Kam To Border Crossing. It is noted that the actual cross-border traffic flow is much less than that predicted in the NIA study. Table 5-10 shows a comparison between the predicted cross-border traffic flows and the annual traffic census in 2006.

Since the actual cross-border traffic flow is less than that predicted in the NIA study and approved EIA Report, the corresponding noise levels will also be less at all the identified locations.

Table 5-10 Comparison between the predicted cross-border traffic flows and the annual traffic census in 2006

	Report on NIA for 24 hr Opening of Border Crossings - Prediction to Year 2006	**Survey data on Year 2006**	
Data Source	Prediction at Year 1996	Traffic count at Year 2006	
Crossing Point	Assuming Man Kam To, Man Kam To East, Sha Tau Kok and Lok Ma Chau were all opened	Lok Ma Chau only, this is no programme for 24 hr opening at other crossing point	
	Traffic Projection / Survey at Tolo Highway	At Island House	At Wo Hop Shek
X-Border Total Heavy Vehicle at 0600-0700	863	181	221
X-Border Total Vehicle at 0600-0700	1151	304	343
X-Border Total Heavy Vehicle at 2200-2300	711	171	209
X-Border Total Vehicle at 2200-2300	948	366	421

5.6 Conclusion

This ERR has compared the findings of the Approved EIA Report and those related to the current Proposed Design.

The findings of the construction noise assessment in the approved EIA Report are still considered valid and hence the proposed mitigation measures are still applicable under this detailed design stage. Although exceedance in the construction noise impact will be expected at two schools (SR41 and SR45), these schools have been installed with adequate noise insulation facilities (i.e. air conditioners and window glazing) according to the Approved EIA Report. As such, the construction noise impact on these schools should be insignificant. No unacceptable residual impacts are anticipated.

An updated traffic flow figures have been used to re-assess the operational noise impact. Exceedances of traffic noise criteria were predicted at some NSRs under the currently proposed design.

However, with the implementation of minor modifications to the scheme, the noise criteria can be met at all NSRs.

The feasibility of implementing adequate noise mitigation measures for the planned NSRs at a later time was also examined. However, the planned NSRs are so close to the existing NSRs that there will be virtually no difference in the extent of proposed noise mitigation measures if those for planned receivers were to be implemented subsequently.

The performance of the proposed mitigation measures for the Project also meets the criterion set out in the 24-hour opening of the border crossing study.

In conclusion, no unacceptable traffic noise impacts caused by this Project are anticipated.

6 Water Quality

6.1 Introduction

This section reviews the water quality impacts from the Project due to the proposed project changes after the approval of the EIA Report. The potential environmental impacts from construction effluent generated by the proposed works are assessed. Standards, guidelines and legislation, recommended mitigation measures and the disposal strategy described in the Approved EIA report are reviewed to assess their present applicability and are updated where necessary.

6.2 Description of Existing Environment

6.2.1 Existing Marine Water Quality

Tolo Harbour is generally in a landlocked situation and has a narrow exit to the open sea. This means that the harbour suffers from weak water circulation. The situation is exacerbated by a northeast wind, which blows against the direction of the outgoing tide during the dry season. Combined, these two factors prevent pollutants that enter the harbour from being flushed away by the tidal flow. In addition, during the summer the harbour occasionally experiences temperature and salinity stratification. Layers of water build up with different levels of temperature and salinity, preventing the mixing of water masses, leading to hypoxia (low oxygen levels) at the sea bottom. As the above factors suggest, water quality at other parts of the eastern waters of Hong Kong is much better than the situation in Tolo Harbour.

EPD's Marine Water Quality Annual Reports show that the water quality of Tolo Harbour has shown a continuous improvement despite a significant increase in the human population within the Tolo Harbour catchment area.

The Tolo Harbour Action Plan over the last two decades has achieved positive results. Water quality in the harbour has improved substantially, and significant decreases in 5-day biochemical oxygen demand (BOD_5), *E. Coli*, nitrogen and phosphate have been recorded by the monitoring programme. Levels of chlorophyll-*a* in the harbour, meanwhile, have remained fairly stable but red tide incidents have reduced markedly, from over 40 in 1988 to around 10 each year in the last decade. Fish kills, which were frequently seen in the 1980s and 1990s, are rare nowadays. The construction of Tolo Highway Widening for the south section (between Ma Liu Shui and Island House Interchange) was carried out from 1999 to 2005, no significant boost of determinants were seen throughout the construction period. It is considered reasonable that the widening of the north section of the Tolo Highway would cause similar or less impact than the south section works.

6.2.2 Existing River Water Quality

Lam Tsuen River and Tai Po River are two major rivers flowing through the Tai Po Town Centre. Downstream, the two rivers join together before entering the inner Tolo Harbour.

The nearest routine monitoring stations with respect to the study area are TR12B at Lam Tsuen River and TR13 at Tai Po River respectively. According to the EPD Publication *River Water Quality*

in Hong Kong in 1997 (before the instance of EIA), water quality in Lam Tsuen River was ranked as "excellent" at station TR12B whilst water quality in Tai Po River was ranked as "good" at station TR13.

The river has shown a decline in organics, nutrients and toxic metals, indicating a general decrease in pollution in the river. Analysis of the long-term monitoring data also revealed significant improvements in the tributary over the past decade.

WQOs (Water Quality Objectives) reflect the present and future needs of the public and, through consultation, the wishes of local communities. They are based on chemical quality, and the Government believes that they represent the best available reference point to establish progress in maintaining and improving river quality. This will be used as the monitoring benchmark of this water quality assessment.

In 2004, Lam Tsuen River achieved 96% compliance with the WQO's. All monitoring stations were graded 'excellent' or 'good'; indicating organic pollution in the river was low. The monitoring station downstream was higher due to discharges from unsewered villages in Lam Tsuen and urban runoff form the Tai Po Town Centre. The water quality in Tai Po River also exhibited a similar characteristic as Lam Tsuen River. Also, in 2004, Tai Po River achieved 95% compliance with the WQOs. Similarly, sewage pollution from the collage houses within the river's catchment area causes high *E. Coli* levels at monitoring station TR13.

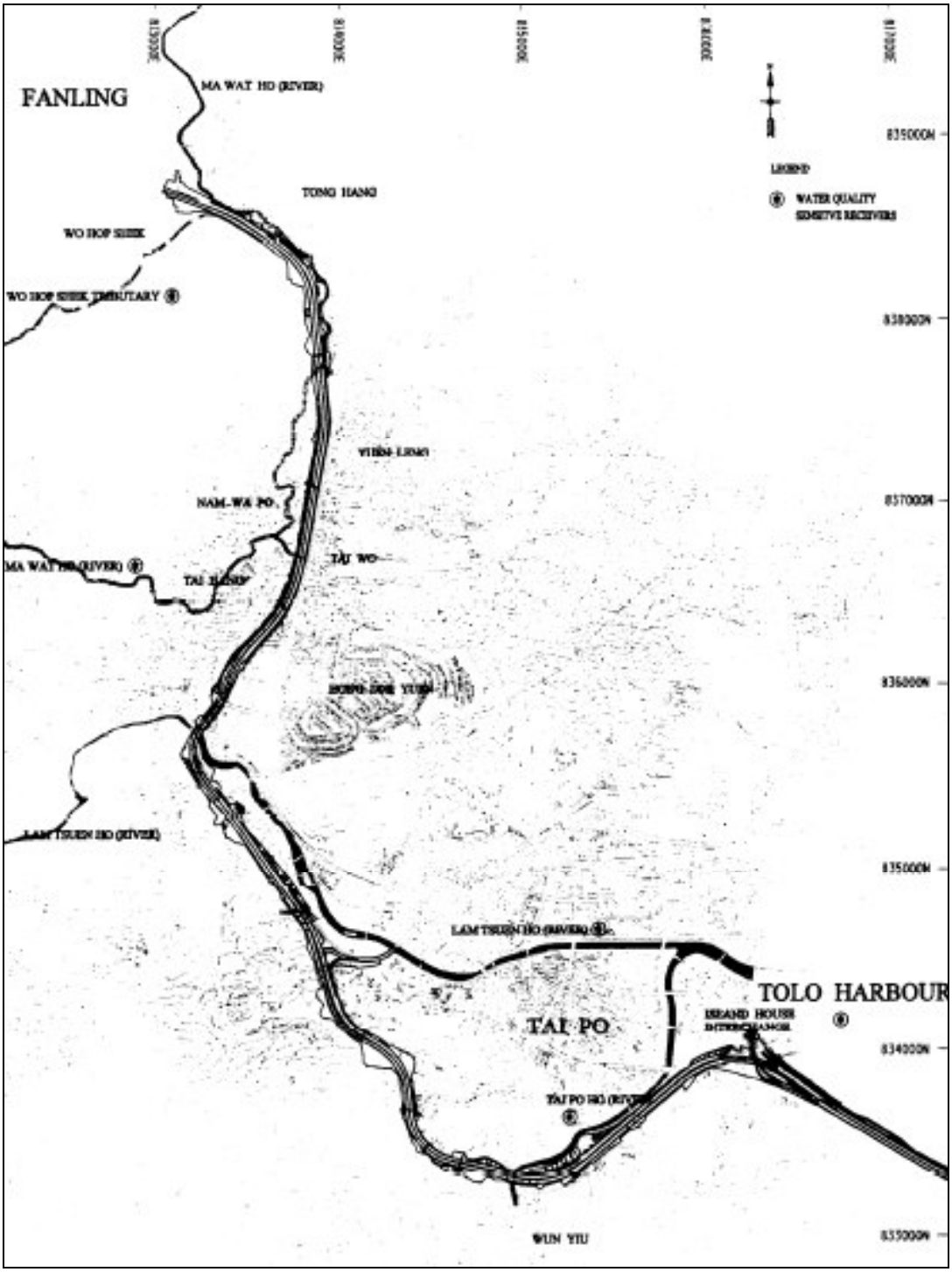
6.2.3 Sensitive Receivers

Water quality sensitive receivers have been defined in accordance with the requirements of the Hong Kong Planning Standards and Guidelines, which have been transposed into the Technical Memorandum of the EIA Ordinance. As stipulated in the Approved EIA Report, water and stream courses, groundwater systems and other sensitive or beneficial uses have been identified.

Water quality sensitive receivers within the Study Area are illustrated in Figure 6-1 and relate to the stream courses and drainage culverts that could be subjected to off-site spillage during and following construction and river training works. The following water sensitive receivers will be set up on site during construction and will include:

- Tai Po River
- Lam Tsuen River
- Ma Wat River
- Wo Hop Shek Tributary
- Tolo Harbour

Figure 6-1 Location of Water Quality Sensitive Receivers



6.3 Impact Evaluation for Construction Phase

Guidelines for the handling and disposal of construction discharges are provided in the Practice Note for Professional Persons (ProPECC Note PN1/94) on Construction Site Drainage. The types of discharge from construction sites outlined in the guidance note include:

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

The study area as described in the Approved EIA Report is still applicable in this ERR. The area of the site falls within the Tai Po District of Tolo Highway, from Island House Interchange to Wo Hop Shek Interchange. A large extent of the water quality assessment refers to a number of water quality monitoring programmes conducted by the EPD. The water quality data obtained from these monitoring programmes are used as a baseline for the monitoring results. To ensure an up-to-date condition of Tai Po Waters is established, reference has been made to the following publications:

- Annual Marine Water Quality Reports
- Annual River Water Quality Reports

A comparison was made between the Proposed Design and the EIA Design presented in the Approved EIA Report. As there is no significant road alignment change, the construction activities and the water and construction effluent detailed in the Approved EIA Report are applicable to this ERR. A desktop study has been carried out to review the standards, guidelines and legislation and to provide updated information where applicable. Recommendations have been made based upon the best available information at the time of writing the ERR.

6.3.1 General Construction Works

As stated above, there is no major alignment change in the Proposed Design from that stated in the Approved EIA Report. Therefore, the findings from the impact evaluation during the construction phase, as stated in the Approved EIA Report, are still valid in this ERR.

Construction activities include land-based works for the extension of the highway and culverts and the related improvement works for the river diversion. Construction activities may cause adverse impacts on the water quality of the receiving waters due to silt-laden runoff and direct contamination of waters during construction works for the extension of the highway over the nearby rivers and nullahs. At Kiu Tau and Tong Hang the proposed road widening works encroach on the Ma Wat River. River training works and recommended mitigation measures are detailed in the Drainage Impact Assessment Report and Drainage Monitoring and Audit Manual. Extracts from

these reports have been included in this ERR for completeness. It should be noted that the design of temporary site runoff should follow the Guidelines for the handling and disposal of construction discharges that are provided in *Practice Note for Professional Persons* (ProPECC Note PN1/94) *on Construction Site Drainage.*

Government policy requires the amount of dredging and consequent sea disposal of contaminated marine deposits to be minimised. Ground treatment would be required if the marine deposits were to be left in place.

The proposed road widening works would only encroach upon the diverted Ma Wat River at the following two locations:

- Tong Hang (Ch 7+860 to 7+990).
- Kiu Tau (Ch 7+240 to 7+415)

The following construction sequence is proposed for the river related works:

i. Works to be commenced in dry season;

ii. Site clearance;

iii. Build a temporary earth berm by sand bays and pumping;

iv. River diversion for construction of half width of river channel;

v. Excavate soil;

vi. Erect formwork, steel fixing and concreting for dry weather flow channel and half width of base slab;

vii. Erect formwork, steel fixing and concreting for side wall to form a reinforced concrete trapezoidal channel;

viii. Install rubber dam and pump house if necessary;

ix. River diversion to the completed section of channel;

x. Extend the effected box-culverts as required;

xi. Repeat steps at above to complete the trapezoidal channel;

xii. Remove temporary cofferdam and open for use; and

xiii. Backfilling.

The potential impacts on receiving water quality will mainly be due to uncontrolled migration of fines or off-site spillage, which will be contained by activity no. 3 “build a temporary earth berm”. The potential impacts shall therefore be controlled through good site practices and monitoring as recommended in the Drainage Impact Assessment (DIA) Monitoring and Audit Manual.

It should also be noted that the Territorial Land Drainage and Flood Control Strategy Study-Phase II BMP Report for the Indus Basin provides guidance for evaluating DIAs in the locality of the road widening scheme. The report recommends that improvements to floodways or watercourses, such as straightening or lining should include attenuation unless the downstream conditions are adequate. The detailed design of river training works must therefore allow for the possible effects of erosion immediately downstream of each trained section arising from increased flow velocities.

Contract No. DL/2004/06 – Construction of Drainage Channels in Ma Wat and north of Hong Lok Yuen, Tai Po is currently under progress and will be completed before the commencement of this Project.

6.3.2 Land Based Road Construction Works

Land based construction works that could affect water quality include:

- Cutting and/or filling embankment along Tolo Highway/Fanling Highway; and
- Road widening to the Tolo Highway/Fanling Highway which crosses over the Tai Po and Lam Tsuen Rivers and associated watercourses.

It is proposed that the surface water generated on site during the construction stage will be diverted to the existing drainage system. Silt/sand traps should be provided on site to remove silty particles and other pollutants from the surface water before discharge to ensure compliance with the standards given in Relevant TM standards for Group D waters (generally encountered in the Study Area) as detailed in Table 6-1.

Table 6-1 Relative TM Standards for Group D Waters

Flow Rate m³/day Determinand	≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤2000	>2000 and ≤3000	>2000 and ≤3000
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (°C)	30	30	30	30	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1
Suspended solids	30	30	30	30	30	30	30	30
BOD	20	20	20	20	20	20	20	20
COD	80	80	80	80	80	80	80	80
Oil & Grease	10	10	10	10	10	10	10	10
Iron	10	8	7	5	4	2.7	2	1.3
Boron	5	4	3.5	2.5	1	1.5	1	0.7
Barium	5	6	3.5	2.5	1	1.5	1	0.7
Mercury	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	1	1	0.8	0.8	0.5	0.5	0.2	0.2
Total toxic metals	2	2	1.6	1.6	1	1	0.5	0.4
Cyanide	0.4	0.4	0.3	0.3	0.2	0.1	0.1	0.05
Phenols	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1
Sulphide	1	1	1	1	1	1	1	1
Sulphate	800	600	600	600	600	400	400	400
Chloride (count/100ml)	1000	800	800	800	600	600	400	400
Fluoride	10	8	8	8	5	5	3	3
Total phosphorus	10	10	10	8	8	8	5	5
Ammonia nitrogen	20	20	20	20	20	20	20	10
Nitrate + nitrite nitrogen	50	50	50	30	30	30	30	20
Surfactants (total)	15	15	15	15	15	15	15	15
E. coli (count/100ml)	1000	1000	1000	1000	1000	1000	1000	1000

Work over water or in proximity to the river/streams includes the river training works at Kiu Tau and Tai Hang, as described in the foregoing section, and the widening or re-construction of bridges. It was identified in the DIA Report that for the river training works, permanent diversions would be necessary to maintain existing river flow.

River diversions will be designed to allow sufficient free board in accordance with the Stormwater Drainage Manual.

Ma Wat River is to be realigned under the Drainage Service Department Improvement Scheme "DC/2004/06 – Drawing Improvement in Northern New Territories, Package A Phase 1." After a review of the working drawing of the Drainage Improvement Project, the proposed road widening works would only encroach upon the diverted Ma Wat River at Tong Hang (Ch. 7+860 to 7+990) and Kiu Tau (Ch 7+240 to 7+415).

During construction, downstream monitoring of the works is recommended to ensure there is no migration of silt particles derived from off-site. As stream courses in the vicinity of the Ma Wat River fall within the "Water Gathering Ground" Group A "abstraction for water supply" standards (TM) will apply. This implies that the discharge of water to these stream courses must not have suspended solids content of greater than 10mg/l, the pH must be within the range 6.5-8.5 and no more than 1mg/l oil and grease shall be present. The use of silt traps/screens is recommended in order to avoid downstream migration of silt. However, it should be noted that the meandering nature of the Ma Wat River (and the distance to Tolo Harbour) would limit the migration of silt locally.

Sheetpiling work will commence after the demolition of the existing bridges namely, Banyan Bridge, Banyan Bridge West and Lam Kam Railway Bridge between Island House and Tat Wan Road, Lam Kam Flyover and Pipe Bridge between Tai Po Tai Wo Road and Hong Lok Yuen Road, Kiu Tau Bridge, Tai Hang Footbridge, Tai Wo Footbridge, Nam Wah Po Footbridge and Ho Ka Yuen Footbridge between Hong Lok Yuen Road and Pak Wo Road.

In general, piling work would be completed within 10-18 weeks after commencement of the bridge construction with the remaining abutment and decking works being completed in a further 60 weeks. This implies that the potential water quality impacts will be controlled after the first two months of construction for the bridges.

During construction of the foundations of the new structure near the streams, sheet piles will enclose the abovementioned bridges. The sheet piles will act as a physical barrier to prevent pollutants, which may be accidentally discharged into the receiving waters during the construction, from entering into the watercourses. It is expected that direct contamination of waters in the rivers during the foundation works would be minimal after the sheet piles have been put in place.

A summary of potential impacts associated with the construction activities is given in Table 6-2.

Table 6-2 Summary of Water Quality Impacts and Proposed Mitigation Measures

Location	Work/Activities	Sensitive Receiver	Potential Impact	Mitigation Measures
Between Island House and Tat Wan Road	1)Filling embankment 2)Construct retaining walls 3)Construct new Banyan & Banyan West Bridge 4) Widening of Lam Kam Railway Bridge	Tolo Harbour Tai Po River Lam Tsuen River	Silt laden runoff Direct contamination of waters Release of suspended solids	Sheet Piling Work Silt Traps/Screens Sand Traps/Oil Interceptors
Between Tat Wan Road and Tai Po Tai Wo Road	1) Temporary protective measures for slope cutting 2) Cutting & Filling of embankments 3) Construct retaining walls 4) Construction of	Tai Po River Lam Tsuen River	Silt laden runoff Direct contamination of waters Release of suspended solids	Sheet Piling Work Silt Traps/Screens Sand Traps/Oil Interceptors

Location	Work/Activities	Sensitive Receiver	Potential Impact	Mitigation Measures
	bridge 12			
Between Tai Po Tai Wo Road and Hong Lok Yuen Road	1) Cutting 2) Filling embankment 3) Construct new Lam Kam Flyover 4) Construct retaining walls 5) Modification of pipe bridge	Lam Tsuen River	Silt laden runoff Direct contamination of Waters Release of suspended solids	Sheet Piling Work Silt Traps/Screens Sand Traps/Oil Interceptors
Between Hong Lok Yuen Road and Pak Wo Road	1) Relocate rubber dam 2) Filling of embankments 3) Construct retaining wall 4) Demolished and rebuild Kiu Tau Bridge	Ma Wat River Wo Hop Shek Tributary	Silt laden runoff Direct contamination of Waters Release of suspended solids	Sheet Piling Work Silt Traps/Screens Sand Traps/Oil Interceptors

6.3.3 Sewage Impact

Sewage generated by the workforce should be disposed of to a foul sewer. If there is no foul sewer in the vicinity, chemical toilets will be required at the work sites. The number of staff engaged at the work site and associated facilities is not expected to exceed 600 at any given time. It should be noted that not all of the workers will be at the same location at the same time. It is unlikely, given the constraints of space and distance between work sites that a canteen will be provided.

6.3.4 Spillage and Construction Wastes

It is anticipated that a fuel tank will be placed at each bore pile installation location for refilling of the bore pile crane. Oil filling points and vehicle and plant servicing areas may also be provided on site. Accidental spillage in these area and run-off from vehicle holding areas contaminated with vehicle-by-products could also impact on water quality. It is recommended that the drainage in these areas should be connected to foul sewers (if available) via a petrol interceptor.

Slurry, cement and soil will also be stored on site. Inadvertent disposal of these construction materials into the nearby drainage system would cause direct contamination at the receiving water bodies. Implementation of best practices and diligent monitoring will reduce the potential impacts to a minimum.

6.3.5 Cumulative Impacts

Cumulative impacts generally relate to the river training works, which are programmed to be carried out over a 52-week period (refer to Appendix B). The recommendation of the DIA is that the works shall be carried out in the dry season. The extended period allocated to this activity is allowed. This is done in order to ensure the mitigation measures are all implemented early on in the construction period. Cumulative impacts of the works will be minimal as the extent of the river training works is small and the potential impact on water quality is confined to off-site spillage. If feasible, the river training works should be completed before the commencement of Stage 2 works.

6.4 Impact Evaluation for Operation Phase

The water quality impact during the operation phase is of significantly less concern than that of the construction phase. The only impact on water quality during normal operation of the road would be due to surface runoff. Typical highway runoff contains low levels of SS and different contaminants resulting from wear of tyres on the road and fuel combustion. Generally, the discharge of the runoff would be unlikely to produce any quantifiable adverse effects.

The erosion control plan associated with the river training works will be defined under the DIA Monitoring and Audit Plan.

6.5 Proposed Mitigation Measures – Construction Phase

Implementing the control measures identified in the guidance notes issued by the EPD - Practice Note for Professional Persons PN1/94 Construction Site Drainage, can mitigate impacts from construction site runoff.

Effluent can be controlled by provision of treatment and control systems where necessary. If spills are contained and drainage is not directed to surface watercourses, the potential problems of accidental spillage are minimal. The following mitigation measures / site practices shall be implemented during the Project:

- Construction of the foundations for the extension of the highway, and its related river training works, shall be carried out carefully in order to prevent contaminants from entering into rivers. Potential impact from activities, which cannot be protected by sheet piles, shall be minimised by reducing the duration of these activities as much as possible in order to mitigate the impacts.
- Before commencing any demolition works all sewer and drainage systems shall be in place with all connections sealed to prevent debris, soil, sand etc. from entering into public sewers/drains.
- Site surface runoff shall be discharged into the existing storm drains. It is recommended that the use of sand/silt removal facilities (silt traps, sediment basins) and oil interceptors should be carefully planned to ensure that they would be installed at appropriate locations in order to capture all surface water generated on site.
- It is also recommended that where necessary, temporary catchpits and perimeter channels shall be constructed in addition to the existing channel system within the site prior to the site formation works and earthworks.
- Wastewater generated from any concrete batching, wash down of equipment or similar activities shall not be discharged into the stormwater drains. All storm catch basins/inlets, if

any, receiving stormwater runoff from the construction area should be covered with a wire mesh filter. The wire mesh filter shall have crushed stone on its upper surface to prevent sediment from entering inlet structures and to reduce potential sediment loading to the receiving waters. It is recommended that the wastewater should be discharged into foul sewers after the settable solids have been removed. Any necessary pH adjustment should be carried out at the same time. All sewage discharges from the study area shall meet the TM standards and approval from EPD through the licensing process is required. Sand traps, and other pollution prevention installations shall be properly cleaned and maintained.

- Construction of the proposed widening works will require some new open-cut, as well as cutting back of existing embankments. Runoff from exposed working areas, unfinished slopes and from unlined temporary channels shall be directed to stilling basins and/ or silt traps before discharging to the drainage outfalls.
- Groundwater seepage into excavations shall be diverted to a nearby stilling basin prior to discharge into existing watercourses.
- A Contractor's Site Management Plan will be required to ensure that adequate labour and plant resources are immediately available to deal with flooding and to carry out necessary rescue measures during exceptional rainstorm conditions.
- Design checks of temporary drainage works shall be carried out to ensure that the existing capacities are maintained at all times.
- Regular inspections of the temporary drainage works to ensure that design capacities are maintained. Particular attention shall be paid to the capacity of culvert N487. In order to restrict the maximum flood storage volume from exceeding its capacity, construction activity immediately upstream of the culvert shall not be allowed.
- A Contractor shall undertake regular inspections of the stilling basins and/or silt traps to ensure that sediment is not conveyed into the existing drainage system.
- Regular inspections of the existing sub-catchment drainage systems must be in place to ensure that there are no blockages resulting from construction activities;
- Inspection and testing of water quality in the nullah on the Tai Po River and in the Ma Wat River, immediately downstream of culvert N490, between the rubber dam and the water intake channel shall be undertaken. Testing of water quality shall be undertaken to ensure there is no deterioration of water quality resulting from the widening works.

6.6 Proposed Mitigation Measures – Operation Phase

It is anticipated that the water quality impacts of the operational phase will be minimal.

It is recommended that appropriate Best Management Practices (BMPs) be incorporated into the design to further reduce storm water runoff impact during the operational phase as far as practicable. The following mitigation measures are suitable, and applicable, for BMP during operational phase.

In the event of a road traffic accident any spilled material should be contained and recovered immediately rather than allowing them to enter the drainage system. This is particularly important at the southern end of the highway in view of the protection measures, which have been being implemented to improve water quality in Tolo Harbour.

6.7 Conclusions

6.7.1 Construction Phase Water Quality

Impacts from construction site runoff can be mitigated by implementing the control measures identified in the guidance notes issued by the EPD – *Practice Note for Professional Person PN 1/94*. Effluents can be controlled by provision of treatment and control systems where necessary. Potential problems of accidental spillage are minimal if spills are contained and drainage is not directed to surface watercourses. With the proper implementation of good site practice/mitigation measures, potential water quality impact arising during the implementation of the scheme is anticipated to be locally confined and minimal.

6.7.2 Operation Phase Water Quality

It is anticipated that the water quality impacts of the operational phase will be minimal and acceptable.

7 Solid Waste Management Review

7.1 Introduction

This section reviews the solid waste management implications from the Project due to the proposed project changes after the approval of the EIA Report. The potential environmental impacts from waste streams generated by the proposed works are assessed. Standards, guidelines and legislation, recommended mitigation measures and the disposal strategy described in the Approved EIA report are reviewed to assess their present applicability and have been updated where necessary.

During the construction phase, quantities of excavated materials and other wastes will be generated and will require disposal at an appropriate facility. The disposal strategy has been based upon the principle of reducing the amount of waste requiring final disposal through the development of outline plans for waste avoidance, material re-use and recycling. This is in accordance with the principles of the waste management hierarchy. Wastes generated during the operational phase have also been considered within this ERR.

7.2 Methodology

The solid waste management assessment undertaken as part of the EIA was carried out in accordance with the agreed methodology presented in the Working Paper WP II – EIA Methodology and Assessment Report, the requirements of clause 6.40.9 of the EIA Study Brief and Annex 7 and 15 of the TM-EIAO.

The project site as described in the approved EIA Report is still applicable in this ERR. The site falls within Tolo Highway from Island House Interchange to Wo Hop Shek Interchange.

Comparing the Proposed Design to the EIA Design presented in the Approved EIA Report, there is no material change caused to the project according to Table 2-1.

As there is no significant alignment change, the construction activities and the waste impacts detailed in the Approved EIA Report remain valid. Nevertheless, a desktop study has been carried out to review the standards, guidelines and legislation and to provide updated information where applicable. Recommendations have been made based upon the best available information at this time.

7.3 Identification of Impacts

7.3.1 Construction Phase

Since the alignment of the widening works of Tolo Highway / Fanling Highway remains primarily the same as the alignment investigated in the Approved EIA Report, the construction activities and potential sources of waste generation predicted in the Approved EIA Report are still applicable. Therefore the waste impacts predicted in the Approved EIA report are also applicable to this ERR and are summarised below.

Wastes that will be generated during the construction phase of the Project include the following:

- Vegetation and demolition waste from site clearance.
- Excavated materials from earthworks (e.g. cuttings, pile foundations, regarding works).
- General construction waste (e.g. wood, scrap metal, concrete).
- Bentonite slurries from pile construction.
- Chemical wastes generated by general site practices (e.g. vehicle and plant maintenance/servicing).
- General refuse generated by site workers.

The construction works will require the diversion of a number of water supply pipes. Historically, water supply pipe-work within Hong Kong has incorporated the use of asbestos containing materials. However, as described in Section 7.3.1 of the Approved EIA report, it is unlikely that asbestos-containing material will be encountered during the utility diversion works.

No sediment quality testing was carried out as part of the geotechnical investigation during the Approved EIA Report because no significant generation of sediments requiring disposal is anticipated, however small quantities may arise during viaduct construction (maximum estimate <100m^3).

In the unlikely event that sediment is excavated and requires offsite disposal, sediment samples shall be analysed to determine the appropriate disposal route. As discussed in Section 7.3.1 of the Approved EIA Report, this shall be in accordance with EPD's Technical Circular No 34/2002 "Management of Dredged/Excavated Sediment".

7.3.2 Operation Phase

As detailed in the Approved EIA Report, and applicable to this ERR, wastes may be generated from specific maintenance operations (e.g. road re-surfacing, upkeep of landscaped areas) and may include asphalt, concrete and organic wastes (vegetation).

The total volumes and types of waste materials will be dependent upon the nature and frequency of the maintenance works undertaken and cannot be accurately estimated at this time.

7.4 Prediction and Evaluation of Environmental Impacts for Construction Phase

The extent of the waste management impact detailed in the Approved EIA Report has been reviewed. As there is no significant alignment change, the majority of the evaluation in the Approved EIA Report is still applicable and is summarised below.

7.4.1 Excavated Materials

As detailed in the Approved EIA Report the greatest volume of excavated material will arise from the re-excavation/modification of existing cuttings and slope cutting for new retaining walls. Wherever possible, excavated material from the earthworks shall be re-used on site as structural

fill or for landscaping purposes. This will maximise the utilisation rate of materials on site and reduce the requirement for off-site disposal.

Estimated volumes of material from cut and fill activities have been revised and are presented in Table 7-1. A total of 243,500m^3 of fill material will be required and a total of 362,500 m^3 of material will be excavated ("cut").

Table 7-1 Estimated Volumes of Material from Cut and Fill Activities

Chainage	Construction Activity	Volume (m^3)	
		Fill	Cut
200-750	Widening of existing embankment	30000	21390
800 – 1100	Widening of existing embankment and modification of existing cutting, including use of a retaining wall	30000	15000
1200-1480	Widening of existing embankment including short retaining wall plus modification of existing cutting	20000	9210
1500-1750	Widening of existing embankment including retaining wall	51600	
2000-2400	Widening of existing embankment and modification of existing cutting, including use of a retaining wall	15000	101000
2400-2800	Modification of existing cutting, including use of a retaining wall and Widening of existing embankment	6000	20900
2850-3100	Widening of existing embankment including retaining wall	16400	101400
3100-3550	Widening of existing embankment	5000	16500
3670 - 3700	New embankment	3500	
3950 – 4000	Re-excavation of the existing cutting		2500
4010 - 4170	Widening of existing embankment and Re-excavation of the existing cutting	14000	
4150 - 4370	Widening of existing embankment including retaining wall	11000	29300
4370 - 4650	New embankment and modification of existing cutting using retaining wall on each side of the carriageway	15000	32900
4850 – 5150	Widening of existing embankment	22500	
5370-5570	New retaining wall for viaduct access road		400
8390-8600	Modification of existing cutting using retaining wall	3500	12,000
	Totals	**243,500**	**362,500**

Based on the results of the Geotechnical Ground Investigation undertaken recently and as part of the Approved EIA Report, the volumes of excavated material that are acceptable or unacceptable for reuse within the Project are summarised in Table 7-2. Of the 362,500m^3 of material to be

excavated, some 243,500m^3 will be acceptable for reuse as fill material whereas 119,000m^3 will be unable for reuse.

Table 7-2 Estimated Volumes of Material from 'Cut' Activities which are acceptable or unacceptable for Re-use within the Project (Earthworks only)

Chainage	Volume of Material from "Cut" Activities (m^3)	Volume able to re-use within Project (m^3)	Volume not able to be re-used within Project (m^3)
200-750	21390	21390	0
800 – 1100	15000	15000	0
1200-1480	9210	9210	0
2000-2400	101000	35100	0
2400-2800	20900	20900	47400
2850-3100	101400	101400	11400
3100-3550	16500	10000	6500
3950 – 4000	2500	2500	0
4150 – 4370	29300	10000	19300
4370 - 4650	32900	14100	18800
5370-5570	400	400	0
8390-8600	12000	3500	8500
Totals	**362500**	**243500**	**110500**

Off-setting the requirement of 243,000 m^3 of fill material by the 362,500 m^3 of reusable material from that excavated, results in the need to export 110,500m^3 of inert material and to dispose of 8,500 m^3 of unusable excavated material.

The potential environmental impact from excavated materials in anticipated being acceptable provided that the mitigation measures discussed in Section 7.7.2 are properly implemented.

7.4.2 Contaminated Soil

For excavated soils to be re-usable, materials must be clean, inert and suitable for the proposed engineering or landscaping use. As part of the Approved EIA Report, a desk-based review of the current land use along the route was undertaken in order to assess the likelihood of encountering contaminated soil materials during the construction works. Layout plans for the alignment were reviewed to identify potential contaminating land uses.

Where only superficial ground works are to be carried out, no significant potential for the generation of excavated materials was anticipated.

A petrol filling station is located at Wo Hop Shek (Grid reference 833490E, 838565N). Only minor works, i.e. provision of cycle track/footpath, are proposed adjacent to the site. As a result, no significant potential for the generation of contaminated excavated materials was considered likely.

Along the route alignment a number of light commercial/industrial uses (including open storage areas) were identified, although in the majority of cases the proposed works do not directly affect these. In view of the minimal excavation and low potential for contamination from current uses, no significant volume of contaminated excavated materials was considered likely. Within areas of cutting no potential contaminating uses were identified.

As part of this ERR, a desktop study has been carried out to review the land use within the Project Site since the approval of the EIA Report. The review focussed on areas where significant excavation would take place, i.e. where cuttings are required. No significant changes in land use or new developments were identified and therefore the recommendations from the Approved EIA report remain valid.

As described above, it is not considered likely that contaminated material will arise. However, in the unlikely event that contaminated materials are encountered, the appropriate measures as outlined under Section 7.7.3 should be followed.

7.4.3 Vegetation from Preparatory Works

During the ground preparatory works, areas of tree and shrub cover will need to be cleared and will require disposal. It is estimated that 19.6 ha of vegetation will be cleared and will require disposal.

The potential environmental impact from vegetation from preparatory works is anticipated to be acceptable provided that the mitigation measures discussed in Section 7.7.4 are properly implemented.

7.4.4 Construction and Demolition Material

The inert portion of C&D materials, such as rock and concrete that can be used as fill material for reclamation and earth filling projects, is termed public fill. The non-inert portion of C&D materials such as timber, glass, steel and plastic, is termed C&D waste. Some C&D waste can be reused or recycled prior to disposal at a landfill site.

As detailed in the Approved EIA Report, construction waste likely to be generated during the site formation works include the following:

- Waste wood from concrete formwork;
- Spent concrete;
- Waste steel rebars from concrete reinforcement activities; and
- Material and equipment wrappings.

The total volume of construction waste to be generated is not expected to exceed 20,000m^3. In addition, buildings resumed along the route may require demolition. These include buildings located within Tai Hang Village (Chainage 6070-6310). The activities involving generation of demolition materials are presented in Table 7-3.

Table 7-3 Activities Involving Generation of Demolition Materials

Chainage	Activity
400	Demolition of bridges – Banyan, Banyan West
3700	Demolition of existing slip road
4600	Demolition of existing retaining wall
6090	Demolition of footbridge at Tai Hang
7520	Demolition of footbridge at Kiu Tau
7990	Demolition of footbridge (N119, N119a)
8525	Demolition of footbridge (NF 82)

Demolition waste will likely comprise reinforced concrete, asphalt/concrete (from excavated road pavements), metal, electrical wiring, brick and tiles.

The potential environmental impact from construction and demolition waste material is anticipated to be acceptable provided that the mitigation measures discussed in Section 7.7.5 are properly implemented.

7.4.5 Bentonite Slurries

The Project incorporate the construction of retaining walls, abutments and viaducts that may have piled foundations requiring the use of Bentonite slurries. It is common practice among contractors to reuse these slurries during construction, thus reducing the volume requiring final disposal.

Volumes of Bentonite slurries requiring final disposal will depend on site practice.

The potential environmental impact from Bentonite slurries is anticipated to be acceptable provided that the mitigation measures discussed in Section 7.7.6 are properly implemented.

7.4.6 Chemical Waste

Plant and vehicle maintenance will likely be the primary source of chemical waste during the construction period. The majority of chemical waste produced is therefore expected to consist of waste oils and solvents. Typical wastes may include the following:

- Solid wastes (empty fuel/lubricant drums, used oil/air filters, scrap batteries, vehicle parts); and
- Liquid wastes (waste oils/grease, spent solvents/detergents and possibly spent acid/alkali from batteries maintenance).

The volume of chemical waste produced will depend on the total number of plant/vehicles and how much maintenance is actually carried out on site. As anticipated in the Approved EIA Report, it is unlikely that volumes of chemical waste will exceed 450 litres/month.

Chemical waste is likely to pose serious environmental, health and safety hazards if not 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. These hazards may include:

- Toxic effects to workers;
- Adverse effects on water quality from spills; and
- Fire Hazards.

The potential environmental impact from chemical wastes is anticipated to be acceptable provided that the mitigation measures discussed in Section 7.7.7 are properly implemented.

7.4.7 General Refuse

Site construction workers will generate general refuse, typically comprising food wastes, packaging, aluminium cans, plastic bottles, waste paper, etc.

The total quantity of waste generated will be dependent on the number of site workers that the contractor proposes to use. In the approved EIA Report, a maximum of 600 site staff was assumed. These figures have been adopted for use in this ERR and have been used to estimate the amount of general refuse produced by site staff. Using the latest (2007) waste generation statistics prepared by EPD, it is assumed that each worker will generate 1.36kg of general refuse per day. Based on a six-day working week, the quantity of general refuse generated will be 8.16 kg/week.

Storage of general refuse on site will generate adverse environmental impacts. These include deterioration of water quality (if waste enters nearby water bodies), odour nuisance and visual impact if waste is stored on site without frequent collection for disposal. The site may also attract pests and vermin if the waste storage areas are not well maintained and cleaned regularly.

The potential environmental impact from municipal waste is anticipated to be acceptable provided that the mitigation measures discussed in Section 7.7.8 are properly implemented.

7.5 Prediction and Evaluation of Environmental Impacts for Operation Phase

Wastes may be generated from specific maintenance operations (e.g. road re-surfacing, upkeep of landscaped areas) and may include asphalt, concrete and organic wastes (vegetation). The total volumes and types of waste materials will be dependant upon the nature and frequency of the maintenance works undertaken and cannot be accurately estimated at this stage.

7.6 Summary and Estimated Volumes of Generated Waste

Broad estimates for the volumes of generated waste for each waste type were detailed in the Approved EIA Report and have been adopted in this ERR. The actual amount of waste disposal offsite will be determined by the Contractor's working practices / site procedures. Table 7-4 summarises the estimated volumes of waste materials generated from the Construction and Operation Phases of the Project.

Table 7-4 Summary of Waste material disposal off site during the Construction and Operation Phases of the Project

Activity	Material Type	Estimated total volumes (Non re-useable within site)
Construction Phase		
Ground preparatory works	Site clearance	(Measured in Area of vegetation) Coverage 19.6 Ha, (17,000 m^3 Non-inert material)
	Demolition materials	3,000m^3 (Inert: 2,000 m^3, non-inert:1000 m^3)
	Demolition of existing bituminous pavement	125,500 m^3 (inert)
Earthworks	Excavated Materials - General Fill (Soft material, Grade III IV or V rock)	93,100m^3 84,600 m^3 (Inert) 8,500 m^3 (Non-Inert)
	Excavation Materials - rock (Grade II or better)	25,900 m^3 (inert)
General works	Construction waste	20,000m^3 (Inert: 11,000 m^3) (Non-inert: 9,000 m^3)
	Chemical waste	450 litres/month
	General refuse (generated by site staff)	4,896 kg/week (Assumes max of 600 staff and a 6 day week and 1.36kg/person/day)(1)
Foundation Construction	Bentonite slurries	Dependent upon site practices
Operation Phase		
Maintenance works	Construction Wastes	Dependent upon extent of works.

Note:

(1) Based on per capita domestic waste generation rate for 2005, Plate 2.7, "Monitoring of Solid Waste in Hong Kong – Waste Statistics for 2005", EPD, May 2006

(2) Non-inert material to be disposed to Landfills

(3) 20% RAP to be used in new pavement

7.7 Mitigation Measures for Adverse Environmental Impacts

Waste materials have the potential to cause adverse environmental impacts during generation, storage, transport and disposal. The principal adverse effects relate to dust, water quality, general health and safety and visual impacts.

Waste management procedures should be implemented to minimise potential impacts to the environment. This may be achieved by the consideration and application of the following protocols:

- Avoiding and/or minimising waste generation where practical by improvements or changes in the project design or site procedures;
- Reusing/recycling/recovering materials where possible and thereby negating / minimising disposal requirements (e.g. by waste segregation according to type, separation of recyclable materials such as metal, reuse of wood from site hoarding/concrete formwork, utilisation of excavated material for filling or landscaping); and
- Ensuring that all treatment and disposal options comply with best practice and all relevant guidelines and legislation.

For each anticipated waste category, the potential environmental impacts have been highlighted and the appropriate mitigation measures/disposal options are recommended below. These recommendations have been adopted and updated from the Approved EIA Report and form the basis of the Waste Management Plan (WMP).

7.7.1 Good Site Practices and Waste Reduction Measures

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

- Obtain the necessary waste disposal permits from the appropriate authorities, in accordance with the Waste Disposal Ordinance (Cap. 354), Waste Disposal (Chemical Waste) (General) Regulation and the Land (Miscellaneous Provision) Ordinance (Cap. 28);
- Obtain a billing account with EPD for disposal of construction waste (Waste Disposal (Changes for Disposal of Construction Waste) Regulation);
- A Waste Management Plan (WMP), incorporated within an Environmental Management Plan (EMP), should be prepared and submitted to the Engineer/Supervising Officer for approval. Reference should be made to Environment, Transport and Works Bureau Technical Circular (Works) (ETWB TCW) 19/2005;
- Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site;
- Minimising excavation requirements as far as possible;
- Balancing cut and fill requirements;
- Evaluating the potential for maximising the re-use of excavated materials for example, within landscape mounds;
- Considering treatments for unsuitable excavated materials e.g. upgrading of subsoil to topsoil by mixing with compost;
- Providing an area within the construction site to allow for sorting and segregation of materials;
- Provision of sufficient waste disposal points and regular collection of waste;
- Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers;

- A trip-ticket system should be included as one of the contractual requirements and implemented by the Environmental Team to monitor the disposal of C&D and solid wastes at public filling facilities and landfills, and to control fly tipping. Reference should be made to ETWB TCW No. 31/2004;
- Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors;
- Segregating waste materials according to type to facilitate re-use and recycling;
- Separation of inert construction and demolition materials for either re-use on-site or use as public fill;
- During demolition works, segregating materials at source as far as practical;
- Co-ordinate material deliveries to site in order to minimise storage times on site and the likelihood of causing damage;
- Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste;
- Consider on site mulching of vegetation to reduce bulk and review opportunities for possible use within landscaping areas;
- Training site staff in waste minimisation practices;
- Encourage collection of aluminium cans by providing separate labelled bins to enable this waste to be segregated from other general refuse generated by the work force;
- The burning of wastes on-site will not be permitted; and
- Implementation of a recording system for the amount of wastes generated, recycled and disposed of (including the disposal sites and transport routes).

Reference should be made to the legislation, standards and guidelines in Section 3.6 including the following:

- WBTC No. 19/2005 “Environmental Management on Construction Sites”;
- WBTC No. 31/2004 “Trip-ticket System for Disposal of Construction and Demolition Material”; and
- WBTC No. 25/99 “Incorporation of Information on Construction and Demolition Material Management.

In addition to the above measures, specific mitigation measures are recommended below for the identified waste arising to minimise environmental impacts during handling, transportation and disposal of these wastes.

7.7.2 Excavated Materials

All materials shall be re-used or transported off site as soon as possible to minimise the potential for adverse environmental impacts. It is recognised that some stockpiling of materials will be required in some instances, although these shall be segregated in terms of material type as far as practical to facilitate material re-use (i.e. top soil for landscaping, suitable fill for engineering works).

All excavated material shall be handled in a manner that minimises the release of fugitive dust (especially during hot and dry weather) and where possible the movement of material shall be kept to a minimum. Mitigation measures for the handling of excavated materials on-site to minimise the release of fugitive dust, have been addressed in Section 4 (Air Quality).

Within the stockpile area, the following measures shall be in place to control potential impacts:

- Covering material during heavy rainfall;
- Using dust suppression techniques (such as dampening with fine water spray and covering with tarpaulin);
- Controlling the excessive use of water during spraying to prevent the generation of runoff contaminated with elevated levels of suspended solids;
- Segregating the surface water system from the stockpile area and fitting silt traps where appropriate;
- Locating stockpiles to minimise potential visual impacts;
- Minimising land intake of stockpile areas as far as possible;
- Providing fencing within designated areas to separate sensitive habitats and prevent stockpiling in unsuitable locations; and
- Designating appropriate haulage roads.

A reduction in the total volume of excavated materials requiring off site disposal shall be achieved as far as possible by optimising the re-use of suitable material on-site.

Excavated material that cannot be re-used on site and inert C&D materials will require disposal at public filling reception facilities, such as those at Tuen Mun Area 38, or as identified by the Secretary of the Public Filling Sub-Committee (PFSC).

The capacity of the public filling facilities to accept inert construction and demolition material will be dependent upon current and future demands on disposal sites. Accurate predictions on the likely disposal site for excavated materials derived from the project works can therefore not be made at this time.

7.7.3 Contaminated Soil

A petrol filling station is located at Wo Hop Shek (Grid reference 833490E, 838565N) and special disposal and handling procedures may be required in the unlikely event that contaminated soils are excavated. These should include segregation of all excavated contaminated soils within a designated area, which is bundled to prevent the discharge of potentially contaminated surface water runoff. The stockpiles should be covered and removed for off-site disposal by a licensed waste collector as soon as practical. Final disposal should be to a licensed landfill site, upon approval from EPD.

During the handling and excavation of any contaminated materials, appropriate health and safety precautions will be required to minimise any potential risks to site workers. Implementation of “standard” civil engineering techniques (e.g. provision of overalls, gloves etc., no smoking or eating on site) and the minimisation of dust generated during construction will ensure that direct contact by site workers is mimimized as far as practicable.

7.7.4 Vegetation from Preparatory Works

Cleared vegetation derived from the ground preparatory works should be segregated from any soil materials where practical and sent to a suitable disposal site, such as WENT Landfill. WENT Landfill will only accept a maximum of 50% by weight of inert construction waste. It is therefore important that soil/vegetation are kept segregated. Mulching of vegetation on site would also reduce the bulk of material requiring disposal. Moreover, prior to landfill disposal, the contractor should identify possible opportunities for the use of the mulch within landscaping areas, either on site, or as part of other landscaping projects.

7.7.5 Construction and Demolition Material

Works Branch Technical Circular No. 2/93, Public Dumps, governs the handling of C&D materials. Inert C&D material (public fill) should be directed to an approved public filling area or reclamation site, where it has the benefit of offsetting the need for removal of materials from borrow areas for reclamation purposes and helps to reduce the pressure on landfill sites. Due to limited space at landfills, disposal at reclamation sites or a public filling area would be the preferred method.

The Land (Miscellaneous Provision) Ordinance requires that individuals or companies who deliver public fill to public filling areas obtain dumping licences. The Civil Engineering and Development Department (CEDD) under delegated powers from the Director of Lands to issue these licenses.

Careful design, planning and good site management can minimise over-ordering and generation of materials, such as concrete, mortar and cement grouts. The design of formwork should maximise the use of standard wooden or metal panels so that high reuse levels can be achieved. Alternatives such as steel formwork, plastic fencing and reusable site office structures should be considered to increase the potential for reuse and minimise C&D waste generation. Reuse of public fill and C&D material shall be practiced on site as far as practicable.

In accordance with WBTC No. 19/2001 “Metallic Site Hoardings and Signboards”, re-useable metal hoarding and signboards should also be utilised on site to reduce the volume of waste wood generated.

Where possible, inert C&D materials, such as wood and metal, should be separated out from other materials for recycling. All recyclable material should be clearly segregated and stored in appropriate skips/containers or stockpiled. Stockpiling of all construction waste prior to disposal should comply with the control measures outlined in Section 7.7.1 in order to minimise any potential impacts related to dust, visual impact, water quality and general health and safety. Proper segregation of waste types on site will increase the feasibility of certain components of the waste stream by recycling contractors.

It shall be the contractor's responsibility to ensure that licensed waste collectors collect inert C&D material and that appropriate measures are taken to minimise adverse impacts during handling and transportation, such as dust generation. The contractor must also ensure that all necessary disposal permits are obtained.

7.7.6 Bentonite Slurries

Bentonite slurries should be reused as far as possible and final residues disposed of in accordance with the Practice Note For Professional Persons ProPECC PN 1/94.

Bentonite slurries used in diaphragm wall and bore pile construction should be reconditioned and reused where ever practicable. If the disposal of a certain residual quantity cannot be avoided, the used slurry may be disposed of at the marine spoil grounds subject to obtaining a marine dumping license from EPD on a case-by-case basis.

For disposal through the public drainage system, used Bentonite slurry should be treated to the respective effluent standards applicable to foul sewers, storm drains or the receiving waters, as set out in the WPCO Technical Memorandum on Effluent Standards.

7.7.7 Chemical Wastes

Should any chemical waste be generated, the Contractor must register with the EPD as a chemical waste producer. The chemical wastes will be readily accepted for recycling at Dunwell's facility in Yuen Long or for disposal at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi. Material that cannot be recycled or disposed of at the CWTC (such as spent batteries) should be sent to a co-disposal landfill, such as SENT Landfill.

All chemical wastes shall be handled according to the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. The chemical waste shall be stored and collected by an approved contractor for disposal at a licensed facility in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

Containers used for the storage of chemical waste shall:

- Be suitable for the substance they are holding, resistant to corrosion, maintained in good condition, and securely closed;
- Have a capacity of less than 450 litres unless the specifications have been approved by the EPD; and
- Display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Waste Disposal (Chemical Waste) (General) Regulation.

The storage area for chemical waste shall:

- Be clearly labelled and used solely for the storage of chemical waste;
- Be enclosed on at least 3 sides;
- Have an impermeable floor and bundling, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest;
- Have adequate ventilation;
- Be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary); and
- Be properly arranged so that incompatible materials are adequately separated.

Disposal of chemical waste shall be:

- Via a licensed waste collector; and
- A facility licensed to receive chemical waste, such as the CWTC, which offers a chemical waste collection service and can supply the necessary storage containers; or
- A waste recycling plant approved by EPD.

Principles of reuse and recycle chemical waste on site as far as practicable shall be adopted by the contractor.

7.7.8 General Refuse

General refuse shall be stored in enclosed bins or compaction units separate from C&D and chemical wastes. A reputable waste collector shall be employed by the contractor to remove general refuse from the site, separately from C&D and chemical wastes, on a daily or every second day basis to minimise odour, pest and litter impacts.

Individual collectors often recover aluminium cans from the waste stream if these are segregated or easily accessible. Therefore, separately labelled bins for their deposit should be provided if feasible. Similarly, plastic bottles and carton package material generated on site shall be separated for recycling as far as possible. Site office waste shall be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme shall be considered if one is available.

7.8 Operation Phase Wastes

Waste generated from the operational phase of the project is likely to be restricted to small quantities associated with maintenance works and the upkeep of landscaped areas. Provided that appropriate waste handling, storage and disposal procedures are adopted no significant impacts are considered likely. The procedures outlined within Sections 7.6 and 7.7 shall be followed, where appropriate.

7.9 Summary of Waste Management Plan (WMP)

A summary of the proposed mitigation measures and proposed disposal options are presented in Section 7.7 and form the Waste Management Plan for the proposed project works is presented in Table 7-5.

Table 7-5 Waste Management Plan

	Control Measures	**Proposed Disposal Method / area**
General Requirements	Good Site Practices and Waste Reduction Measures ▪ Obtain the necessary waste disposal permits from the appropriate authorities, in accordance with the Waste Disposal Ordinance (Cap. 354), Waste Disposal (Chemical Waste) (General) Regulation and the Land (Miscellaneous Provision) Ordinance (Cap. 28). ▪ Obtain a billing account with EPD for disposal of construction waste (Waste Disposal (Changes for Disposal of Construction Waste) Regulation). ▪ A Waste Management Plan (WMP), incorporated within an Environmental Management Plan (EMP), should be prepared and submitted to the Engineer/Supervising Officer for approval. Reference should be made to Environment, Transport and Works Bureau Technical Circular (Works) (ETWB TCW) 19/2005. ▪ Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site. ▪ Minimising excavation requirements as far as possible. ▪ Balancing cut and fill requirements. ▪ Evaluating the potential for maximising the re-use of excavated materials for example, within landscape mounds. ▪ Considering treatments for unsuitable excavated materials e.g. upgrading of subsoil to topsoil by mixing with compost. ▪ Providing an area within the construction site to allow for sorting and segregation of materials. ▪ Provision of sufficient waste disposal points and regular collection of waste. ▪ Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers. ▪ A trip-ticket system should be included as one of the contractual requirements and implemented by the Environmental Team to monitor the disposal of C&D and solid wastes at public filling facilities and landfills, and to control fly tipping. Reference should be made to ETWB TCW No. 31/2004. ▪ Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors. ▪ Segregating waste materials according to type to facilitate re-use and recycling. ▪ Separation of inert construction and demolition materials for either re-use on-site or use as public fill.	N/A

	Control Measures	**Proposed Disposal Method / area**
	▪ During demolition works, segregating materials at source as far as practical. ▪ Co-ordinate material deliveries to site in order to minimise storage times on site and the likelihood of causing damage. ▪ Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste. ▪ Consider on site mulching of vegetation to reduce bulk and review opportunities for possible use within landscaping areas. ▪ Training site staff in waste minimisation practices. ▪ Encourage collection of aluminium cans by providing separate labelled bins to enable this waste to be segregated from other general refuse generated by the workforce. ▪ The burning of wastes on-site will not be permitted. ▪ Implementation of a recording system for the amount of wastes generated, recycled and disposed of (including the disposal sites and transport routes).	
Vegetation from Preparatory Works	▪ Segregation of materials to facilitate disposal. ▪ On site mulching by contractor to reduce bulk, ▪ Review of opportunities for possible use within landscaping areas,	Re-use / landfill
Excavated Materials	▪ Segregation of materials to facilitate disposal / reuse. ▪ Appropriate stockpile management. ▪ Re-use of excavated material on or off site (where possible). ▪ Special handling and disposal procedures in the event that contaminated materials are excavated.	Re-use on site for suitable material. Disposal to public fill areas for unsuitable materials.
Construction and Demolition Material	▪ Segregation of materials to facilitate recycling/reuse (within designated area and in appropriate containers/stockpiles). ▪ Appropriate stockpile management. ▪ Planning and design considerations to reduce over ordering and waste generation. ▪ Recycling and re-use of materials where possible (e.g. metal, wood from hoardings, formwork). ▪ For material, which cannot be re-used/recycled, an approved waste contractor for landfill disposal should carry out collection.	Public fill (inert wastes) to Public Filling Area or reclamation site. Disposal to landfill for materials unsuitable for public filling
Bentonite Slurries	▪ Bentonite slurries should be reused as far as possible ▪ Disposal in accordance with Practice Note For Professional Persons (ProPECC PN 1/94)	Marine disposal (upon EPD approval) or disposal to drainage system satisfying WPCO requirements.

	Control Measures	**Proposed Disposal Method / area**
Chemical Waste	▪ All the chemical waste shall be handled according to the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. The chemical waste shall be stored and collected by an approved contractor for disposal at a licensed facility in accordance with the Waste Disposal (Chemical Waste) (General) Regulation. ▪ Principles of reuse and recycle chemical waste on site as far as practicable shall be adopted by the contractor. Containers used for the storage of chemical waste shall: ▪ Be suitable for the substance they are holding, resistant to corrosion, maintained in good condition, and securely closed. ▪ Have a capacity of less than 450 litres unless the specifications have been approved by the EPD. ▪ Display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Waste Disposal (Chemical Waste) (General) Regulation. The storage area for chemical waste shall: ▪ Be clearly labelled and used solely for the storage of chemical waste. ▪ Be enclosed on at least 3 sides. ▪ Have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest. ▪ Have adequate ventilation. ▪ Be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary). ▪ Be properly arranged so that incompatible materials are adequately separated. Disposal of chemical waste shall be: ▪ Via a licensed waste collector. ▪ A facility licensed to receive chemical waste, such as the CWTC, which offers a chemical waste collection service and can supply the necessary storage containers; or ▪ A waste recycling plant approved by EPD.	Dunwell's Recycling Facility, CWTC or SENT
General Refuse	▪ General refuse shall be stored in enclosed bins or compaction units separate from C&D and chemical wastes. ▪ A reputable waste collector shall be employed by the contractor to remove general refuse from the site, on a daily or every second day basis to minimize odour, pest and litter impacts.	Recycle / Landfill

	Control Measures	**Proposed Disposal Method / area**
	▪ General refuse shall be separated (plastic bottles, aluminium cans, paper etc) for recycling as far as possible. ▪ Participation in a local collection scheme shall be considered if one is available.	
Operational Waste	▪ Waste should be stored within a designated storage area ▪ Waste should be segregated into recyclable, non-recyclable and putrescible wastes, where possible to facilitate disposal.	Dependent on material waste type. Refer to waste categories above.

7.10 Conclusion

The proposed construction activities associated with the proposed works will generate a number of waste materials including:

- Vegetation and demolition wastes from site clearance;
- Excavated materials;
- Construction waste;
- Chemical waste; and
- General refuse.

Waste generated from the operational phase of the project is likely to be restricted to small volumes associated with intermittent maintenance works (e.g. asphalt from resurfacing works) and landscape upkeep (vegetation).

The potential impacts of wastes arising from the construction and operational phases of the project have been assessed. There is no significant change in the potential impact that was predicted within the Approved EIA Report.

Provided that the mitigation measures outlined in this review are properly implemented, potential impacts to the environment associated with waste generated by the construction and operational phases of the project will be acceptable. With the recommended procedures/measures in place, the construction and operational wastes generated/disposed as part of this project, will not lead to any significant adverse environmental impacts.

These waste management measures should be included in the contractor's Environmental Pollution and Control Requirements as well as the Environmental Monitoring and Audit Manual.

8 Ecology

8.1 Introduction

8.1.1

This section reviews the predicted ecological impacts arising from the Project based on the project changes after the approval of the EIA Report (Mott Connell Ltd. (2000). Desktop review of relevant documents (literature publications and EPD endorsed EIA), review of aerial photos, Ecological Surveying and Site-Visits have been undertaken to update baseline conditions of the ecological environment within the Study Area. The Study Area is considered to be 500 m from either side of the highway and the Project limit ends; and areas or habitats likely to be directly or indirectly impacted by the Project. The mitigation measures proposed in the Approved EIA Report have also been reviewed to assess if they are still applicable.

8.1.2

Specifically the references used in updating the Approved EIA Report include:

- *Environmental Impact Assessment Ordinance, Cap. 499, Guidance Note [GN 6/2002]* - Observations on Ecological Assessment from the Environmental Impact Assessment Ordinance Perspective
- *Environmental Impact Assessment Ordinance, Cap. 499, Guidance Note [GN 7/2002]* - Ecological Baseline Survey for Ecological Assessment
- *ACE Nature Conservation Sub-Committee Paper NCSC 9/06* - Fung Shui Woods in Hong Kong & AFCD's 'Venturing Fung Shui Woods'.
- *ACE Nature Conservation Sub-Committee Paper NCSC 7/06* - Egretries in Hong Kong
- *Agreement No. CE 63/2001 (DS)* Drainage Improvement in Northern New Territories – Package A - Final ES Report
- *DSD Contract No. DC/2004/06*, Drainage Improvements in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po. Final Ecological impact Monitoring Report (6 Reports dated between April 2006 and December 2007)
- *ETWB TCW No. 5/2005* - Protection of natural streams/rivers from adverse impacts arising from construction works
- Recent Aerial photos (2006) produced by Survey and Mapping Office of Lands Department
- Site visits carried out on the 17th August, 2007 in near Wan Tau Tong, San Tong, Hong Lok Yuen, Tai Po Tai Wo Road, near Wo Hop Shek. An overview of the habitat in these area were re-identified and updated on the habitat map.
- Site visits carried out on the 11th November, 2007 near Ma Wat river to identify the extent of habitat change due to the river training works, and visit to identify habitat near Island House is carried out as well.

- Ecological Survey carried out on 21st and 22nd April of 2008, particularly on Northern Meander of old Ma Wat River.
- Site visit on 4th July 2008 to review the locations of the Fung Shui Woodlands stated in the Approved EIA report.

8.2 Relevant Changes in the Project

8.2.1

The alignment of the widening works of Tolo Highway / Fanling Highway in this ERR is predominantly the same as the alignment investigated in the Approved EIA Report. The main difference is that the proposed alignment of Tai Po Tai Wo Road On-slip is now mostly an elevated road rather than an at grade section so as described in the Approved EIA Report. In addition the land requirements as indicated in the approved EIA vary from the updated proposed land requirement plan. The difference in land requirement includes slopeworks adjacent to the proposed road widening works. The slope stabilisation works are deemed necessary to improve safety for road users and increase protection to nearby residents. **Chapter 2** and **Appendix A** show specifically where the differences can be found.

8.2.2

Under the 'Drainage Services Department' project *'DC/2004/06, Drainage Improvements in Northern New Territories, Package A, Phase 1'*, after the carrying out of the flood improvement works, two meanders remain, which are both within the boundary of the works of the proposed Project. The most northerly meander is proposed to be filled under this project.

8.2.3

The Study Area lies within a 500 m corridor on either side of the carriageway of the sections of the Tolo Highway / Fanling Highway to be widened, which extends from Island House Interchange in Tai Po to Fanling.

8.3 Changes in Baseline Habitat or Ecological Impacts

8.3.1 General Variations in the Ecology

8.3.1.1

No new ecological areas of interest have been identified in relation to the Approved EIA. However some of the previously identified habitats have changed in their coverage due to the following reasons, since the approval of the EIA Report;

- Development from natural habitats into urbanised land;
- Abandonment of active agricultural land; and
- Encroachment of woodlands by hill fire.

8.3.1.2

In addition EIA's and other relevant studies which have been endorsed after the EIA was approved, contact with organizations such as the Agriculture, Fisheries and Conservation Department, (hereafter "AFCD") and the Hong Kong Bird Watching Society (hereafter "HKBWS") and review using recent aerial photos (2006) produced by Survey and Mapping Office of Lands Department has provided additional information whereby the classification, description or location of habitats required updating. The amended composition of the areas and the overall percentage for each of the habitats within the Study Area is summarised in **Table 8-1**.

Table 8-1 Habitat Types within Study Area (500 m boundary)

Habitat Type	Habitat Area (ha)	% of total Study Area
Active Agricultural Land	32.47	3.11
Inactive Agricultural Land	22.27	2.13
Orchards	0.72	0.07
Grassland	30.06	2.88
Natural Woodland	232.01	22.20
Plantation Woodland	161.40	15.44
Fung Shui Woodland	3.00	0.29
Natural rivers and streams	8.62	0.82
Artificial Drainage Channel	21.28	2.04
Mangroves & Mudflats	0.50	0.05
Sea	46.51	4.45
Urbanised Areas	484.70	46.37
Park	1.75	0.17
Cemetery	2.26	0.22
Total	**1047.55**	**100%**

8.3.1.3

Since the Approval of the EIA Report a 1.8 km long drainage channel, parallel to the Ma Wat River has been commissioned as part of the Drainage Improvements in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po (DSD agreement DC/2004/06). This results in significant changes in the nature of the Ma Wat River within the study area and has provided supplementary ecological information due to the studies that have been conducted under this drainage project.

8.3.1.4

The updates to the habitats identified in the Approved EIA Report are summarised in the following sections.

8.3.2 Overview of Habitat Types

8.3.2.1

The key habitats identified and the corresponding regions within the Study Area, defined in Figures 8.1.1 – 8.1.6 of the Approved EIA Report, are reviewed and summarised in the following sections. Fung Shui Woodlands (hereafter "FSWs") and the Ma Wat River are found in various sub-areas and these are discussed in separate sub-sections. The revised habitat map is shown in **Appendix I**.

8.3.2.2 Area 1 Habitat Description

8.3.2.2.1

Area 1 is located in the northern portion of the Study Area and comprises of urbanised area of Fanling, Wo Hop Shek and the village of Tong Hang and Kiu Tau. Dominant habitats identified include plantation and natural woodlands. However, a large area of the natural woodland, to north of Fanling Highway, previously identified in the Approved EIA Report was found to have become bare ground and / or patches of grassland since the EIA study. This may possibly be due to natural hill fire. Small patches of inactive agricultural land, north to Fanling Highway, and two patches of plantation woodland, south of Wo Hop Shek San Tsuen, are now found to be concrete paved and are now classified as urbanised.

8.3.2.2.2

The Habitat Map for this area has been adjusted accordingly.

8.3.2.3 Area 2 Habitat Description

8.3.2.3.1

Area 2 includes the rural communities of Kiu Tau, Kau Lung Han San Wai, Yuen Leng, Tai Wo (Ta Po), Nam Wa Po and Tai Hang. Habitats present within Area 2 include plantation and natural woodlands and a FSW (Section 8.3.2.8 refers), and active and inactive agricultural land. Several natural and artificial watercourses flow through the area. There is an Ecologically Important Stream (hereafter "EIS") at Kau Lung Hang, which is within the Study Area and a considerable number of a tree species for example the *Podocarpus macrophyllus* (羅漢松) which are found near Kiu Tau. A patch of inactive agricultural land, located east and west of Fanling Highway respectively, is found to have been developed into village houses in this ERR. In addition, a patch of active agricultural land located east of Fanling Highway has been abandoned. Based on the Provision of Wo Hop Shek Crematorium EIA, an area of plantation woodland has been reclassified into urbanized area.

8.3.2.3.2

The EIS at Kau Lung Hang, is registered as No.7 EIS. According to the Technical Circular (ETWB TCW No.5/2005) issued by Environment, Transport and Works Bureau dated 15 March 2005, Ecologically Important Streams are natural streams, which consist of mixtures of bedrocks, boulders, cobbles, gravels, sand, silt or clay, with important ecological functions such as providing habitats for diverse or rare animal or plant communities

8.3.2.3.3

Kau Lung Hang supports a great abundance of organism with aquatic species, namely midges *Chironomidae*, snail *Biomphalaria straminea* and *Radix plicatulus*, exotic snail *Pomacea lineate*, mayfly *Baetis sp.*, leech *Glossosiponia sp. Poecilobdella sp.*, freshwater fish *Sarotherodon mossambicus* and *Poecilia reticulate*, but neither rare nor protected species were identified. *Chironomidae* were the dominant species in the stream (EIA report). This species indicates that this watercourse is polluted with organic material (Shea, 1993). *Poecilia reticulate* was also found this is a common freshwater fish which inhabits standing to slow-flowing watercourse. This species is extremely tolerant in poor water quality (AFCD, 2004a). A subsequent Environmental Study did identify a rare fish species in the Kau Lung Hang EIS, namely *Acrossocheilus parallens (*Maunsell, 2008).

8.3.2.3.4

The Habitat Map for this area has been adjusted accordingly.

8.3.2.4 Area 3 Habitat Description

8.3.2.4.1

Area 3 comprises the residential settlement of Hong Lok Yuen, together with several small villages: Mui Shue Hang, Wai Tau Tsuen, Wo Tong Pui, Kau Liu Ha and Hang Ha Po. Dominant habitats include active and inactive agricultural land. Plantation and natural woodlands exist in the vicinity of Mui Shui Hang and at Hang Ha Po and Wai Tau Tsuen and two FSWs are found (Maunsell, 2006a). A natural river, 'Lam Tsuen River', flows from the western region down to Lam Kam Road Interchange where it has been developed into an artificial drainage channel. In general there is little change of the habitats since the approval of the EIA Report. Only a small patch of plantation woodland located east of Lam Kam Road Interchange is developed into a Raw Water Pumping Station.

8.3.2.4.2

The Habitat Map for this area has been adjusted accordingly.

8.3.2.5 Area 4 Habitat Description

8.3.2.5.1

Area 4 consists of urban areas of Tai Po Tau Shui Wai, Kam Shek New Village and Shek Kwu Lung. A tract of plantation woodland is present at Mui Shue Hang, whilst natural woodland is found at Kam Shan and Pun Chun Yuen. Natural stream course is present in the southern region of Area 4, whilst an artificial drainage channel flows adjacent to Tai Po Tau Shui Wai. It is observed in this ERR is that a patch of plantation and natural woodlands have been encroached upon by the Tai Po Water Treatment Works.

8.3.2.5.2 Shek Kwu Lung

8.3.2.5.2.1

Referring to the Approved EIA Report, a FSW of 100 m^2 was recorded adjacent to Shek Kwu Lung and the existing Tolo Highway. A site inspection was conducted on 26 March 2008 to record the existing species and the existence of *Aquilaria sinensis*. (ACLA, 2008).

8.3.2.5.2.2

The woodland was found to be dominated by native species, however no *Aquilaria sinensis* was found and according to the inspection/survey carried out, the woodland is considered to be 'Mixed Woodland' with both native and exotic plantations. On the Habitat Map this is shown as 'Natural Woodland' as this is most predominant.

8.3.2.5.2.3

The Habitat Map for this area has been adjusted accordingly.

8.3.2.6 Area 5 Habitat Description

8.3.2.6.1

Area 5 is located in the southern region of Tai Po District and includes the urbanised areas of Ma Wo, Pan Chung San Tsuen, Tai Po Market, Wan Tau Tong Estate, Lai Chi Shan and Sheung Wun Yiu. Terrestrial habitats within the Study Area include natural woodland around Kam Shan, Pun Chun Yuen, Ha Wun Yiu and To Yuen Tung and plantation woodland around Shan Tong New Village and along the perimeter of Tolo Highway. A section of grassland is found on the southern side of the Tolo Highway at Lai Chi Shan and a small orchard in present at north east of Shan Tong new village. In addition, a section of previously classified grassland at Lai Chi Shan has been reclassified after review as natural woodland. A patch of natural woodland north to Tolo Highway at Ma Wo has been developed into residential developments.

8.3.2.6.2

The Habitat Map for this area has been adjusted accordingly.

8.3.2.7 Area 6 Habitat Description

8.3.2.7.1

Area 6 – To the west of the highway the land is urbanised, whilst to the south the habitats are dominated by plantation woodlands along the perimeter of the highway and Sheung Wong Yi Au, Natural woodlands is found at Ha Wong Yi Au and Tai Po Kau. The marine environment of Tolo Highway is present adjacent to the highway in this area, whilst a small area of inter-tidal mudflat (0.05 ha) is present along the southern boundary of Yuen Chau Tsai, where a small strand of mangroves is located. It is observed that since the approval of the EIA Report there is now terrestrial habitat where a patch of natural woodland west of Care Village has been developed into residential buildings and a freshwater pumping station. A small section of plantation woodland by Shan Tong Shan Village has been reclassified as grassland.and two small urbanized areas to the south of Shan Tong Shan Village have been added.

8.3.2.7.2 Parks

8.3.2.7.2.1

Within Area 6 there are three significant park areas, namely Tai Po Waterfront Park, Yuen Sin Park and Yuen Chau Tsai Park, situated nearby the Tolo Harbour. All of the parks can be considered to be artificial/ modified. The photos of the park could be found in **Appendix L-1**

8.3.2.7.2.2

'Tai Po Waterfront Park' occupies an area of about 22 ha. The Park has a wide range of facilities for the public including rest gardens, sitting-out areas, an insect house and a 1.2km promenade along the harbour front.

8.3.2.7.2.3

'Yuen Shin Park' occupies around 4 ha, is situated at the alongside of Lam Tsuen River. The Park has a playground and a lookout tower which gives a view of Tai Po Town and Tolo Harbour.

8.3.2.7.2.4

'Yuen Chau Tsai Park' is situated on the newly reclaimed land along the Tolo Harbour. It was built in 1991 and occupies around 2 ha.

8.3.2.7.3 Egretries

8.3.2.7.3.1

In Area 6, contrary to what was stated in section 8.3.6.1 of the Approved EIA Report, two egretries can be found, namely the Tai Po Egretry (1.2 ha) and in addition the Tai Po Market Egretry (0.5 ha) (AFCD, 2006a; HK Discovery, 2004). The Tai Po Egretry is classified as a Site of Special Scientific Interest (hereafter "SSSI") (Pland, 2008a). SSSIs are land based or marine sites of special interest because of their flora fauna, geographical or geological features. Currently there are seven SSSIs that have been listed because of their scientific importance as egretries, the Tai Po Egretry was surveyed as part of the 4 avifaunal surveys which were carried out in 1999 for the EIA study (AFCD, 2006a).

8.3.2.7.3.2

The Tai Po Market Egretry is also an important breeding ground and according to the material and maps provided by a representative of HKBWS, Mr. Captain L.C. Wong, this Egretry is situated at Wan Tau Kok Lane and the SSSI is situated at the area by the Old District Office and Wong Shiu Chi Secondary School; see **Appendix I** (Pland 2008b).

8.3.2.8 Fung Shui Woodlands (FSWs)

8.3.2.8.1

FSWs are enhanced forests that are usually located behind traditional villages in a crescent form, typically comprising of fruit trees and other economic plants planted by the villagers on the edges of native forests (AFCD 2004b). Historically, villagers have also planted additional medicinal and edible species within the woodlands for both medicinal uses and harvest for food, e.g. Litchi and

Dimocarpa longan, etc. and 'Pak Kung (Earth God)' shrines are commonly found under the towering old trees, particularly under the banyans or camphors trees. It is generally believed that FSWs are the oldest surviving and primary forests in Hong Kong.

8.3.2.8.2

According to the Approved EIA report, there are eight FSWs identified within the Study Area. Since the approval of the EIA, two key publications have been produced by the AFCD; '*Venturing Fung Shui Woods'*, (AFCD 2004b) and *'Fung Shui Woods in Hong Kong*' (AFCD 2006b) and the "*EIA for Provision of Cremators at Wo Hop Shek Crematorium*", (Hyder 2008) has been approved which covers a section of the Study Area. None of the woodlands stated in the Approved EIA are listed in the AFCD literature.

8.3.2.8.3

Based on the literature sources, a review of 2006 aerial photos, contact with the AFCD and the 4th July 2008 site visit the presence of FSWs in the Study Area, as presented in the Approved EIA Report, has been revised. The conclusions of this work have been summarised in **Table 8-2**.

Table 8-2 Revision of FSWs

Name of Woodland	Location	Conclusion
FSW stated in Approved EIA		
Wong Kong Shan	Area 1	Reclassified as 'Natural Woodland' after July 2008 site visit*
Tong Hang	Area 1	Reclassified as 'Natural Woodland' after July 2008 site visit*
Wo Hop Shek San Tsuen	Area 1	Reclassified as 'Natural Woodland' according EIA Report "*Provision of Cremators at Wo Hop Shek Crematorium*", February 2008.
Nam Wa Po	Area 2	Reclassified as 'Natural Woodland' after July 2008 site visit*
Yuen Leng	Area 2	Reclassified as 'Natural Woodland' after July 2008 site visit*
Shek Kwu Lung	Area 4	Reclassified as " Natural Woodand" after site inspection was conducted on 26 March 2008 to record the existing species and the existence of *Aquilaria sinensis*. (ACLA, 2008)
Ha Wun Yiu	Area 5	Reclassified as 'Natural Woodland' after July 2008 site visit*
Ha Wong Yi Au	Area 6	Reclassified as 'Natural Woodland' after July 2008 site visit*
Additional FSW in ERR		
Hang Ha Po	Area 3	Added as 'FSW' based on finding of two key ' AFCD' publications.
Wai Tau Tsuen	Area 3	Added as 'FSW' based on finding of two key ' AFCD' publications.
Tai Wo (Tai Po)	Area 2	Added as 'FSW' based on finding of two key ' AFCD' publications.

* Site visit was undertaken on 4th July 2008 to investigate the locations of the previously identified 'FSWs', see **Appendix L-14** for further details.

8.3.2.8.4

In total three FSWs are concluded to be found within the Study Area, however none of these FSWs are located within the Project works boundary.

8.3.2.9 Ma Wat River

8.3.2.9.1

The Ma Wat River flows in a Northerly direction through Habitat Map Areas 1 and 2 towards the Ng Tung River and has many tributaries including the Kau Lung Hang 'EIS' found in Area 2. The Ma Wat River is currently undergoing improvements and it has been widened and straightened under drainage improvement project *DSD Contract No. DC/2004/06, (Drainage Improvements in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po)* to provide channel sections that give adequate flood control. Of the five original meanders, within the Study Area, three have been filled under the DSD contract, leaving two meanders situated to the north and to the south of the existing Kiu Tau Bridge.

8.3.2.9.2

The new drainage channel in the Kiu Tau Bridge area was commissioned in June 2007(Maunsell 2007c). Flow in the Ma Wat River has been diverted to the new drainage channel and there are inlets and outlets connecting the two original meander sections of the original river with the trained Ma Wat River to maintain flow passing through these sections (**Appendix L-2**).

8.3.2.9.3

The ecological value of the Ma Wat River has been reviewed before the Drainage works were carried out under the 'Investigation' Stage of *DSD Agreement No. CE 63/2001 (DS) Drainage Improvement in Northern New Territories – Package A*. According to the Final Environmental Study (Maunsell, 2003), the Ma Wat River is described as a relatively large lowland river which has been extremely modified, with some sections partially or completely lined with concrete, and weirs/dams constructed across the river. The ecological value of the river before the drainage improvements is shown in **Table 8-3**.

Table 8-3 Ecological Value of Ma Wat River extracted from DSD Agreement No. CE63/2001 Final ES Report

Criteria	Evaluation
Naturalness	The river has been dammed and lined with concrete in some areas. The river is polluted with organic waste and petrochemicals.
Size	The affected river is large in size.
Diversity	The river supports several fish species, but macroinvertebrate taxon richness was low.
Rarity	Relatively unmodified lowland rivers are increasingly rare habitats in Hong Kong Three fish species with declining local populations recorded from the river.
Re-creatability	Re-creatability of natural sections is low

Criteria	Evaluation
Fragmentation	The river is not fragmented
Ecological linkage	The river is not functionally linked to any highly valued habitat in close proximity in a significant way.
Potential value	Through appropriate management (e.g. pollution control measures) the ecological value of the river could be increased. Potential value is therefore moderate.
Nursery/breeding ground	The streams support breeding populations of several species of fish, dragonflies and other macroinvertebrates.
Age	N/A
Abundance/Richness of wildlife	Low-moderate
Overall Ecological value	Moderate

8.3.2.9.4

The overall impact of the drainage works was found to lead to direct habitat loss (directly impacting 2.6 km of river) and to indirectly affect three fish species (*Ophicephalus maculatus, Carassius auratus, Clarias fuscus*) with declining populations. Impact was concluded to be 'temporary' and 'low-moderate' as the impacted habitat would be replaced by 'ecologically- friendly' channels with natural substrate (Maunsell 2003).

8.3.2.9.5

Three specific locations were monitored before drainage improvement works began *(Baseline Monitoring Report, Maunsell, 2005)* and during the drainage works in the period April 2006 – Dec 2007 (Maunsell 2006 a-b, 2007 a-d). The monitoring locations are shown on **Appendix L-3**. With reference to the Baseline Monitoring Report, the Ma Wat River was generally found to have low water quality and supported an impoverished aquatic fauna and flora with a small number of exotic and/ or highly tolerant or invasive species.

8.3.2.9.6

Table 8-5 summarises the baseline conditions and ecological monitoring results of Ma Wat River at the three monitoring locations.

8.3.2.9.7 Ecological Conditions of Kiu Tau Bridge Meanders

8.3.2.9.7.1

To the north and south of the existing Kiu Tau Bridge two meanders can be found which are in close proximity to the project works therefore more detail is given on the ecology of these sites. The Northern meander forms part of the project site and will be impacted by the project, therefore an Ecological Survey was carried out in April 2008 (hereafter 'ES April 2008') to update the Ecological Value of this location in relation to the previous surveys that have been carried out;

- Final ES Report (Maunsell, 2003) and,
- Ecological Baseline Monitoring Report (Maunsell, 2005).

8.3.2.9.7.2

The Southern Meander will not be impacted by the project (refer to section 8.4.2.6) the nature of the site and the ecology is assessed based on the above-mentioned first report and the general site visit conducted on 21 April 2008.

8.3.2.9.8 North Meander

8.3.2.9.8.1 Description of the location:

Appendix L-2 shows the location of the meander in relation to the Drainage Channel. A site visit to the North Meander was conducted in April 2008. **Appendix L-4** gives the general view of the North Meander and **Appendix L-5** shows the northern extent and southern extent of the North Meander which is around 90 m. The outflow of the North Meander was observed to join with the Drainage Channel however the water was found to be stagnant. The southern extent of the North Meander is within the limit of works area of the Ma Wat river works. It appears that the part of meander has been disconnected from the new Drainage Channel and it can be seen that no visible inflow was observed from the mainline drainage channel.

8.3.2.9.8.2

Based on the observations and the ES April 2008, the nature of this watercourse can be described as significantly affected by human influence. The inflow and outflow of water along the North Meander is dependent on the flow in the existing drainage channel. ***Appendix L-6*** shows the existing condition of the drainage channel. It can be observed that the drainage channel is currently low flow to stagnant.

8.3.2.9.9 Scope of Field Survey:

8.3.2.9.9.1

The field survey site is defined as the area of the affected meander which is approximately 90m. The meander belongs to old Ma Wat River. The surveys were designed to collect data to supplement ecological information to previously approved EIA of Widening of Tolo/Fanling Highway. Special attention was paid to rare/protected species of flora and fauna which would be directly impacted by the proposed road works.

8.3.2.9.9.2

The following surveys were undertaken:

Biotic Data Collection

- Vegetation surveys;
- Bird survey;
- Fish survey; and
- Other wildlife including bat, Odonate (dragonfly and damselfly), Butterfly, Macro-invertebrates and Herpetofauna (amphibian and reptile) survey;

Abiotic Data Collection

- Sediment characteristics
- Water flow

8.3.2.9.9.3

The conclusions presented in the following paragraph are based on the findings of the field surveys performed on the 21 and 22 April 2008 and on the previous Ecological Survey of the Ma Wat River carried out in August 2002 (Maunsell 2003). The ecological conditions were evaluated based on the criteria laid out in *Annex 8 & 16* of the *EIAO TM (*EPD 2008a; EPD 2008b).

8.3.2.9.9.4

A detailed methodology of the survey and the conclusions are found in **Appendix L-7**.

8.3.2.9.10 Ecological Evaluation

8.3.2.9.10.1

The ecological importance of the habitats and wildlife identified within the surveyed meander are evaluated in accordance with the EIAO TM Annex 8 criteria, this is presented in **Table 8-4**.

Table 8-4 Ecological evaluation of the surveyed meander, Ma Wat River.

Criteria	Evaluation
Naturalness	Natural but disturbed by drainage improvement works
Diversity	Low
Rarity	Common
Re-creatability	Re-creatable.
Fragmentation	Fragmented
Ecological linkage	Linkage was interrupted by road and artificial drainage channel
Potential value	Feeding and foraging ground for aquatic life such as bird and amphibian.
Nursery/breeding ground	Nursery/breeding ground for aquatic life, such as fish, amphibian and dragonfly.
Age	N/A
Abundance/Richness of wildlife	Low
Overall Ecological value	Low

8.3.2.9.10.2

The meander is isolated from the original Ma Wat River as a result of river improvement works. Only some common flora and fauna species were recorded at the site and no rare or protected flora and fauna species were found. The ecological value of this meander is considered to be low.

8.3.2.9.10.3

The ecological value concluded from ES April 2008 is lower than that concluded in the Final ES Report (Maunsell, 2003). The deterioration may be attributed to the ongoing construction works in close proximity to the meander. In addition the river surveyed in the Final ES was described as large and unfragmented whereas the Northern Meander is fragmented and stagnant. Lastly, it was observed during the ES that it also likely that it receives sewage.

8.3.2.9.11 South Meander

The Southern Meander has been surveyed under the 'Investigation' Stage of *DSD Agreement No. CE 63/2001 (DS) Drainage Improvement in Northern New Territories – Package A* and is found to be of low-moderate ecological value as shown in **Table 8-3**. During a site visit on the 21st and 22nd of April 2008 the Southern Meander the outflow of the South Meander was observed to join with the drainage channel. However, unlike the North Meander, slight water flow has been observed in South Meander and the watercourse is yet to be affected by human influence. **Appendix L-8** gives the general view of Southern Meander.

8.3.2.10 Artificial Drainage Channel

8.3.2.10.1

As a result of the drainage improvement project *DSD Contract No. DC/2004/06, (Drainage Improvements in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po*), a 1.8 km long drainage channel is now in place to give adequate flood control to the surrounding area.

8.3.2.10.2

At three specific locations impact monitoring has been carried out in the period between April 2006 and December 2007 (Maunsell 2006 b-c, 2007 a-d) to assess the ecological conditions of the drainage channel during the works. The monitoring locations are shown on **Appendix L-3**. **Table 8-5** summarises the water quality, sediment characteristics, freshwater fish, aquatic macro invertebrate and vegetation characteristic evaluations during the monitoring period.

8.3.2.10.3

The sixth ecological impact monitoring report for this project was carried out after more than 95% of the drainage channel works for the contract had been carried and the conclusions were as follows;

8.3.2.10.4

"The diversity and abundance of fauna…recorded during this monitoring survey were comparatively lower than those recorded during the baseline survey (refer to Section 8.3.2.9). These decreases could be caused by poor water quality, disturbance from construction works and potential surface runoff at nearby worksites. Water quality had not improved since the last monitoring visit in September 2007; the abundance and diversity of fish, and the abundance of benthic macro invertebrates have not seen a significant change.

8.3.2.10.5

Vegetation composition has changed at all three locations when compared to the baseline survey, as clearance and re-establishment were required to give way to the construction works. Vegetation cover at monitoring Location 1 was limited compared to last visit as the original stream course has now been fully diverted into the new drainage channel and therefore vegetation recorded during the last visit has been removed. Vegetation will take some time to re-establish on the completed channel banks. Vegetation at monitoring Location 2 was similar to the last monitoring visit, but new vegetation is beginning to establish where water line meets channel banks. Vegetation within the channels is expected to increase as more vegetation becomes established on the completed channel banks.

> *"As channelization works have largely been completed, turbidity in the water could be more easily controlled. If sediment plumes can be eliminated or reduced, water quality and subsequently diversity of aquatic fauna is expected to increase within the channel".*

8.3.2.10.6

Appendix L-3 shows photos of the impacts monitoring locations and photos of the completed Drainage Channel taken during the 21st and 22nd of April 2008 site visit.

Table 8-5 Summary of baseline condition and ecological monitoring results of Ma Wat River at the three monitoring locations

Date / Parameters	Water Quality	Sediment Characteristics	Freshwater Fish	Aquatic Macro invertebrates	Vegetation Characteristics
Baseline monitoring on 12 September 2005 (Maunsell, 2005)	Dissolved oxygen concentration was generally low	Stones and pebbles with interstitial finer sediments	A small number of Mosquito Fish were observed, no Tilapia. A single juvenile Sucker-belly Loach was identified.	Eight macro invertebrate taxa were collected, including species typically associated with running waters, such as baetid mayflies. It is notable, however that taxa indicative of good water quality were absent.	The dominated vegetation was ruderal grasses and a species of *Wedelia*. No rooted or floating aquatic macrophytes were present.
First impact monitoring on 6 April 2006 (Maunsell, 2006b)	The DO level had increased at all monitoring stations, particularly at the mid-stream monitoring location 2. The increase was likely due to a more turbulent flow at the monitoring location as a result of flow disturbance immediately in front of it.	Stones and pebbles with interstitial finer sediments	Tilapia was observed at monitoring locations 2 and 3, but no Mosquito Fish were recorded.	Two macro invertebrate taxa were collected, namely chironomidae insects and annelid worms.	The dominated vegetation was ruderal grasses and herbs such as *Polygonum spp, Wedelia Trilobata, solanum americanum* and *Oxalis sp*. No rooted or floating aquatic macrophytes were present.

Date / Parameters	Water Quality	Sediment Characteristics	Freshwater Fish	Aquatic Macro invertebrates	Vegetation Characteristics
Second impact monitoring on 27 September 2006 (Maunsell, 2006c)	The DO level increased at all monitoring stations, particularly at the mid-stream monitoring location 2. The increase was likely due to a more turbulent flow at the monitoring location as a result of flow disturbance immediately in front of it.	Sediment characteristics of the riverbed were similar at all monitoring locations and mainly consisted of stones and sandy sediments.	Mosquito Fish was observed at monitoring locations 2 and 3.	Eight macro invertebratte taxa were collected, namely Mayfly larva, chironomidae insects, annelid worms and snail.	The dominated vegetation was ruderal grasses, herbs and climbing plants such as *Polygonum spp, Bidens pilosa, Wedelia trilobata* and *Mikania micrantha.* No rooted or floating aquatic macrophytes were present.
Third impact monitoring on 30 January 2007 (Maunsell, 2007a)	The DO level had increased at all three monitoring stations, particularly at the mid-stream monitoring locations 2 & 3. The increase was likely due to a more turbulent flow at the monitoring location as a result of flow disturbance immediately in front of it.	The bottom substrates at monitoring location 2 & 3 remained similar as those recorded during baseline survey, though there was diversion of water flow to a new drainage channel at monitoring location 3.	Mosquito Fish was recorded at all monitoring locations while the previously recorded Sucker-belly Loach, Guppy and Tilapia were absent.	Two macro invertebrate taxa were collected and benthos samples were dominated by chironomid. The presence of Mayfly larva recorded in last survey indicated that water quality at this monitoring location was generally fair. Water flow was comparatively faster and cleaner than that at the other	The dominated vegetation was herbs (*Wedelia trilobata, Polygonum chinense), climber (Pueraria lobata*) and grasses (*Neyraudia reynaudiana*, *Lophatherum gracile, Pancium sp.*). No rooted or floating aquatic macrophytes were present.

Date / Parameters	Water Quality	Sediment Characteristics	Freshwater Fish	Aquatic Macro invertebrates	Vegetation Characteristics
				monitoring locations and the substrate was mainly pebbles with sandy mud.	
Forth impact monitoring on 5 June 2007 (Maunsell, 2007b)	The DO level had increased significantly at all monitoring stations.	The bottom substrate at monitoring location 2 was relatively rocky.	Mosquito Fish *Gambusia affinis* was observed at monitoring locations 1 and 2, in moderate abundance within 5 m radius from the observation point. Moderate numbers of Tilapia were observed. Sucker-belly Loach and Guppy were absent.	The absence of Mayfly larvae (presented on September 2006) and observation of sediment plumes and generally murky water indicates water quality has deteriorated.	The dominated vegetation along the shore was the grass, *Pancium sp*. And herb, *Neyraudia reynaudiana*. The climber *Pueraria lobata* and herbs, *Urena lobata*, *Polygonum chinense* and *Pennisetum alopecuroides* were present but in low abundance. No rooted or floating aquatic macrophytes were recorded.
Fifth impact monitoring on 4 September 2007 (Maunsell, 2007c)	The DO level was raised at all monitoring stations.	The sediment characteristics have changed from “fine sandy mud with pebbles” to “pebbles and sand” at locations	Mosquito Fish was most abundant at location 1 but was rare at location 2 and 3. Nile Tilapia *Oreochromis niloticus* was recorded	Channel diversion works have been carried out at location 2 since the last monitoring visit. Only four taxa were	Due to the diversion of water, vegetation along the stream bank had changed since the last monitoring. Common plants recorded along

Date / Parameters	Water Quality	Sediment Characteristics	Freshwater Fish	Aquatic Macro invertebrates	Vegetation Characteristics
		1 and 2.	and it was rarely recorded at location 1, commonly recorded at location 2.	recorded during the visit. On average one fragmented work was recorded during each kick-sampling; Chironomidae, Ephemerellidae and Copepod were also recorded. It is the location with the highest diversity and second highest abundance.	the new channel include herb species such as *Sesbania sp.*, *Cyperus flabelliformis*, *Polygonum chinense* and *mimosa pudica*; grass species such *Eleusine indica*, and climber species such as *Pharbitis nil*. The vegetation was young, newly established and has sparse coverage. No rooted or floating aquatic macrophytes were recorded.
Sixth impact monitoring on 18 December 2007 (Maunsell, 2007d)	pH values at all monitoring locations were neutral and ranged between 6.65 and 7.11. Sediment plumes were recorded at locations 1 and 3.	Mainly consisted of rock and sand/mud at all locations. The sediment changed from finer sandy mud with some pebbles to relatively rocky and muddy.	Mosquito Fish *Gambusia affinis* was observed only at monitoring location 1. Nile Tilapia *Oreochromis niloticus* was dominant at monitoring location 3, common at monitoring location 1 but only 2 individuals were observed at monitoring	Three benthic macro invertebrate Taxa were recorded. The most common Taxa at monitoring location 1 was Chironomidae, followed by Polychaete and Oligochaete. Chironomidae was the only Taxa recorded at location 2, whereas Chironomidae and	Limited plant species were found at monitoring location 1, while monitoring location 3 had the most well established vegetation. The common species at all monitoring locations were *Ludwigia octovalvis, Eleusine indica* and *Sesbania*

Date / Parameters	Water Quality	Sediment Characteristics	Freshwater Fish	Aquatic Macro invertebrates	Vegetation Characteristics
			location 2. Sucker-belly Loach and Guppy were not found.	Oligochaete were found at location 3.	*sp.* No rooted or floating aquatic macrophytes were recorded.

8.4 Evaluation of Habitat and Ecological Impacts

8.4.1 General

8.4.1.1

Habitat impacts are evaluated according to the requirements of Annex 8 of the EIAO-TM and compared with the evaluation stated in the Approved EIA Report. The majority of the impacts and evaluations for the identified habitats are still applicable in the ERR, the sections on 'Natural Woodland', 'Fung Shui Woodland', 'Natural Rivers and Streams', and 'Artificial Drainage Channel' have been updated. Whilst the direct ecological impacts are specific with respect to direct loss of habitat, potentially there are also indirect ecological impacts as a result of noise, dust or deterioration in water quality that may arise from the Project.

Table 8-6 Habitats Areas to be Lost / Impacted by Construction

Habitat	Improved EIA: Direct Loss or Impacted Habitat within the Study Area		ERR: Direct Loss or Impacted Habitat within the Study Area		Change (as percentage)
	Ha	% of Total Habitat	Ha	% of Total Habitat	
Terrestrial Habitat					
Active Agricultural Land	0.075	0.030	0.000	0.000	-100%
Inactive Agricultural Land	0.195	0.090	0.000	0.000	-100%
Orchards	0	-	0	-	0
Grassland	0.410	0.186	1.752	5.828	327%
Plantation Woodland	9.750	4.420	17.248	10.686	77%
Natural Woodland	0.740	0.360	1.217	0.525	64%
Fung Shui Woodland	0.040	-	0	-	-100%
Aquatic Habitat					
Natural Rivers and Streams (remaining northern meander of Ma Wat River, 90 m/ 400m^2)	60 m	-	0.040	0.464	50%
Artificial Drainage Channel	520 m	-	-520 m		-100%
Ponds	0	-	0		0
Intertidal/ Mangroves & mudflats	0	-	0		0
Marine / Sea	0	-	0		0
Urbanised / Developed Areas					
Urbanised or Abandoned land	1.430	0.650	1.130	0.233	-21%
Cemetery	0	-	0		0
Total Areas					
Terrestrial		11.210		20.217	
Aquatic Habitat		580 m		90 m	
Urbanised/ Developed Areas		1.430		1.13	

8.4.1.2

The reasons for ecological impacts stated in the approved EIA Report are still applicable. The severity of such impacts anticipated are also similar, however, due to changes in the project which are identified in Section 8.2 the impacts to some habitats, namely Natural and Plantation Woodland vary more significantly. Details of impacts to these two habitat types and the other habitat types found with the study area are provided in the following sections.

Table 8-7 Ecological Evaluation of Identified Habitats

Criteria	Active Agricultural Land	Inactive Agricultural Land	Orchards	Grassland	Natural Woodland	Plantation Woodland	Fung Shui Woodland	Natural watercourses	Artificial Drainage Channel	Marine Habitat
Abundance/ Richness of Wildlife	Moderate	Moderate	Low	Low	Moderate	Low	Moderate	Moderate	Poor	Moderate
Age	Not known	Not known	Not known	Not known	Moderate	Young-moderate	Old	Not known	Recent	Not known
Diversity	Relatively low	Relatively low	Low	Low	Moderate	Low	Structurally complex and diverse species	Moderate	Low	Low
Ecological Linkage	Linkage to adjacent habitats reduced due to abandon or urbanisation	Linkage to adjacent habitats reduced due to urbanisation	Linkage to adjacent habitats	Provides linkage to other adjacent habitats	Natural woodland located notably in south westerly region of the site (e.g., Pun Chun Yuen area) is relatively well linked to other habitats thereby providing an ecological corridor for	Plantation along side of highway are linked physically to natural woodland	Linked to other forms of woodland habitat	Linkage to adjacent habitats and areas.	Poor	Linked to inter-tidal habitat

Criteria	Active Agricultural Land	Inactive Agricultural Land	Orchards	Grassland	Natural Woodland	Plantation Woodland	Fung Shui Woodland	Natural watercourses	Artificial Drainage Channel	Marine Habitat
					wildlife A portion of natural woodland was changed to grassland and urbanised area, hence reducing its ecological linkage					
Fragmentation	Sites are relatively fragmented as interspersed with inactive agricultural land; fragmentation patterns may also change on a seasonal or annual basis	Sites are relatively fragmented as interspersed with inactive agricultural land; fragmentation patterns may also change on a seasonal or annual basis	Fragmented	Relatively intact	Very fragmented in the northern region of the Study Area	Plantation at northern region of Study Area is fragmentated.	Habitat has been significantly fragmented to accommodate urban encroachment	Habitats partially fragmented (Ma Wat River is now fragmented)	Not fragmented	Fragmented as some lost to reclamation

Criteria	Active Agricultural Land	Inactive Agricultural Land	Orchards	Grassland	Natural Woodland	Plantation Woodland	Fung Shui Woodland	Natural watercourses	Artificial Drainage Channel	Marine Habitat
Naturalness	Artificial	Artificial	Artificial	Natural	Natural habitat that has been modified by humans	Planted	Natural habitat that historically has been modified by villagers	Relatively natural with exception to channels which have been partially cemented.	Artificial	Modified by reclamation
Nursery/Breeding Grounds	Moderate as supports several species of birds, amphibians, reptiles and Odonata	Moderate as supports several species of birds, amphibians, reptiles and Odonata	Low	None	Likely to providing nesting areas for a variety of species of birds, possibly mammals	None	Dense vegetation provides good habitat for a variety of birds and other wildlife	Good where water quality is acceptable	Not known	Low
Potential Value	Moderate	Moderate	Low	Low due to low ecological complexity	Ecological value would be high if the disturbance factors were removed	Could be increased by planting more native species	Moderate due to proximity to highway and urban areas	Good	Could increase after completion of drainage works	Low

Criteria	Active Agricultural Land	Inactive Agricultural Land	Orchards	Grassland	Natural Woodland	Plantation Woodland	Fung Shui Woodland	Natural watercourses	Artificial Drainage Channel	Marine Habitat
									project	
Rarity	None	None	None	No rare or protected species are known to reside in this habitat	No rare or protected flora or faunal species identified	None	No rare species of flora or fauna identified	None apart from in the EIS[1]	Neither species nor habitat are rare	None
Re-creatability	Achievable in short term	Achievable in short term	Achievable in short term	Achievable in short term	Achievable in the long term	Achievable in short term	Achievable in long term	Difficult possibly achievable in long term	Achievable in short term	Not applicable
Conclusion	Moderate ecological value	Moderate ecological value	Low ecological value	Low ecological value	Moderate ecological value	Low ecological value	Moderate ecological value	Low to High[2]	Low ecological value	Low ecological value

[1] The rare fish species *Acrossocheilus parallens* was recorded in the Kau Lung Hang EIS (Maunsell, 2008).

[2] The survey of Ma Wat River Meander (North meander) revealed low ecological value, whereas the Kau Lung Hang EIS has high value.

8.4.2 Impact due to Direct Habitat Loss

8.4.2.1

It is estimated that around 22 ha of habitat will be lost, around 17 ha of which will be plantation woodland **Table 8-6** gives further specification of area of habitat loss per habitat type. The areas directly impacted are found within the boundary of the works area boundary as shown in **Appendix I.**

8.4.2.1.1

The evaluation of and impacts to the following identified habitats remain unchanged since the Approval of the EIA Report;

Terrestrial Habitat
Orchards

Aquatic Habitat
Ponds
Intertidal/ Mangroves & Mudflats
Marine

Urbanised / Developed Areas
Cemeteries

8.4.2.2

Reference should be made to Section 8.4 of the Approved EIA Report for both the evaluation and impacts to these habitats.

8.4.2.3

Table 8-8 indicates the changes proposed in the project which result in a difference in impact in comparison the approved EIA. The results are categorised per habitat type.

Table 8-8 Description of Impacts of Project Changes

Habitat Type	Description	Impact
Grassland	Widened alignment boundary near southbound of Chainage 7000, Kau Lung Hang	Increased impact to grassland is **1,870** m^2
	Realignment of Tai Wo Service Road East impacts two subsections near Ho Ka Yuen	Increased impact to grassland to **7,800** m^2

Habitat Type	Description	Impact
	Reclassification of urban area to grassland to the south-east of the Wo Hop Shek Interchange.	Theoretical increase in impact by **3,750** m^2
Total Impact		**13,420 m^2/ 1.34 ha**
Plantation Woodland	Junction modifications at Island House Interchange area.	Three small subsections of woodland will be impacted, in total **2,856** m^2.
	Widening of North and South Boundary near Kwong Fuk Park	There will be approximately **2,110** m^2 woodland impacted.
	Widened alignment boundary near Grand Dynasty View Estate, Ma Wo	Two small subsections of woodland will be impacted, in total **7,245** m^2.
	Widened alignment boundary near Wan Tau Tong Estate	Two larger subsections of woodland will be impacted. In total there will be an impact to **21,267** m^2
	Widened alignment and additional slope works near Ha Wun Yiu	Marginal increase in impact of **4,750** m^2
	New alignment shifted to avoid Tai Kwong Yuen and now involves more slopeworks near ch 3000- 3600, Shek Kwu Lung	Significant increase in Plantation woodland for 2 reasons, (i) upon further review natural woodland on slope is reclassified as plantation woodland (4180m2). (ii) new alignment encroaches on extra additional woodland (6865m2), In total **11,045** m^2
	Widened boundary involves additional slopeworks near Shek Lin Road	Increase in woodland impact of **5,160** m^2.
	Change in road alignment at Tai Po North Interchange near ch 3600, Tai Po North Interchange	Increase of woodland impact of **4,679** m^2**.**
	Review of alignment at Lam Kam Interchange indicates modification of sliproad is required at Hong Lok Yuen Junction	Increase of woodland impact **1,318** m^2**.**
	Wai Tau Tsuen and Hong Lok Yuen junction, the new alignment requires additional lanes and traffic islands	Marginal increase in woodland impact, **1,170** m^2.
	Bridge modifications at Kiu Tau Bridge	Increase in woodland impact, **2,340** m^2
	Modification on layout at Wo Hop Shek Interchange leads to increased impact on sub-sections of woodland.	Increase in woodland impact in total, **6,045** m^2

Habitat Type	Description	Impact
	Urbanised area by Wo Hop Shek adjacent to railway is reclassified as plantation woodland.	Theoretical increase in impact of **5000** m^2
Total Impact		**74,985 m^2/ 7.50 ha**
Natural Woodland	Widened alignment and slope works near Ha Wun Yiu	increase in impact of **3.850**m^2
	New alignment shifted to avoid Tai Kwong Yuen and now involves more slopeworks	Additional natural woodland is impacted, 5100 m2, however around 4180 m2 previously reported has been reclassified as plantation woodland. Total = **920** m^2
Total Impact		**4770 m^2/ 0.477 ha**
Fung Shui Woodland	Reclassification of previously classified FSW at Shek Kwu Lung as mixed/ natural woodland	Theoretical reduction in impacted FSW by **0.04 ha**
Total Impact		**-400 m^2/ -0.04 ha**
Active Agricultural Land	The revised Habitat Map with clearer impacted area boundaries indicates that no Active Agricultural Land will be impacted.	Theoretical reduction in impacted area by **0.075 ha.**
Total Impact		**-750 m^2 /-0.075 ha**
Inactive Agricultural Land	The revised Habitat Map with clearer impacted area boundaries indicates that no Inactive Agricultural Land will be impacted.	Theoretical reduction in impacted area by **0.195 ha.**
Total Impact		**-1950 m^2/-0.195 ha**
Natural Rivers and Streams	Meander North of Kiu Hau Bridge	90 m long meander will be filled, which is around 0.04 ha
Total Impact		**400 m^2/ 0.04 ha**
Artificial Drainage Channel	Three segments of drainage channel (520 m) were considered to be impacted in the EIA near the newly built Ma Wat River After review none of these sections are now considered to be impacted.	Theoretical decrease (-520m) in the length of drainage channel which will be affected.
Total Impact		**-520 m**
Urbanised/ Abandoned land	Widening of North and South Boundary near Kwong Fuk Park	Approximately **4,320** m^2 impacted.

Habitat Type	Description	Impact
	Widened alignment boundary near Kau Lung Hang	Approximately **1,430** m2 land impacted
	Reclassification of urban area to grassland to the south-east of the Wo Hop Shek Interchange.	Theoretical decrease in impact by **3750** m^2
	Urbanised area by Wo Hop Shek adjacent to railway is reclassified as plantation woodland.	Theoretical reduction in impact of **5000** m^2
Total Impact		**- 3,000 m^2/ -0.30 ha**

8.4.2.4 Terrestrial Habitat

8.4.2.4.1 Plantation woodlands

8.4.2.4.1.1

Among the 22 ha of habitat loss, a loss of 17 ha of plantation woodland is predicted. This is as a result of the land requirements for the necessary slope stabilisation works. The hill slopes are densely vegetated with a combination of woodland and shrub vegetation on more exposed slopes. The majority of the affected vegetation is previously planted exotic species such as Acacia *auricuformis* (耳果相思), *Acacia confusa* (台灣相思), *Cassia siamea* (鐵刀木) and *Eucalyptus robusta* (大葉桉). In lesser numbers exotic species such as *Casuarina equisetifolia* (木麻黃) and *Eucalyptus citriodora* (檸檬桉) are also found. These trees are mainly located on steep slopes along the existing highway.

8.4.2.4.1.2

Native species also exist in various locations along Tolo/Fanling Highway. Representative species include *Celtis sinensis* (朴樹), *Cinnamomum camphora* (香樟), *Ficus microcarpa* (細葉榕), *Macaranga tanarius* (血桐) and *Liquidambar formosana* (楓香). In view of the lower species diversity, absence of any rare and/or protected floral species in these plantation woodlands, it was concluded in the Approved EIA Report that this habitat is considered to be of low ecological value and that recreation of the habitat is achievable over a short time scale. This evaluation is still applicable in this ERR.

8.4.2.4.2 Natural Woodlands

8.4.2.4.2.1

Due to slopeworks, which are required for the widened alignment, two sections of natural woodland will be more significantly impacted that previously proposed in the Approved EIA. In addition to the original 0.740 ha an additional 0.385 ha near Ha Wun Yiu and 0.092 ha near Tai Kwong Yuen are expected to be impacted. Location of these impacted areas is shown in **Appendix A-4**.

8.4.2.4.2.2

The representative native species found in the Natural Woodlands are *Acronychia pedunculata*(山油柑*), Celtis sinensis*(朴樹), *Choerospondias axillaris*(南酸棗), *Cinnamomum camphora*(樟樹), *Ficus microcarpa*(細葉榕), *Liquidambar formosana*(楓香), *Macaranga tanarius* (血桐), *Schefflera heptaphylla* (鴨腳木), *Bridelia tomentosa* (土密樹*), Ficus hispida* (對葉榕)*, Ficus variegata* 青果榕 and *Ficus simplicissima* (五指毛桃).

8.4.2.4.2.3

The natural woodlands along the sides of the Tolo Highway have been assessed as having a 'moderate' ecological value. This is namely due to the level of disturbance (modified by humans), in addition no rare or protected floral or faunal species have been identified. The total impact to this habit of 'moderate' ecological value is expected to be 1.217 ha.

8.4.2.4.2.4

Recreation of this habitat is concluded to be achievable over a longer time scale.

8.4.2.4.3 Fung Shui Woodlands (FSWs)

8.4.2.4.3.1

The FSWs indicated accordingly in the habitats maps are within the Study Area however they are not found within the Project boundaries. Because of this there are no residual impact or habitat loss of FSWs and the mitigation measures put in place during the construction will ensure that there is are no significant in-direct impacts during the construction phase.

8.4.2.4.3.2

The impact to terrestrial habitats has been amended as a result of the reclassification of the Shek Kwu Lung woodland as 'Mixed woodland/ majority natural woodland". Due to reclassification the area of Natural Woodland and FSWs impacted have been adjusted, no FSWs within the Study Area would be impacted by the Project as identified in the ERR.

8.4.2.4.4 Egretries

8.4.2.4.4.1

As neither the Tai Po Egretry SSSI or the Tai Po Market Egretry are within the Project works boundary there will be no loss of habitat for these nesting areas. In section 8.4.1.2.1 of the Approved EIA Report the indirect impacts through noise were assessed and it is anticipated that the road widening will have no adverse impacts to the Tai Po Egretry. Likewise the Tai Po Market Egretry (which was not assessed in the approved EIA) is approximately the same distance from the Project works as the SSSI and is therefore also not expected to have any adverse impacts. Based on the field surveys carried out for the Approved EIA and based on observations made by local ornothologists monitoring behaviour of egrets along the East Rail line south of Tai Po Market, the egrets have adapted to the presence of trains passing by (Pers. Comm., Tucker/Leven).

8.4.2.5 Aquatic Habitat; Artificial Drainage Channel

8.4.2.5.1

The DSD Ma Wat River Drainage Channel commissioned in 2007 is found within the Study Area but outside the boundary of the Project Works and will not be impacted, the proposed Project does not involve any waterworks.

8.4.2.6 Aquatic Habitat; Natural River and Streams

8.4.2.6.1

In the approved EIA three stream sections (each around 20 m long) were identified as being in close proximity to the Project works. Two streams (one is north and another to the south of Tai Wo) were found within the works area boundary. However, since the highway is elevated, the impact for the two Tai Wo streams is not significant and would be reduced by following the guidelines and precautionary measures stated in Technical Circular ETWB TCW No. 5/2005.

8.4.2.6.2

As such the two streams found near Tai Wo will not be considered in this ERR to be 'impacted habitat'.

8.4.2.6.3

For this study re-assessment identifies two river meanders in the close vicinity of the Fanling Highway widening works, the Project. After the DSD Contract No. DC/2004/06 improvements of the Ma Wat River these two of the original five river meanders will be left unfilled and intact.

8.4.2.6.4

The meanders lie to the north and to the south of the existing Kiu Tau Bridge. The locations of the two meanders are shown on **Appendix L-2**.In order to provide adequate space for road widening work, the northern meander is required to be completely filled however the South Meander will remain intact during and after the works.

8.4.2.6.5 Direct Impacts to the Ma Wat River - Northern Meander

8.4.2.6.5.1

The proposed carriageway widening for Fanling Highway is dual four-lane carriageway, it is proposed to widen the existing carriageway eastwards in order to avoid resumption of Wo Hop Shek village. Such resumption would involve reproviding for a vast number of dwellings at Wo Hop Shek Village. In order to provide adequate space for the widening of Fanling Highway, the remaining meander to the north of Kiu Tau Bridge will be required to be filled at a length of about 90m long and 400m^2 in area. This approach is still seen to be in line with good practice (avoid or minimize) as the work and loss of this habitat is seen to be unavoidable.

8.4.2.6.5.2

In Section 8.3.2.9 the ecological value of this meander is reported. The ES April 2008 concludes that the meander is isolated from the original Ma Wat River as a result of river improvement works and that only some common flora and fauna species was recorded at the site. The ecological value of the meander was considered low, this is also inline with the findings of the ES studies from DC/2004/06 which were conducted between September 2005 and December 2007.

8.4.2.6.5.3

Based on these findings, compensation of this meander with a commensurate area (i.e. similar habitat type, ecological value and size) is not deemed to be necessary.

8.4.2.6.6 Mitigation Measures for Northern Meander

8.4.2.6.6.1

It is proposed to capture and relocate the native frog species of *Rana guentheri* to the nearby, undisturbed meander or river channel. Tadpoles, if present, should also be captured and relocated. Fish should also be live-captured and relocated to the same relocation habitat as the frog before filling of the meander.

8.4.2.6.7 Southern Meander

8.4.2.6.7.1

For the widening of the Fanling Highway at this location the majority of the widening will be carried out in the land between the existing Fanling Highway and the Tai Wo Service Road East. The existing retaining wall shown in Photos 5 and 6 will remain after the Project is carried out and will not be impacted by the works. The proposed works involve construction of projections for the proposed footpath beyond the limit of this remaining Ma Wat River meander. This will be at about 2 to 3m above the meander site as shown in **Appendix L-10**. As such, this section of original Ma Wat River will not be directly impacted.

8.4.2.6.8 Potential Impacts to Kau Lung Hang EIS

8.4.2.6.8.1

It is acknowledged that this EIS is found within the Study Area and has a high ecological value as mentioned previously in Section 8.3.2.3. Due to the following reasons there will be no any ecological impacts for this EIS from the Project;

- the EIS is actually located upstream of the project area, which ensures that the quality of waterflow from the Project Area into the EIS is not an issue, and
- regarding any changes in outflow from the EIS, the stream discharges into the Ma Wat River and more specifically the new drainage channel. The Project will not alter this outflow in any way. The filling of the meander located 130 m downstream cannot impact on the EIS as flow compensation is already provided by the new drainage channel parallel to the meander.

8.4.2.6.8.2

As such there are no flow or water quality implications and consequently no ecological implications expected for the Kau Lung Hang EIS. Mitigation measures to avoid impacts are therefore not applicable. The revised Habitat Map (Area 2) clearly shows the location of this specific EIS and the area of the Project works.

8.4.2.6.9 General Impacts to Streams

8.4.2.6.9.1

Apart from the Ma Wat River, Natural Watercourses will not be directly impacted by the Projects works. As the highway is elevated, there will be no significant impact to the streams any potential impact will be reduced by following the guidelines and precautionary measures stated in Technical Circular ETWB TCW No. 5/2005. The Habitat Map has illustrated the location of the streams which pass under the highway.

8.4.2.7 Aquatic Habitat; Marine and Intertidal

8.4.2.7.1

These identified habitats are found outside the Works Boundary of the Project and will not be impacted.

8.4.3 Potential Indirect Impacts

8.4.3.1

Indirect ecological impacts from the Project anticipated in the Approved EIA Report are still applicable in this ERR and are summarised as below, in addition indirect impacts to rivers or streams have been added:

- Elevated levels of noise and associated human induced disturbance have the potential to disturb faunal species including birds as stated in the Approved EIA Report.
- Dust may be generated by construction activities, particularly the movement of heavy machinery / equipment, during various activities of site clearance / site formation. Fugitive dust emissions are anticipated to be localised and not significant. Any run-off may increase the level of turbidity and suspended solids in nearby waters, potential contaminants including sediment, organic, oil, grease and solvents may also be brought about. However, the release of sediment into the aquatic ecosystem is unlikely to be significant.
- Construction works may cause pollution or disturbance to waterflow of streams/rivers this should be minimised and works carried out in/ or near natural streams and rivers must be carried out in an environmentally responsible manner with appropriate mitigation measures.

8.4.3.2 Bird Collision with Noise Barriers

8.4.3.2.1

Bird collisions with transparent noise barriers can be a concern during the operation of the highway and currently the Tolo Highway has coloured strips in place on the to reduce this risk. As discussed in Chapter 5 of this ERR additional noise barriers have been proposed along the Tolo Highway to abate increase in noise levels as a result of the project.

8.4.3.2.2

Some sections along the proposed highway are close to flight path of birds, in particular the sections close to identified egretries and the Tolo Harbour, which is an important foraging area for egrets.

8.4.3.2.3

In accordance with standard practice in Hong Kong, colored strips will be embedded or superimposed on the noise barriers to mitigate against the risk of bird collision. This approach to mitigation is described in the Practice Note No. BSTR/PN/003 – Revision B on "Noise Barriers with Transparent Panels (October 2006)".

8.4.4 Cumulative Impacts

8.4.4.1

There are five relevant interfacing projects within the Study Area more detail can be found in **Chapter 4**, (locations are shown in **Appendix L-11** and the bar-chart programme for various interfacing projects are shown in **Appendix L-12**). The proposed Project is scheduled to commence at the end of 2008 and would be completed by 2012. The "*Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po – Stage 2, 'DC/2004/06"* and *"Drainage Improvement Works in Kau Lung Hang, Yuen Leng, Nam Wa Po and Tai Hang Stage 1 & 2, ''DC/2006/09"*. The former commenced in 2004 and would be completed by 2007 whereas the latter commenced at the end of 2007 and would be completed by 2010.

8.4.4.2

The "*North District Sewerage Stage 2 Phase 1 (Stage 1 contract 2 & Stage 2*)" project is located within the works area of the proposed Project, the Sewage Project is scheduled to commence at the end of 2008 and should be completed by the end of 2012, overlapping in time with the proposed Project. The works for this project have been entrusted to the proposed Project whereby the same site area will be used by both projects where relevant.

8.4.4.3

"Cycle Track Connecting North West Territories with North East New Territories, Stage 1 & 2", will tentatively commence in mid 2009 and be completed by end of 2011, currently this project is still in the discussion phase therefore there is limited information available. The Cycle Track project

proposes to construct a 4m wide track along roadside verge areas. The expected impact is for adjacent 'roadside' areas.

8.4.4.4

Highways Project *'Retrofitting of Noise Barriers on Fanling Highway (East Rail Fanling Station to Wo Hing Road)*' ties in with the northern end of our project as shown in **Appendix G**. Noise barrier will be built at verges of the existing Fanling Highway. The expected impact is for adjacent 'roadside' areas.

8.4.4.5

It is recognized that the proposed Project would have a construction works period which overlaps with the Drainage Improvement works from late 2008 to 2010 (approximately 2 years) and also with the construction programme of the Cycle Track from end of 2009 to end of 2011 (approximately 2 years). Because of the overlap in construction programmes of these projects, there is potential for cumulative disturbance. However residual cumulative impact is expected to be limited to the 'developed' habitats adjacent to the roadside such as urbanized areas and active/inactive agriculture land with relatively low ecological value. The ecological impact resulting from the overlapping of proposed Project with *"Drainage Improvement Works in Kau Lung Hang, Yuen Leng, Nam Wa Po and Tai Hang Stage 1 & 2, "DC/2006/09"*, "*North District Sewerage Stage 2 Phase 1 (Stage 1 contract 2 & Stage 2)*" as well as the "*Cycle Track Connecting North West Territories with North East New Territories, Stage 1 & 2*" can be minimized through entrustment of projects. The ecological impacts of these projects are summarized in **Table 8-9**.

8.4.4.6

No significant cumulative impact for habitat is expected and tree felling of "Plantation Woodlands" is expected to be the only prominent cumulative impact. Compensatory planting will be implemented on-site to mitigate this. Liaison between the interfacing projects ensures mitigation is carried out in efficient manner whereby disruption to habitats will be minimised. For example the compensatory planting scheme for the Drainage Improvement Works 'DC/2006/09' has been assessed alongside the tree felling for the proposed Project and where necessary trees which would have been felled and compensated under the project 'DC/2006/09' will be accounted for in the compensatory planting scheme for the proposed Project.

8.4.4.7

It is therefore anticipated that cumulative impact resulting from these Projects is acceptable.

Table 8-9 Summarised Table of ecological impact of concurrent project

Concurrent Project	Active / Inactive Agricultural Land	Grassland	Plantation Woodland	Natural Woodland	Urbanized / Developed Area	Natural Streams and Rivers	Others
Widening of Tolo Highway / Fanling Highway between Island House Interchange and Fanling	-	1.752 ha	17.248 ha	1.217 ha	1.130 ha	0.09 km	Dust and noise generated during the construction phase could potentially impact the surrounding habitat.
Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po[3]	--	--	--	--	--	2.6 km of river was impacted directly	
Drainage Improvement Works in Kau Lung Hang, Yuen Leng, Nam Wa Po and Tai hang Areas and Construction of Ping Kong Drainage Channels[4]	--	--	--	--	--	1.25km of stream was impacted	
North District Sewerage Stage 2 Phase 1[5]	0.02 ha	--	--	--	0.359 ha	--	
Retrofitting of Noise Barriers on Fanling Station to Wo Hing Road			Tree felling is needed				
Cycle Track Connecting North West New Territorities with North East New Territories			Tree felling is needed				

[3] Construction phase activities and residual impacts have potential to adversely impact aquatic communities, including the locally endangered fish *A. hemispirus* and locally declining damselfly *N. chinensis* (Maunsell 2003). The project uses 'ecologically friendly channels' with natural substrate.
[4] Construction phase activities have the potential to adversely impact aquatic communities, although no rare, protected or otherwise notable species would be affected and the existing streams are small, highly degraded, and are of low ecological value.
[5] Due to the total overlapping of work site boundary and partial overlapping of the phasing these Projects will be carried out together, the impacts from this interfacing project have already been included in the proposed Project impacts. The additional impacts from the Sewage works are limited.

8.5 Impact Mitigation

8.5.1

Annex 16 of the **EIAO-TM** states that the general policy for mitigation of significant ecological impacts, in order of priority, is:

- Avoidance: Potential impacts shall be avoided to the maximum extent practicable by adopting suitable alternatives;
- Minimisation: Unavoidable impacts shall be minimised by taking appropriate and practicable measures such as constraints on intensity of works operations or timing of works operations; and
- Compensation: The loss of important species and habitats may be provided for elsewhere as compensation. Enhancement and other conservation measures shall always be considered whenever possible.

8.5.2

Therefore the mitigation measures / good practices recommended in the Approved EIA Report are still applicable in this ERR and are repeated likewise in the following sections. An extra section has been added on 'Precautionary Measures near Streams and Rivers and in addition to this the section on 'Compensatory Planting' has been checked against the updated "**Tree Removal Application**' (June 2008).

8.5.3 Delineation of Works Area

8.5.3.1

Boundaries of works area shall be clearly defined and separated from external areas by a physical barrier to prevent encroachment of adjacent habitats. Individual trees which fall within the works area shall be retained and fenced off whenever applicable to maximise protection.

8.5.4 Check of Hoarding Positioning

8.5.4.1

Hoarding/fencing positioning and durability shall be checked before the start of any works to ensure suitable positioning of hoarding to separate the works areas from external areas of ecological importance. Special attention shall be paid for checking of hoarding position at the works areas that are in the vicinity of ecologically important habitats.

8.5.5 Construction Dust

8.5.5.1

Good site practice as recommended in the Approved EIA Report and as specified in the Air Pollution Control (Construction Dust) Regulation on 'Dust Control Requirements', shall be implemented. This is necessary to avoid / minimise incidences of dust emission related to construction activities. These measures include provision of vehicle washing facilities and water spraying facilities.

8.5.6 Site Run-off and Sewage Effluent

8.5.6.1

Implementing construction phase mitigation measures in accordance with ProPECC PN1/94 on "Construction Site Drainage" as recommended in the Approved EIA Report is still applicable in this ERR.

8.5.7 Precautions with Vegetation Clearance

No fires shall be lit within the works area for the purpose of burning cleared vegetation and the Contractor should give consideration to mulching the cleared vegetation for recycling within the works area / adjacent land.

8.5.8 Precautionary Measures near Streams and Rivers

8.5.8.1

For relevant rivers and streams, precautionary measures may have to be devised and implemented in accordance with recommendations made in *Technical Circular (Works) No. (ETWB TCW No.5/2005), "Protection of natural streams/ rivers from adverse impacts arising from construction works".* This TC is concerned with minimising possible disturbance to streams/ rivers and ensuring that any works carried out in/ or near natural streams and rivers are carried out in an environmentally responsible manner with appropriate mitigation measures. The relevant guidelines, as set out in *Appendix D "Guidelines on Developing Precautionary Measures during the Construction Stage"* of the TCW No.5/2005, will be followed.

8.5.9 Ecological Compensation for Woodland Habitat Loss

8.5.9.1

Although field survey investigations did not identify any individual vegetation species of particular conservation value, significant loss of natural woodlands and plantation woodlands is to be compensated by a planting / replanting programme. Woodlands that will be affected by the project are to be compensated as recommended in the "*Tree Removal Application"* (dated June 2008).

8.5.9.2

Compensation of the 'moderate' ecological value natural woodlands and the 'low' ecological value plantation woodlands will be achieved through replanting of native species and ensuring that the compensation areas link up to the undisturbed woodlands. This encourages reversibility by allowing the areas to reform naturally. The proposed tree compensatory planting is enhanced by using a selection of native species which would encourage and support wildlife, by recreating a similar living environment as the lost habitat.

8.5.9.3

The replanting for the compensatory areas encompasses large areas and the '*Tree Removal Application*" (June 2008) specifies singular trees and areas of trees that will be retained. The proposed compensatory areas will have low fragmentation. The approach is that linkage will exist between to the undisturbed areas and the replanting areas, making use of the trees that will be retained. **Appendix L-9** shows the ecological compensation areas which will provide the linkage.

Table 8-10 Evaluation of compensatory planting areas

Criteria	Remarks
Size	Around 9.878 ha where areas totalling 5.5 ha will be earmarked specifically to provide good linkage.
Abundance/ Richness of Wildlife	Moderate – the compensation areas will encourage and support wildlife and recreate a similar living environment as the lost habitat
Age	Newly planted woodland
Diversity	Wide range of species including native species will be used for the planting and the habitat will become more diverse with time due to the natural process
Ecological Linkage	5.5ha have been earmarked to provide linkage specifically with undisturbed woodlands via retained trees.
Fragmentation	Where possible larger areas will be planted. Due to nature of project, (slip roads and highway sections) some of replanting areas will be fragmented.
Naturalness	Inherently highly modified however natural species will be used for replanting and in a longer time-scale a 'secondary'(more natural) woodland is expected to develop.
Nursery/Breeding Grounds	Likely to regenerate nesting areas for a variety of species of birds, possibly mammals.
Potential Value	Initially low – moderate, in a medium to longer time-scale through natural processes and appropriate management the potential value will be moderate.
Rarity	Low, the habitat is not very rare and the exiting woodland have no rare or protected flora or faunal species identified.
Re-creatability	N/A this is a recreated/ compensatory habitat
Conclusion	The ecological value is considered to be low initially and will, through natural processes, develop into a woodland of moderate ecological value. Where possible larger areas will be replanted and the areas will be well linked to undisturbed woodland to re-establish the habitat loss.

Criteria	Remarks
Compensation Statement	The proposed areas of compensatory planting sufficiently compensate for the loss of the natural and plantation woodland, within the constraints of this project.

8.5.9.4

After the construction work the modified slopes are expected to be steeper than the current slopes with gently sloping areas along the sides of the highway. Due to the steep nature of the slopes much of the replanting will be carried out in the form of seedling trees and plants. 'Heavy standard trees' (more mature trees) can be used for the more gently sloping areas. The 'Tree Removal Application' (June 2008) can be referred to for specifics on the areas and nature of the replanting. As mentioned in the earlier sections both seedlings and trees used for replanting will be predominantly native species to encourage recolonisation by native species and support the local wildlife.

8.5.9.5

Six key areas for compensatory planting were identified in the Approved EIA Report these have a cumulative planting area of around 5.5 ha. These areas aim to provide linkage with existing woodland habitats. The locations of the six areas along the highway are indicated in **Table 8-11** and shown in **Appendix L-9**.

Table 8-11 Key Areas for Compensation Planting

Approximate Chainage	Highway Side	Approximate Planting Area (ha)
Area 1	South	0.25
Area 2	North and South	1.257
Area 3	North and South	0.50
Area 4	South	0.36
Area 5 & 5A	East (Area 5) and West (Area 5A)	2.36 (1.06 + 1.30)
Area 6	East (at approach road access)	0.78

8.5.9.6 Replanting Strategy

8.5.9.6.1

Species for the tree felling compensatory planting proposals should satisfy the following criteria:

i. A combination of evergreen and deciduous species have been selected to provide green year round interest. The evergreen species will also provide for year round screening of the highway from adjacent visually sensitive receivers. Trees adjacent to the carriageway have also been selected for their flowering characteristics.

ii. Some plant species selected, especially the whip trees, will require low maintenance, be hardly and able to adapt to roadside environment.

iii. Woodland mix and reinstatement planting will be designed to encourage recolonisation by native species and attract wildlife.

iv. Trees are proposed to infill the existing tree groups will be of compatible size and species.

v. Climbers are proposed to soften the retaining structure.

vi. Heavy standard trees with year round flowering theme and transplanted trees will be planted along roadside and cycle tracks where applicable.

vii. Native whip trees, grasslands by hydroseeding are proposed to treat some cut/fill/existing slope.

Table 8-12 Proposed tree species for compensatory planting

	Botanical Name	**Chinese Name**
	Bauhinia variegata var. candida	白花羊蹄甲
*	*Sapium sebiferum*	烏桕
*	*Celtis sinensis*	朴樹
	Crateva unilocularis	樹頭菜
*	*Ficus virens*	大葉榕
	Jacaranda mimosifolia	藍花楹
*	*Liquidambar formosana*	楓香
*	*Machilus chekiangensis*	浙江潤楠
	Koelreuteria bipinnata	複羽葉欒樹
	Melia azedarach	苦楝
	Spathodea campanulata	火焰木
	Syzygium jambos	蒲桃
	Tabebuia impetiginosa	風鈴木
*	*Mallotus paniculatus*	白楸
*	*Bischofia javanica*	秋楓
*	*Cinnamomum burmannii*	陰香
*	*Cinnamomum camphora*	樟
	Bauhinia variegata	宮粉洋蹄甲
	Peltophorum pterocarpum	雙翼豆

Remarks * - Native Species

Table 8-13 Proposed whip species for compensatory planting

	Botanical Name	Chinese Name
*	*Sapium discolour*	山烏桕
*	*Sapium sebiferum*	烏桕
*	*Celtis sinensis*	朴樹
*	*Litsea glutinosa*	潺槁
*	*Schefflera heptaphylla*	鴨腳木
*	*Mallotus paniculatus*	白楸
*	*Machilus chekiangensis*	浙江潤楠
*	*Machilus breviflora*	短序潤楠
*	*Cratoxylum cochinchinense*	黃牛木
*	*Phyllanthus emblica*	油甘子
*	*Castanopsis fissa*	裂斗錐栗
*	*Rhus chinensis*	鹽膚木
*	*Ficus hispida*	對葉榕

Remarks * - Native Species

8.5.9.6.2

The actual compensation planting location and species will be confirmed after the detailed landscape design is finalised.

8.5.9.6.3

The division of vegetation planting and maintenance responsibilities within Government shall follow the guidelines stipulated in Environment, Transport and Works Bureau (ETWB) Technical Circular (Works) No.2/2004.

8.5.10 Residual Impact

8.5.10.1

8.5.10.1.1

Table 8-14 summarises the ecological impacts within the Study Area along with recommended mitigation measures, more detail on this issue can be found in Table 11.1 and 11.2 which are updated version of Table 13.5 of the Approved EIA Report. A total of 21.38 ha of terrestrial habitat

will be affected around 80% of this impact being due to the loss of plantation and natural woodland. Due to the proposed 9.878 ha of compensatory planting using predominately native species, the impacts to plantation woodland (low ecological value) and natural woodland (moderate ecological value) is found to be sufficiently compensated.

8.5.10.1.2

Mitigation measures such as fencing boundaries of works area in the vicinity of ecological important habitats and replanting of native species are recommended in the proposed scheme to minimise the residual impact. Compensation, other mitigation and good practise on site will be implemented to ensure that the 'residual impact' for this habitat is low.

8.5.10.2

The residual impact to 'Grassland' has increased in comparison with the Approved EIA by 1.342 ha. In total an area of 1.752 ha will be directly impacted. The ecological value of this habitat is low and appropriate mitigation measures will be taken, the residual impact is considered to be low and compensation of this habitat is not deemed to be necessary.

8.5.10.3

The filling of the 90 m Ma Wat River Northern Meander differs considerably from the findings of the Approved EIA Report. The filling of the Meander is considered to be an unavoidable impact as widening the existing carriageway eastwards is necessary to avoid resumption of Wo Hop Shek village. Since the Ecological Survey indicates that the Ecological Value is low and appropriate mitigation measures will be taken, the residual impact is considered to be low and compensation of this habitat is not deemed to be necessary. It is proposed to capture and relocate the native frog species of *Rana guentheri* to the nearby, undisturbed meander or river channel. Tadpoles, if present, should also be captured and relocated. Fish should also be live-captured and relocated to the same relocation habitat as the frog before filling of the meander.

Table 8-14 Summary of Impacts, Mitigation Measures and Residual Impacts within Study Area

Habitat Type	Area of Habitat to be Affected (ha)	% of Habitat to be affected	Ecological Evaluation e.g. high, moderate or low ecological value, with key species associated with the habitat and in turn their conservation value	Impact Assessment in Absence of Mitigation	Mitigation Measures	Potential for Mitigation and its Extent / Deliverability e.g. on-site, off-site	Significance of Residual Impact
Terrestrial Habitat							
Active Agricultural	0.00	0.00	Moderate	N/A	Fencing boundaries of works area	N/A	N/A
Inactive Agricultural	0.00	0.00	Moderate	N/A	Fencing boundaries of works area	N/A	N/A
Orchards	0.00	0.00	Low	N/A	N/A	N/A	N/A
Grassland	1.752	5.828	Low	L	Minimise the clearance of land required to accommodate the highway widening Fencing boundaries of works area	N/A	Insignificant
Natural Woodland	1.217	0.525	Moderate	M	Identification and preservation of mature trees Fencing boundaries of works area Replanting with native species along the highway corridor including 5.5ha ecological compensatory planting	On site	Low / insignificant

Habitat Type	Area of Habitat to be Affected (ha)	% of Habitat to be affected	Ecological Evaluation e.g. high, moderate or low ecological value, with key species associated with the habitat and in turn their conservation value	Impact Assessment in Absence of Mitigation	Mitigation Measures	Potential for Mitigation and its Extent / Deliverability e.g. on-site, off-site	Significance of Residual Impact
Plantation Woodland	17.248	10.686	Low	M	Fencing boundaries of works area Replanting of native species	On site	L
Fung Shui Woodland	0.00	0.00	Moderate	N/A	N/A	N/A	N/A
Aquatic Habitat							
Natural Rivers and Streams	90m / 0.04 ha	0.464	Low to High[6]	L [7]	Implementation of good site practices e.g. waste management control, wastewater interceptors Use of sandbags or slit curtains with lead edge and supported props Live capture and relocation of tadpoles, frogs and fish to nearby undisturbed meander or river channel.	On site On site Off site	N/A N/A L

[6] The survey of Ma Wat River Meander (North meander) has low ecological value, whereas the Kau Lung Hang EIS has high value

[7] Low impact 'L' as the High Value EIS is outside the Project Works Boundary

Habitat Type	Area of Habitat to be Affected (ha)	% of Habitat to be affected	Ecological Evaluation e.g. high, moderate or low ecological value, with key species associated with the habitat and in turn their conservation value	Impact Assessment in Absence of Mitigation	Mitigation Measures	Potential for Mitigation and its Extent / Deliverability e.g. on-site, off-site	Significance of Residual Impact
Artificial Drainage Channel	0.00	0.00	Low	N/A	N/A	N/A	N/A
Ponds	0.00	0.00	Moderate	N/A	N/A	N/A	N/A
Intertidal/ Mangroves & mudflats	N/A	N/A	Low	N/A	N/A	N/A	N/A
Marine/Sea	N/A	N/A	Low	N/A	N/A	N/A	N/A

Note: N/A denotes not applicable “L” denotes low ecological impact; “M” denotes moderate ecological impact

8.6 Conclusion

8.6.1

This ERR on ecology provides a review on the ecological impacts based on changes regarding the Project details and any changes in habitat within the Study Area since the EIA Report was approved.

8.6.2

The extent of habitat loss is summarised **Table 8-6** and the type of the habitat most significantly affected by the Project is low ecological value plantation woodland. As stated in the Approved EIA Report, none of the habitats affected support any vegetation species of conservation value.

8.6.3

Where necessary appropriate compensation and measures of mitigation have been proposed as shown in **Table 8-14**. The mitigation measures for habitat loss that are proposed in the Approved EIA Report, namely compensation tree planting is still considered appropriate and sufficient to compensate any loss. Compensation of the aquatic habitat 'North Meander Ma Wat River" and the loss of grassland habitats is not deemed to be necessary as the significance of the residual impact for these habitats is low.

8.6.4

Other indirect ecological impacts which may arise from the Project including localised impacts upon air and water quality from site clearance / site formation shall be mitigated through good site practice. Compensation, mitigation and good practise on site will be implemented to ensure that the 'Residual Impact' from the Project is low.

References:

ACLA. (2008). *Site Inspection Report. Woodland in Shek Kwu Lung. D&C Assignment for Widening of Tolo Highway / Fanling Highway between Island House Interchange and Fanling Supplementary Agreement No. 3*. Prepared for Highway Department (HyD).

Agriculture, Fisheries and Conservation Department (2004a). *Field Guide to the Freshwater Fish of Hong Kong*. Friends of the Country Parks and Cosmos Book Ltd. Hong Kong: 162-163.

Agriculture, Fisheries and Conservation Department. (2004b).Venturing Fung Shui Woods. Friends of the Country Parks and Cosmos Book Ltd. Hong Kong

Agriculture, Fisheries and Conservation Department. (2006a). *Egretries in Hong Kong*. Advisory Council on the Environment Nature Conservation Subcommittee Committee Paper NCSC 7/06. HKSAR Government.

Agriculture, Fisheries and Conservation Department. (2006b). *Fung Shui Woods in Hong Kong*. Advisory Council on the Environment Nature Conservation Subcommittee Committee Paper NCSC 9/06. HKSAR Government.

China-Hong Kong Ecology Consultants (2007). Contract No. DC/2006/09, July 2007, Drainage Improvement Works in Kau Lung Hang, Yuen Leng, Nam Wa Po and Tai Hang Areas and Construction of Ping Kong Drainage Channels Ecological Baseline Survey Report. Prepared for Drainage Service Department (DSD)

Environment, Transport and Works Bureau. (2004). Technical Circular (Works) No. 2/2004. "*Maintenance of Vegetation and Hard Landscape Features*". HKSAR Government.

Environment, Transport and Works Bureau. (2005). Technical Circular (Works) No. 5/2005. "*Protection of natural streams / rivers from adverse impacts arising from construction works*". HKSAR Government.

Hong Kong Discovery Magazine. (2004). Site of Special Scientific Interest. Cover Story. *Hong Kong Discovery Magazine Vol. 18: 46-59*

Hyder Consulting Ltd. (2008). Provision of Cremators at Wo Hop Shek Crematorium Environmental Impact Assessment Report. Prepared for Architectural Services Department (ASD).

Maunsell Consultants Asia. Ltd. (2003) Agreement No. CE63/2001(DS), July 2003, Drainage Improvement in Northern New Territories – Package A – Investigation, Final ES Report. Prepared for Drainage Service Department (DSD).

Maunsell Environmental management Consultant Ltd. (2005) Contract No. DC/2004/06, Sept. 2005, Drainage Improvement in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po. Ecological Baseline Monitoring Report. Prepared for Drainage Services Department (DSD).

Maunsell Consultants Asia. Ltd. (2006a) Agreement No. CE50/2001(DS) Drainage Improvement in Sha Tin and Tai Po Design and Construction Final Environmental Study Report. Prepared for Drainage Service Department (DSD).

Maunsell Environmental management Consultant Ltd. (2006b) Contract No. DC/2004/06 Drainage Improvement in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po. Final Ecological Impact Monitoring Report (No.1). Prepared for Drainage Services Department (DSD).

Maunsell Environmental management Consultant Ltd. (2006c) Contract No. DC/2004/06 Drainage Improvement in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po. Draft Ecological Impact Monitoring Report (No.2). Prepared for Drainage Services Department (DSD).

Maunsell Environmental management Consultant Ltd. (2007a) Contract No. DC/2004/06 Drainage Improvement in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po. Final Ecological Impact Monitoring Report (No.3). Prepared for Drainage Services Department (DSD).

Maunsell Environmental management Consultant Ltd. (2007b) Contract No. DC/2004/06 Drainage Improvement in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po. Final Ecological Impact Monitoring Report (No.4). Prepared for Drainage Services Department (DSD).

Maunsell Environmental management Consultant Ltd. (2007c) Contract No. DC/2004/06 Drainage Improvement in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po. Final Ecological Impact Monitoring Report (No.5). Prepared for Drainage Services Department (DSD).

Maunsell Environmental management Consultant Ltd. (2007d) Contract No. DC/2004/06 Drainage Improvement in Northern New Territories, Package A, Phase 1 – Construction of Drainage Channels in Ma Wat and North of Hong Lok Yuen, Tai Po. Final Ecological Impact Monitoring Report (No.6). Prepared for Drainage Services Department (DSD).

Maunsell – Metcalf and Eddy Joint Venture. (2008). *Agreement No. CE 12/2005 (DS) North District Sewerage Stage 2 Phase 1 Design and Construction Final Environmental Study Report*. Prepared for Drainage Services Department (DSD).

Mott Connell Ltd. (2000). *Investigation Assignment for Widening of Tolo Highway / Fanling Highway between Island House Interchange and Fanling* Final EIA Report*: Section 8. Ecology.* Prepared for Highway Department (HyD).

Planning Department. (2008a). Figure 3: Sites of Special Scientific Interest. Retrieved on web: http://www.pland.gov.hk/tech_doc/hkpsg/english/ch10/ch10_fig3.htm

Planning Department. (2008b). Statutory Planning Portal WTT. Retrieved on Web. http://www.ozp.tpb.gov.hk/

Shea, S.S. (1993) *Determinants of Macro Invertebrate Community Structure on Stone Surfaces in Hong Kong Streams.* Ph.D. Thesis. Department of Zoology, University of Hong Kong.

Shea, S. S. (2008) Proposed Ecological Baseline Monitoring Method and Programme for River Section in Ma Wat River, Fanling. Prepared for Highway Department (HyD).

EPD. (2008a). Technical Memorandum Annex 8: Criteria for evaluating ecological impact. Retrieved on web. http://www.epd.gov.hk/eia/english/legis/memorandum/annex8.html.

EPD. (2008b). Technical Memorandum Annex 16: Guidelines for Ecological Assessment. Retrieved on web on web: http://www.epd.gov.hk/eia/english/legis/memorandum/annex16.html.

9 Landscape and Visual Impact Assessment

9.1 Introduction

LVIA has been conducted to review design modification and design additions to the project assumptions adopted in the Approved EIA Report. In this regard, methodology and assessment of the previous LVIA which are still applicable in this ERR, are utilized to draft this report.

In 2002, a Working Paper – "EIA Re-visit for Proposed Design Changes (LVIA)" (hereafter named "EIA-LVIA Revisit") was submitted to the EPD and PlanD, regarding the visual impact due to the design changes of the scheme.

An LVIA Report was already submitted to HyD, PlanD – Shatin Tai Po and North District Planning Office, PlanD – Urban Design and Landscape Section and EPD separately to this ERR in the letter ref. 798/10.11/H07/044739 dated of 30 November 2007. This section summaries the major findings on this submission.

9.2 Summary

The LVIA Report, since the previous Approved EIA Report in 2000, concludes that the proposed changes listed in Section 1 of the LVIA Report will cause a slight to negligible impact on the findings. It has been assessed that, with appropriate mitigation measures, the visual impact of the additions will be slight during construction and negligible during operation.

Change of type of noise barriers and minor change of alignment in several locations as mentioned in Appendix A-4 will not cause significant impact. Although there is a comparatively large-scale change caused by the realignment of northbound carriageway, the impact is considered similar to the original alignment in the previous revisit.

Therefore, it is considered that the findings of the Approved EIA Report in 2000 are still applicable with the inclusion of the listed changes and that the residual impact would be 'acceptable with mitigation'. For ease of reference, the following paragraphs constitutes the conclusions from the EIA in 2000:

- The construction phase of the proposed scheme would result in sources of visual impact arising from the loss of existing vegetation, the scale of the proposed earthworks and the nature of construction activities to be undertaken. Although a higher adverse visual impact is predicted for the construction phase, these effects would be temporary in nature.
- Overall during the opening year, the sources of the landscape and visual impacts would arise from the loss of the roadside vegetation, the disturbance caused by the new areas of cut and fill and construction of the proposed noise barriers.
- The loss of roadside planting would initially have a large adverse visual impact on VSRs and on the existing landscape character of the local area particularly within the road corridor. This would expose views of the highway, and lead to a loss of the visual integration between the road corridor and the surrounding landscape.
- The proposed areas of cut and fill will be visually prominent both within the road corridor and within the wider landscape context of the scheme's visual envelope. However, the existing

level of disturbance caused by the highway structures would do much to lessen the perceived level of impact caused by the proposed works.

- The proposed noise barriers and other highway structures would, even with the design approach described above, form large and visually prominent structures both within the road corridor and the wider landscape context. The proposed highway structures are generally replacing existing ones and so the level of adverse visual impact would remain largely unchanged. However, in the context of the wider landscape, the combination of the proposed noise barriers and the roadside planting would successfully mitigate many of the adverse visual impacts caused by the operation of the proposed carriageway, with its associated engineering structures and vehicular activity.
- During the design year, generally described as between ten and fifteen years after the opening, although in practice often well in advance, the compensatory planting would have reached a level of maturity whereby it will perform the design role for which it was planted. This planting would reduce the adverse visual impacts caused by the proposed highway structures including the vertical barriers and ease the scheme's perceived visual integration into the existing landscape.
- The level of residual adverse impacts would be relatively low due to the existing disturbance caused by the existing highway and adjacent development, and the combined effect of the proposed mitigation measures. For the majority of the landscape and visual impacts predicted to occur as a result of the operational phase of the proposed widening scheme, the residual impact would be 'acceptable with mitigation'.
- The predicted impacts to the Planning and Development Control Framework would be negligible in that the proposed development has been designed where possible to stay within the existing landtake or widened within limited landtake and thus would not affect the viability of the existing planning designations within the road corridor.

10 Cultural Heritage Impact Assessment

10.1 Introduction

This section reviews the cultural heritage impacts arising from the Project due to the project changes as shown in Table 2-1 after the approval of the EIA Report. Desktop review of relevant information was undertaken to characterize the up-to-date baseline conditions of the environment within the Study Area and sites of cultural heritage likely to be directly or indirectly impacted by the Project. Recommendations and mitigation measures proposed in the Approved EIA Report were also reviewed to see if they are still applicable.

10.2 Investigation Study for Widening of Tolo Highway Assessment

The project site as described in the Approved EIA Report is still applicable in this ERR. The site falls within Tolo Highway and Fanling Highway from Island House Interchange to Wo Hop Shek Interchange.

The sites highlighted in the Approved EIA Report that potentially could be impacted directly or indirectly by the project are still applicable to this ERR. A desktop study has been carried out to provide updated information where applicable. Review of existing data regarding cultural heritage has been undertaken and include:

- The report on "Built Heritage Impact Assessment" (1999): recommendations from the report have been taken into account to ensure no disturbance will be made to the historic items identified in the report.
- Final EIA Report on Investigation Assignment for Widening of Tolo Highway / Fanling Highway between Island House Interchange and Fanling
- Investigation Study for Widening of Tolo Highway / Fanling Highway between Island House Interchange and Fanling: Archaeological Impact Assessment Report (Archaeological Assessments, 1999)
- Antiquities and Monuments Office information on graded historical buildings and declared monuments: http://www.amo.gov.hk/en/main.php

For the Kiu Tau footbridge, it will be re-provided close to existing footbridge and around a section of abandoned Ma Wat River, which no built heritage was found at/near the footbridge. The 1999 Built Heritage Impact Assessment depicts the same. Therefore, no adverse built heritage impact is caused by the footbridge re-provision.

Recommendations have been made based upon the best available information at the time of writing the ERR.

10.3 Sites of Archaeological Value

According to the Approved EIA Report, several areas were identified as having high archaeological potential and it was recommended that care must be taken in the design and implementation stage to ensure that they will not be affected, directly or indirectly in any way by the Project. These areas included:

- North of Tai Wo Village
- Ha Wun Yiu
- Yuen Chau Tsai

Other areas were highlighted by the archaeological assessment as having medium archaeological potential. These areas included:

- Mui Shui Hang South
- West of Lam Kam Roundabout
- Kiu Tau
- Tai Hang to Nam Wa Po
- Wai Tau
- Wai Tau to Tai Hang

The recommendations and mitigation measures provided in the Approved EIA report will be considered and assessed in later sections of this Chapter.

10.4 Sites of Cultural and Heritage Value

The report on "Built Heritage Impact Assessment" identified and assessed a number of built heritage sites. Table 10-1 summarizes the buildings of historical and cultural values identified in the Built Heritage Impact Assessment.

Table 10-1 Buildings of historical and cultural value

Built Heritage	Minimum Distance between project and historic site
The Wall of Fui Sha Wai, Built in Ming Dynasty	These individual houses (except No. 6 Tai Hang Fui Sha Wai) are within the wall of Fui Sha Wai of Tai Hang Village. The wall itself has minimum of **50m** away from site boundary. (Please refer to Figure 9-1e for location) No. 6 Tai Hang Fui Sha Wai is at 20m from proposed highway (see Figure 9-1e)
No 6 of Tai Hang Fui Sha Wai, Built in End of Qing Dynasty	
No 44 of Fui Sha Wai Built in Qing Dynasty	
No 45 of Fui Sha Wai Built in Qing Dynasty	
No 46 of Fui Sha Wai Built in Qing Dynasty	
No 51 of Fui Sha Wai Built in Qing Dynasty	
No 59 of Fui Sha Wai Built in Qing Dynasty	
No 60 of Fui Sha Wai Built in Qing Dynasty	
No 62 of Fui Sha Wai Built in Qing Dynasty	
No 63 of Fui Sha Wai Built in Qing Dynasty	
No 64 of Fui Sha Wai Built in Qing Dynasty	
No 65 of Fui Sha Wai Built in Qing Dynasty	
No 66 of Fui Sha Wai Built in Qing Dynasty	
No 71 of Fui Sha Wai Built in Qing Dynasty	

No 72 of Fui Sha Wai Built in Qing Dynasty	
No 73 of Fui Sha Wai Built in Qing Dynasty	
No 31 of Shek Kwu Lung Tsuen, Built in End of Qing Dynasty	House No.31 to 35 has minimum of 50m from the proposed alignment Please refer to Figure 9-1d for location
No 32 of Shek Kwu Lung Tsuen, Built in End of Qing Dynasty	
No 33 of Shek Kwu Lung Tsuen, Built in End of Qing Dynasty	
No 34 of Shek Kwu Lung Tsuen, Built in End of Qing Dynasty	
No 35 of Shek Kwu Lung Tsuen, Built in End of Qing Dynasty	
No 43 of Shek Kwu Lung Tsuen, Built in Republican Period	90m from proposed alignment see Figure 9-1d
No 44 of Shek Kwu Lung Tsuen, Built in Republican Period	
Island House (Yuen Chau Tsai), Built in 1905.	More than 100m away from the interchange see Figure 9-1a
No 5 of Tai Wo Tsuen, Built in End of Qing Dynasty	50m from proposed highway (Figure 9-1e)
No 6 of Tai Wo Tsuen, Built in End of Qing Dynasty	40m from proposed highway (Figure 9-1e)
No 8 of Tai Wo Tsuen, Built in Republican Period	Minimum 60m from proposed alignment see Figure 9-1e
No 10 of Tai Wo Tsuen, Built in End of Qing Dynasty	90m from proposed highway
No 11 of Tai Wo Tsuen, Built in End of Qing Dynasty	see Figure 9-1e
No 16 of Tai Wo Tsuen, Built in Republican Period	Minimum 90m from proposed alignment see Figure 9-1e
No 17 of Tai Wo Tsuen, Built in Republican Period	
No 19 of Tai Wo Tsuen, Built in Republican Period	
No 20 of Tai Wo Tsuen, Built in Republican Period	
No 21 of Tai Wo Tsuen, Built in Republican Period	
No 22 of Tai Wo Tsuen, Built in End of Qing Dynasty	Over 100m from proposed highway see Figure 9-1e
No 23 of Tai Wo Tsuen, Built in End of Qing Dynasty	Over 90m from proposed highway (Figure 9-1e)
No 27 of Tai Wo Tsuen, Built in End of Qing Dynasty	105m from proposed highway
No 28 of Tai Wo Tsuen, Built in End of Qing Dynasty	see Figure 9-1e
No 37 of Tai Wo Tsuen, Buit in Late Qing and Early Republican Period	Over 120m from proposed highway see Figure 9-1e
No 96 of Wai Tau Tsuen, Built in End of Qing Dynasty	Over 150m from proposed highway

No 109 of Wai Tau Tsuen, Built in End of Qing Dynasty	see Figure 9-1d
No 110 of Wai Tau Tsuen, Built in End of Qing Dynasty	
No 3 of Wo Hop Shek Tsuen , Built in End of Qing Dynasty	50m from Tai Wo Service Road West (no realignment)
No 3A of Wo Hop Shek Tsuen, Built in End of Qing Dynasty	see Figure 9-1c
No 4 of Wo Hop Shek Tsuen, Built in Late Qing and Early Republican Period	40m from Wo Hing Road (no works)
No 4B of Wo Hop Shek Tsuen, Built in Republican Period	see Figure 9-1c
No 5 of Wo Hop Shek Tsuen, Built in Republican Period	
No 6 of Wo Hop Shek Tsuen, Built in Republican Period	40m from Wo Hing Road (no works) see Figure 9-1c
Residence of Wong Siu Wai (Pun Chun Yuen), Built in Early 1930s	More than 150m from the proposed alignment see Figure 9-1b
The Tai Hung Po Dien of Pun Chun Yuen, probably built in post WWII	Over 50m from proposed highway see Figure 9-1b
Pun Chun Yuen Glass House, built in early 1930s.	Over 100m from proposed highway see Figure 9-1b
Pun Chun Yuen Tak Wai Tong, probably built in post WWII	Over 130m from proposed highway see Figure 9-1b
No 30 Ma Wo Tsuen, Built in Republican Period	80m from proposed slopeworks (Figure 9-1c)

A number of buildings (except Ting Wai Monastery) closer to proposed widening road are looked in further and illustrated as below. A series of location plan of the built heritage relative to existing highway is illustrated in Appendix I.

Island House (a declared monument in Yuen Chau Tsai, with its boundary including the whole islet and the Tai Wong Yeah Temple at the foot of the hill slope.), the Tai Hung Po Dien of Pun Chun Yuen (a graded historic building probably built in post-WWII) were identified as being located within the study area while the Tak Wai Tong (probably built in post-WWII), Pun Chun Yuen Glass House and Residence of Wong Siu Wai (built in early 1930s) are graded historic buildings, however they were identified as being located outside of the study area.

Wun Yiu Village was once a center of porcelain industry in the New Territories. As early as the Ming dynasty (1368-1644), clans of Man and Tse had started manufacturing the blue and white porcelain. The Ma clan, a group of Hakka people originated from Changle county in Guangdong Province, settled in Tai Po and purchased the kilns from the Man clan in 1674 (the 13th year of Kangxi reign of the Qing dynasty). The industry declined in the early 20th century due to the

competition from good quality and inexpensive porcelain produced by other coastal kilns in Guangdong. The kilns at Wun Yiu finally ceased to operate in 1932.

Ting Wai Monastery (定 慧 寺), previously known as Lan Yeuk Yuen (蘭 若 園) was found in 1923. In 1934, a Buddha temple 'Tai Hung Po Dien' (大 雄 寶 殿) was established adjacent to premises of Ting Wai Monastery. The temple was refurbished in 1988, the condition of the temple was restored to its original exquisiteness. The Monastery premise is outside the proposed project boundary.

Two structures near Fui Sha Wai, Tai Hang will be directly affected by the proposed road widening. Both of these structures are cultural features of modern construction. Both of these structures have encroached our proposed widening works, and both of them are scheduled to be resumed under the Roads (Works, Use and Compensation) Ordinance.

According to the Built Heritage Impact Assessment in 1999, Fui Sha Wai was recognized as the most important historic building. It was recommended that height restriction of new buildings should be imposed in specific designated zonal areas in order to maintain the consistency of built settings and architecture. The report also recommended that the proposed road widening project could be undertaken as long as historic buildings, which are located close to the highway, including Wo Hop Shek Tsuen (No. 3, 3A, 4, 4B, 5 and 6), shall have protection in order to isolate demolition works during the construction.

Several built heritage resources might be affected by the Project; the sites of high cultural importance in the vicinity of the project site area pose a cause for concern and include:

- Pun Chun Yuen
- Fui Sha Wai, Tai Hang (Historical walled village surrounding buildings and structures)
- Island House (a declared monument in Yuen Chau Tsai with its boundary including the whole islet and the Tai Wong Yeah Temple at the foot of the hill slope)
- Tai Kwong Yuen (Buddhist centre)

It should be noted that Tai Kwong Yuen (Buddhist centre) is not a graded building but has a high public value and religious significance. Tai Kwong Yuen is therefore considered in this assessment in further detail in Section 10.4.5.

10.4.1 Definition of Declared Monuments and Gradings of Historical Buildings

Subject to section 4 of the Antiquities and Monuments Ordinance (Cap. 53), the Antiquities Authority may, after consulting the Antiquities Advisory Board and with the approval of the Chief Executive as well as the publication of notice in the Gazette, declare any place, building, site or structure, which the Antiquities Authority considers to be of public interest by reason of its historical, archaeological or palaeontological significance, to be a monument, historical building or archaeological or palaeontological site or structure under section 3 of the Antiquities and Monuments Ordinance. The Antiquities Authority is empowered to prevent alterations, or to impose conditions upon any proposed alterations as s/he thinks fit, in order to protect each monument.

Some other buildings are classified as Grades I, II and III historic buildings. The definitions of grading buildings are internal guidelines adopted by the Antiquities Advisory Board and the Antiquities and Monuments Office for the preservation of historic buildings and are as follow:

- Grade I: buildings of outstanding merit of which every effort should be made to preserve if possible.
- Grade II: buildings of special merit; efforts should be made to selectively preserve.
- Grade III: buildings of some merit, but not yet qualified for consideration as possible monuments. Historic details of these buildings are to be recorded and used as a pool for future selection.

10.4.2 Pun Chun Yuen

Located at Shek Kwu Lung, the place was first developed as a lectorium for Buddhists to practise meditation in the early 30's. The place of worship was further developed in 1950's with addition of new features, including the Tai Hung Po Dien and the Halls for the Goddess of Mercy (Guanyin) and the God of Earth. Along with these attractions, the beautiful landscape and setting of Pun Chun Yuen has made it a popular tourist attraction in Tai Po (Figure 10-1).

Pun Chun Yuen, Residence of Wong Siu-wai, is a Grade II historical building. Pun Chun Yuen Tai Hung Po Dien, Tak Wai Tong and the Glass House are Grade III historical buildings.

Since the project works are situated in an acceptable distance from the Pun Chun Yuen complex, no significantly negative impact to the heritage resource within the complex is anticipated.

Figure 10.1a shows the view from Pun Chun Yuen before and after the road widening works. Visual impact to Pun Chun Yuen is considered minimal.

Figure 10-1 Pun Chun Yuen

Fig. 10 - 1a

Existing Tolo Highway viewed from Pun Chun Yuen

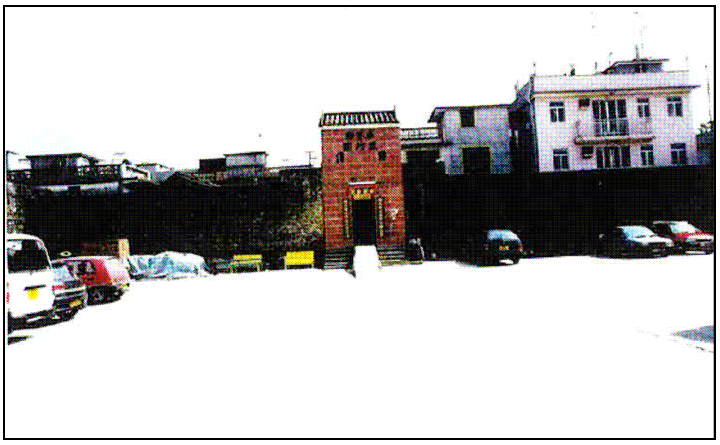
Photomontage of completed Road Widening Works viewed from Pun Chun Yuen

10.4.3 Fui Sha Wai

Fui Sha Wai, Tai Hang (Figure 10-2) is a historical walled village surrounding buildings and structures. The wall of Fui Sha Wai was built in Ming Dynasty and several of the buildings were built in the Qing Dynasty. Fui Sha Wai is considered as an important historic village. The impact from construction and operation phase of the Project imposed to the village is considered minimal.

Figure 10-2 Fui Sha Wai

(a) Fort Wall



(b) Front Entrance

As regards No.6 Fui Sha Wai, which located at 20m away from the proposed works, it is considered that the proposed works would not cause any adverse impact since bored piles / mini piles founded on bedrock with shallow excavation would be constructed.

Two structures near Fui Sha Wai, Tai Hang will be encroached by the proposed road widening works and resumed under the project. One of the structures is the recently constructed Tsz Tong (see Figure 10.3), which was built in 1980's, at entrance of Fui Sha Wai Village, which is in the form of modern facade. The shrine, built in 1980's, nearby Fui Sha Wai is an ordinary form of feature and commonly found in New Territories.

Figure 10-3 Shrine and Tsz Tong near Tai Hang Fui Sha Wai


Since both of these structures have encroached our proposed widening works and taking into account that both of these structures are cultural features of modern construction and thus considered not to have high cultural importance, both of them are to be removed under the Roads (Works, Use and Compensation) Ordinance.

Figure 10-4 Island House

10.4.4 Island House and Tai Wong Yeah Temple

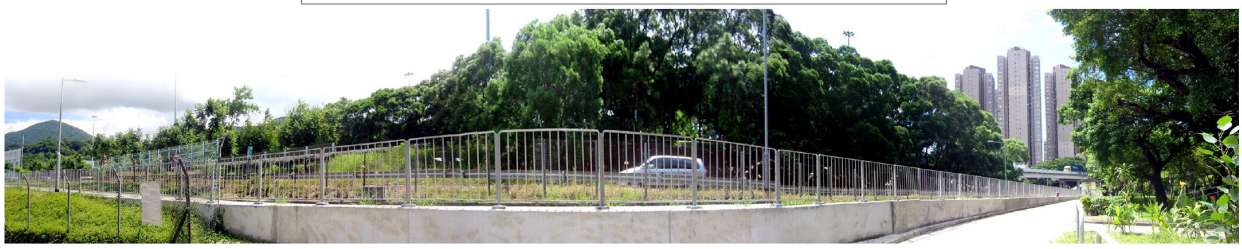
Island House (Figure 10-4) was built in 1905 and is now a declared monument. It formerly stood on a small islet named Yuen Chau Tsai near the head of Tolo Harbour, which was connected to the mainland by a causeway. The two-storey plastered building with open verandas is a classic example of the colonial architecture at the turn of the century. It was erected as quarters for government officers and is now used by the World Wide Fund for Nature as a Conservation Studies Centre.

At Yuen Chau Tsai, there is also a Tai Wong Yeah Temple located within the declared monument boundary of Island House. The temple was originally a stone tablet which was erected on the northern shore of Yuen Chau Tsai in the mid-Qing Dynasty. In the late Qing Dynasty, some fishermen raised funds to build the temple for worship. In 1960, a formal launching ceremony for dragon boats was first held at the Temple on Dragon Boat Festival. The ceremony has remained a tradition since then.

The temple remains some distance with the site boundary. (as illustrated by Figure 10.5a) The road widening works closest to the temple is mainly junction modification works and should not impose a vast built heritage impact on the temple. However, care must be taken to ensure that the Project does not affect these buildings and their surroundings. The noise barriers and landscaping will be implemented concurrently to form a consistent design along the seaside promenade.

Due to the very dense trees surrounding the Island House, Tolo Highway is not visible at Island House and no visual impact is caused.

Perspective View from Tai Wong Yeah Temple
(Existing view)



Perspective View from Tai Wong Yeah Temple
(Proposed view)

Figure 10-5a Island House photomontage viewing from the entrance of Tai Wong Yeah Temple

Island House interchange is subjected to road widening and junction improvement works under our project. However, these works are located on the mainline itself and in some distance away. Figure 10-5b illustrates the location of road widening and junction improvement works adjacent to Tai Wong Yeah Temple. Both type of works are not visible from entrance of Tai Wong Yeah Temple. Hence the project works should not impose a vast built heritage impact on the temple.

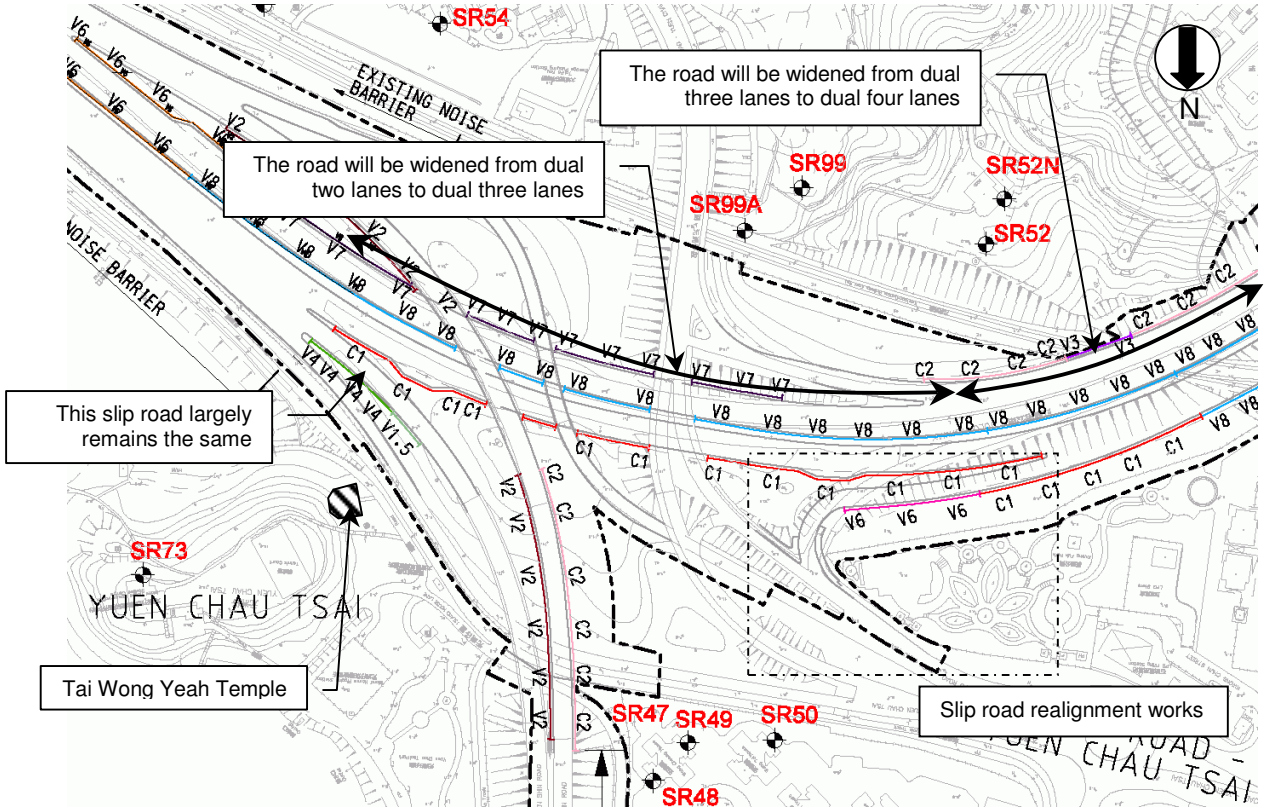


Figure 10-5b Plan of Island House Interchange and junction modification works.

10.4.5 Tai Kwong Yuen

The project coverage will avoid encroachment of Tai Kwong Yuen area although the existing Tai Kwong Yuen monastery in Shek Kwu Lung is close to the project boundary. A Buddhist Monk, Sik Chi Cheung, who chose the site, established Tai Kwong Yuen in the 1930's. The current garden was established around the same time as the founding of the primary school in 1945. The built heritage features of Tai Kwong Yuen include the main hall (about 30m from the construction works) which is the owners residence and place of worship, an L-shape Annex next to the Main Hall (about 30m from the construction works), Kwai Fah Road in front of the Main Hall (about 40m from the construction works), Stone Steps (about 60m from the construction works), a garden pavilion (Wai Tor Din) dating to the 1950's (about 25m from the construction works), Tai Kwong Yi Hok Primary School Building (about 75m from the construction works), two archways (about 40m from the construction work) located slightly down the hill from the main structure that dates to the same period as the main building. The works to be carried out near Tai Kwong Yuen includes construction of a new vehicular bridge (Bridge 12A) which comprises excavation, piling works and pile caps for the bridge piers. Since the proposed works to the Tai Kwong Yuen compound are more than 25m away and these works involve bored piles founded on bedwork, it is considered that the proposed works would not cause any adverse impact (see Figure 10-6d).

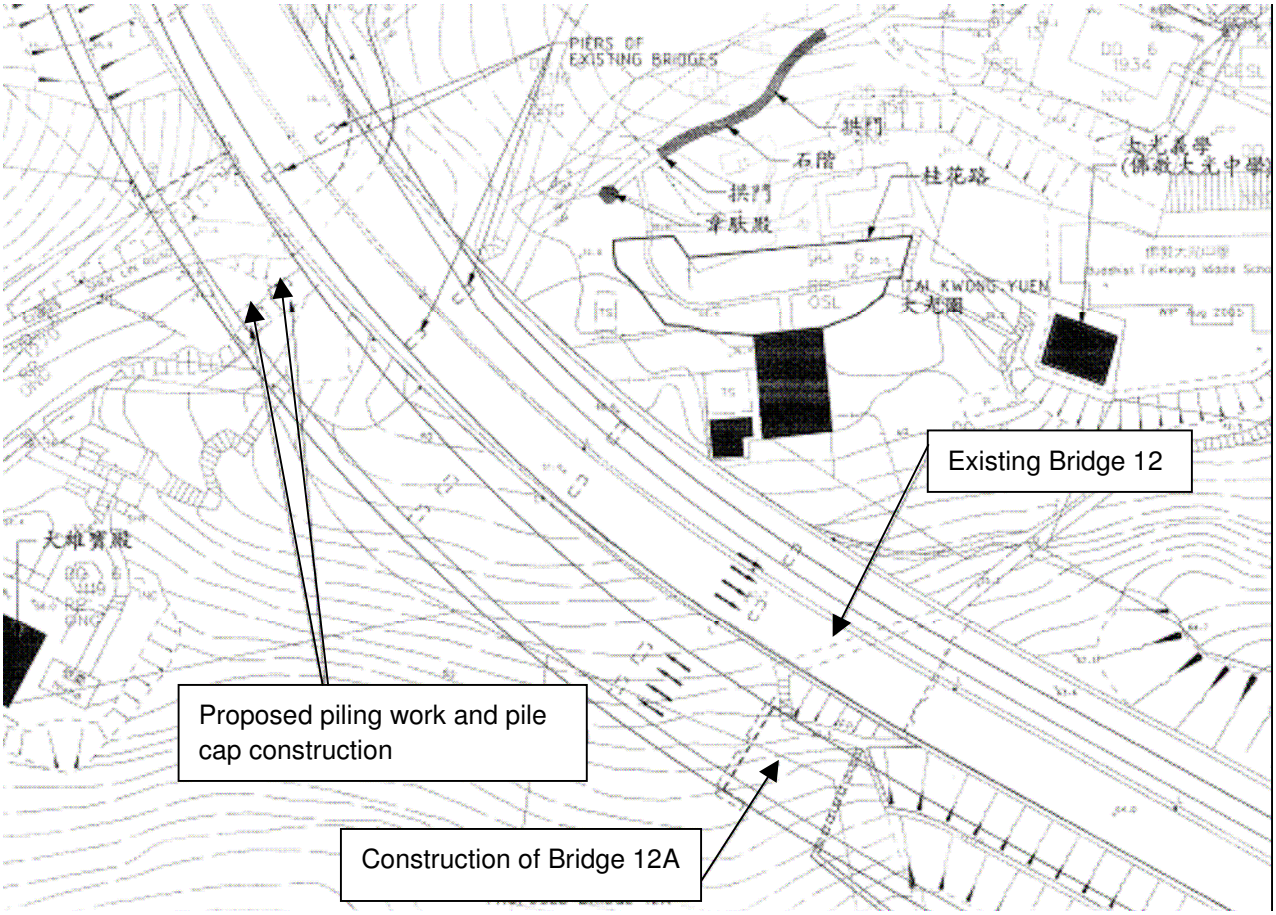
The Figure 10-6a is facing towards Tai Kwong Yuen and the Tolo highway bridge. The photo in Figure 10-6b and Figure 10-6c is taken at the Tai Kwong Yuen Garden Yard and towards Tolo Highway.

Figure 10-6 Tai Kwong Yuen

(a) Tai Kwong Yuen

(b) Tai Kwong Yuen Garden Yard

(c) Location of Bridge Pier



(d) Plan of Tai Kwong Yuen

As this is a place of worship highly respected and used by the local public, the local needs shall be considered and handled in a way to avoid public upset and inconvenience. If construction works of the Project were to affect the area around, and access to Tai Kwong Yuen, resulting in closure of the monastery for part of the construction works, an alternative place of worship is required for the public that use the monastery as a place of worship. The monastery owners and users should be consulted, and advised of any closures in advance to avoid unnecessary upset and inconvenience. Since there will be no direct impact to the built heritage resources within Tai Kwong Yuen, protective measures to Tai Kwong Yuen is considered not necessary. However, mitigation measures for indirect impact resulting from the construction works are recommended. Monitoring points (settlement markers) will not be installed onto the existing structures in Tai Kwong Yuen but will be installed by the Contractor under the supervision of the Engineer within the boundary of our works area at the edge closest to Tai Kwong Yuen (main hall and garden pavilion) to monitor the possible ground settlement induced by the construction works. If the ground settlement is found to be exceeded during construction, the works will be immediately suspended and structural conditions appraisal will be carried out by structural engineering experts. The works would only be resumed after the rectification proposal submitted by the Contractor has been accepted by the Engineer.

10.5 Recommendations on Archaeological Mitigation

The following areas identified as having high archaeological potential according to the approved EIA report are confirmed not to be affected directly or indirectly by the proposed works during both the construction and operation phases:

- North of Tai Wo Village
- Ha Wun Yiu
- Yuen Chau Tsai

In addition, as the Shek Kwu Lung Archaeological Site is more than 50m away from the proposed works areas of the project, it is confirmed that it would also not be affected directly or indirectly by the proposed works during the construction and operation phases.

The following areas are identified as having medium archaeological potential in the approved EIA report.

- Kiu Tau
- Tai Hang to Nam Wa Po
- Wai Tau to Tai Hang

Kiu Tau is under extensive impacts from constructions works for drainage improvement for Ma Wat River project. With reference to the study conducted under North District Sewerage, Stage 2 Phase 1- Design and Construction (2007), it is assessed that Tai Hang to Nam Wa Po and Wai Tau to Tai Hang has very little potential for archaeology remains.

As regards the remaining three areas with medium archaeological potential identified in the approved EIA report (viz., Mui Shue Hang South, Wai Tau and the area west of Lam Kam Road Roundabout), they will not be affected by the project. Thus, no archaeological mitigation measure is required.

Archaeological monitoring is required on areas as defined in Figures 10.1 and 10.2 of the approval EIA report. It is confirmed that the archaeological monitoring is no longer required.

10.6 Recommendations on Built Heritage Mitigation

The following mitigation measures are recommended:

- Tai Kwong Yuen – Monitoring points (settlement markers) shall be installed by the Contractor under the supervision of the Engineer within the boundary of the works area at the edge closest to Tai Kwong Yuen (main hall and garden pavilion) to monitor the possible ground settlement induced by the construction works. If the ground settlement is found exceeded during construction, the works will be immediately suspended and structural condition appraisal will be carried out by structural engineering experts. The works would only be resumed after the rectification proposal submitted by the Contractor has been accepted by the Engineer.

10.7 Conclusion

The study area includes several sites of special archaeological and cultural significance. The areas of high importance located within the vicinity of the project area include:

- North of Tai Wo Village;
- Ha Wun Yiu;
- Island House, Yuen Chau Tsai;
- Pun Chun Yuen;
- Fui Sha Wai, Tai Hang; and
- Tai Kwong Yuen Compound (Buddist Centre)

The project will not impose any direct or indirect impact on North of Tai Wo Village, Ha Wun Yiu and Island House, Yuen Chau Tsai during both the construction and operation phases since the proposed works are far away (more than 50m) from these areas.

The impact to cultural heritage has been reviewed. Since the project works are situated at an acceptable distance (more than 50m) from the Pun Chun Yuen complex, no significantly negative impact to the heritage resources within the complex is anticipated.

For Fui Sha Wai, Tai Hang (except No.6 Fui Sha Wai), the impact from the project is considered minimal as the individual houses are within the wall of Fui Sha Wai of Tai Hang Village and they are more than 50m away from the project boundary. As regards No.6 Fui Sha Wai, which is located at 20m from the proposed works, since bored piles / mini piles founded on bedrock with shallow excavation will be carried out, it is also not anticipated that the project will cause any adverse impact. However, two structures near Fui Sha Wai, Tai Hang (viz., the Shrine and the Tsz Tong) will be directly affected by the project. Both of these structures will encroach onto the road widening works and would need to be resumed under the Roads (Works, Use and Compensation) Ordinance.

For the Tai Kwong Yuen Compound, it will be preserved in-situ. No protective measures are considered necessary since there will be no direct impact to the built heritage resources within Tai Kwong Yuen. Mitigation measures for indirect impact resulting from the construction works are recommended. Monitoring points (settlement markers) will be installed by the Contractor under the supervision of the Engineer within the boundary of the works area closest to Tai Kwong Yuen (main hall and garden pavilion) to monitor the possible ground settlement induced by the construction works. If the ground settlement is found to be exceeded during construction, the works will be immediately suspended and structural condition appraisal will be carried out by structural engineering experts. The works would only be resumed after the rectification proposal submitted by the Contractor and to the satisfaction of the Engineer.

11 Conclusion

11.1 Overview

This ERR had made a direct comparison with the Approved EIA Report. This ERR has also identified and provided mitigation measures for the potential impacts associated with both the construction and operational phases of the Project.

The following aspects have been reviewed:

- Air Quality;
- Noise;
- Water Quality;
- Waste Management Implications;
- Landscape and Visual Impact Assessment
- Ecology (Terrestrial and Aquatic); and
- Cultural Heritage.

The findings of the assessments are summarised in Table 11-1 which details:

- Key impacts (without mitigation measures) for each of the environmental aspects considered;
- Proposed measures (where appropriate) to mitigate against the identified impacts; and
- Residual impacts (after implementation of mitigation measures).

The residual impacts define the acceptability of the Project, and are categorized in accordance with EIA-TM. Five impact categories have been adopted:

- The impact is *beneficial* if the Project will improve the overall quality of the environmental aspect under consideration;
- The impact is *acceptable* if the assessment indicates that there will be no significant effects on the environmental aspect under consideration;
- The impact is *acceptable with mitigation measures* if there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures;
- The impact is *unacceptable* if the adverse effects are considered excessive and are unable to be practically mitigated. In these circumstances compensation may have to be considered by Government; and
- The impact is *undetermined* if significant adverse effects are likely, but the extent to which they may occur or be mitigated cannot be determined from the study. Further detailed study will be required. The time scale over which the impacts will occur has also been categorised into short, medium or long term, and reversible or irreversible.

11.2 Air Quality

A review of construction dust impacts has identified that fugitive dust is the primary potential air pollutant during the road widening works of the project. Established dust suppression techniques such as regular watering of haul roads, covering / dampening any stockpiles and dampening dusty materials before transportation, have been proposed.

Through proper implementation of the recommended mitigation measures, dust generation will be controlled and will not exceed the acceptable criteria. The implementation of the recommended mitigation measures will be further verified through the EM&A programme which will be undertaken during the construction phase of the Project.

A review on the vehicular emission impact during the operation phase by air quality modelling exercise indicates that neither the hourly NO_2 nor 24-hour RSP assessment criteria will be exceeded during the operation phase of the Project. As the air quality modeling exercise were based on the worst-case traffic forecast (Year 2028), it is concluded that there will be no adverse the air quality impact during operation phase of the Project.

There is no change on the findings of the Approved EIA Report with regard to the air quality assessment for both construction and operation phases of the Project.

11.3 Noise

This ERR has concluded that with the use of silenced equipment, reduction in equipment percentage on-time, as well as 1.5 to 7 m high purpose-built barriers positioned at appropriate locations during the construction phase of the Project, the construction noise impact will be effectively mitigated. The predicted construction noise levels at two schools (SR41 Wong Shiu Chi Middle School and SR45 HK Teacher's Association Secondary School) are found to exceed the noise criterion (during examination period only). However, as confirmed by the school officials, both schools are equipped with adequate noise insulation facilities (i.e., air conditioners and window glazing) at the noise sensitive facades. Therefore, the noisy construction activities will be adequately mitigated by the existing measures, and no residual impacts are anticipated.

Year 2028 road traffic noise impacts caused by the Project are shown to be effectively mitigated through the use of 2 to 8 m high vertical roadside barriers, central reserve barriers and canopy type barriers. With the proposed mitigation in place, the noise contribution from the Project at all SRs satisfy the two assessment criteria:

(1) the predicted $L_{10(1\ hour)}$ noise level from the "new" roads must be below the relevant noise standards, i.e., 70 dB(A) for domestic premises and 65 dB(A) for education institutions; and

(2) the noise contribution from the "new" roads to the increase in the predicted overall noise level must be less than 1 dB(A) if the overall noise level exceeds the relevant criterion.

The criterion as set out in the 24 Hour Opening of the Border Crossing study is also met with the proposed mitigation measures for the Project in place. Therefore, it is concluded that there will be no significant traffic noise impact caused by the Project.

With the latest barrier design, there is no change on the findings of the Approved EIA Report with regard to noise assessment for both construction and operation phases of the Project.

11.4 Water

Water quality within Tolo Harbour has improved since the Approved EIA Report. This ERR identifies the new water quality standard required for construction and operation phases. Water quality impacts have been reviewed for both construction and operational phases. It has been concluded that the impacts are both locally confined and controllable within acceptable levels, on the basis that environmental mitigation measures are included in the Construction Works Programme. There is no change on the findings and recommendations of the Approved EIA Report.

11.5 Waste

In order to suitably manage the potential environmental effects associated with construction related wastes, full consideration must be given to the re-use of surplus clean material on site (where practicable), or within other development projects, once material balances are finalised. This will help reducing the pressure on the filling capacity of the territory's landfills due to excess construction and demolition waste disposal. All mitigation measures and waste management procedures outlined within this ERR must be implemented in order to control or eliminate the potential impacts to the environment, from waste generation and disposal perspectives. There is no significant change in the potential impact that was predicted within the Approved EIA Report.

11.6 Ecology

This ERR on ecology provides a review on the ecological impacts based on changes regarding the Project details and any updates in habitat within the Study Area since the EIA Report was approved.

The extent of habitat loss has been summarized and the type of the habitat most significantly affected by the Project is low ecological value plantation woodland. As stated in the Approved EIA Report, none of the affected habitats within the impacted area supports any vegetation species of conservation importance.

Where necessary appropriate compensation and measures of mitigation have been proposed. The mitigation measures for habitat loss that are proposed in the Approved EIA Report, namely compensation tree planting is considered appropriate and sufficient to compensate the loss. Compensation of the aquatic habitat 'North Meander Ma Wat River" and the loss of grassland habitats is not deemed to be necessary as the significance of the residual impact for these habitats is low.

Other indirect ecological impacts which may arise from the Project including localised impacts upon air and water quality from site clearance / site formation shall be mitigated through good site practice. Compensation, mitigation and good practice on site will be implemented to ensure that the 'Residual Impact' from the Project is low.

11.7 Cultural Heritage

The study area includes several sites of special archaeological and cultural significance. The areas of high importance which are located within the vicinity of the Project area include:

- North of Tai Wo Village;
- Ha Wun Yiu;
- Fui Sha Wai, Tai Hang;
- Island House, Yuen Chau Tsai;
- Pun Chun Yuen; and
- Tai Kwong Yuen Compound (Buddhist Centre);

The impact to cultural heritage is considered to be comparable with the Approved EIA report. Since the project works are situated in an acceptable distance from the Pun Chun Yuen complex, no significantly negative impact to the heritage resources within the complex is anticipated.

The Tai Kwong Yuen (TKY) Compound, built by a renowned Buddhist monk in 1930s, will be preserved in-situ. No protective measures to TKY is considered necessary since there will be no direct impact to the built heritage resources within TKY. Mitigation measures for indirect impact resulting from the construction works are recommended. Monitoring points (settlement markers) will be installed within the boundary of the works area at the edge closest to TKY (main hall and garden pavilion) to monitor the possible ground settlement induced by the construction works. If the ground settlement is found to be exceeded during construction, the works will be suspended and structural condition appraisal on the TKY Compound will be carried out by structural engineering experts. The works would only be resumed after the rectification proposal submitted bythe Contractor has been accepted by the Engineer. Relevant clauses will be included in the contract documents requiring works to be carried out as unintrusively as possible.

As regards No.6 Fui Sha Wai which is located at 20m away from the proposed works. It is considered that the proposed works would not cause any adverse impact since only bored piles/minipiles founded on bedrock with shallow excavation would be constructed.

Two structures near Fui Sha Wai, Tai Hang will be directly affected by the Project. Descriptions of the two structures are illustrated in section 10.4.3. Both of these structures are cultural features of modern construction. Both of these structures have encroached onto the proposed widening works, and both are scheduled to be resumed under the Roadworks Ordinance.

For the archaeological monitoring recommended in the approved EIA report, it is confirmed that the archaeological monitoring is no longer required as discussed in Section 10.5.

11.8 Environmental Monitoring and Audit

An environmental monitoring and audit (EM&A) programme adopted in the Approved EIA Report has been reviewed. The EM&A requirements in the Final EM&A Manual of the Approved EIA Report include archaeological monitoring, construction dust, noise and water quality monitoring and site environmental audit during construction phase of the Project; and operation phase noise monitoring. A schedule of recommended mitigation measures is also included in the Final EM&A Manual of the Approved EIA Report.

As there is no major alignment change and no construction noise criteria exceedance were found at the newly identified NSRs, the EM&A programme and requirement as recommended in the Final EM&A Manual of the Approved EIA Report for noise, construction dust and water quality during

construction phase are considered applicable and recommended to be undertaken during the construction phase of the Project.

The operation phase noise monitoring requirements in the Final EM&A Manual of the Approved EIA Report is considered still applicable and the approach of the confirmation of operation noise monitoring with EPD after the completion of the Project should be followed.

The schedule of recommended mitigation measures in the Final EM&A Manual is considered still applicable, except for the mitigation measures for the noise impact, and is recommended to be undertaken during the implementation of the Project. The eighth item under "Noise during Construction" and "Noise during Operation" under Table A.1, Annex A of the Final EM&A Manual of the Approved EIA Report should be updated as below. The schedule of recommended mitigation measures extracted from the Approved EIA Report is given in Appendix L.

Impact	Mitigation Measures	Timing	Responsibility
Noise during Construction	3.5m and 7m high temporary noise barrier along Tai Wo Services Road West near Tai Hang as shown in Appendix F-2 of this ERR.	During Construction	Contractor
Noise during Operation	Various types of barriers of varying heights as shown in Appendix A-2 – Layout of Noise Barriers of this ERR.	Review of required noise barrier layout during the design stage	Designer to implement in the engineering design
	Low noise reducing surfacing along both the widened and reconstructed sections of the works	Review of required noise barrier layout during the design stage	Designer to implement in the engineering design

11.9 Overall Conclusion

The findings of this ERR have provided information on the nature and extent of environmental impacts arising from the construction and operation of the project. The ERR has, where appropriate, identified mitigation measures to ensure compliance with environmental legislation and standards.

Overall, the EIA Report for the proposed road widening works has predicted that the project will comply with all environmental standards and legislation with the implementation of the proposed mitigation measures for construction and operation phases. This ERR has also demonstrated the acceptability of the residual impacts from the project and the protection of the population and environmentally sensitive resources. Environmental monitoring and audit programmes have been recommended as necessary, to verify the validity of the EIA predictions and the effectiveness of recommended mitigation measures.

Table 11-1 Summary of Findings

Environmental Aspect	Key Impacts (without Mitigation Measures)	Proposed Mitigation Measures	Residual Impacts (after Mitigation)	Time Scale of Impacts
Air Quality ***(Construction)***	Short term elevated dust levels are expected	Regular watering of haul road surfaces, covering/dampening of stockpiles in dry/windy conditions	Acceptable with mitigation measures	Short term, reversible
Air Quality ***(Operational)***	N/A[1]	N/A	N/A	N/A
Noise ***(Construction)***	Elevated construction noise levels are anticipated	Adoption of silenced equipment, reduction in equipment number, 2 to 7 m high purpose built noise barrier at locations required	Acceptable with mitigation measures	Short term, reversible
Noise ***(Operational)***	Traffic noise impacts from the widened highways and the associated slip roads	Direct mitigation measures: 2 to 8 m high vertical noise barriers (roadside and central reserve), and 2 types of canopy barriers. Type I consists of 5.5 m high vertical barrier with a 4.5 m cantilever (2.5 m high from base of cantilever, i.e., a total height of 8.0 m), and Type II consists of 5.5 m high vertical barrier with 3.0 m cantilever (2.5 m high from base of cantilever, total height of 8.0 m)	Acceptable with mitigation measures	Long term, irreversible
Water Quality ***(Construction)***	Widening and reconstruction of bridges River training works	Sheet piles to avoid off-site migration and to protect affected areas	Acceptable with mitigation	Short term, reversible
Water Quality ***(Operational)***	Highway drainage	None	Acceptable	Long term

Environmental Aspect	Key Impacts (without Mitigation Measures)	Proposed Mitigation Measures	Residual Impacts (after Mitigation)	Time Scale of Impacts
Waste ***(Construction)***	Wastes produced during construction may include excavated spoil, waste from associated construction works, small quantities of chemical wastes, bentonite slurries, and municipal wastes	Normal construction waste management measures are proposed, including full consideration on the potential for re-use of excess spoil, segregation of recyclable and non-recyclable wastes (where practicable) and good housekeeping practice on site to minimise nuisances	Acceptable with mitigation measures	N/A
Waste ***(Operational)***	Wastes produced during specific maintenance operations (e.g. road re-surfacing, upkeep of landscaped areas) and may include tarmacadam, concrete and organic wastes (vegetation and top soil)	Full consideration on the potential for re-use of excess spoil or maintenance material, segregation of recyclable and non-recyclable wastes (where practicable) and good housekeeping practice to minimize nuisances	Acceptable with mitigation measures	N/A
Landscape Impacts ***(Construction)***	Loss of roadside tree vegetation as landscape buffer	Preservation of existing vegetation, where possible, by modifications to alignment Tree Survey in accordance with WBTC 24/94 and tree felling, transplanting and retention proposals Conservation of topsoil Compensatory tree and shrub planting	Acceptable with mitigation measures	Medium term, reversible

Environmental Aspect	Key Impacts (without Mitigation Measures)	Proposed Mitigation Measures	Residual Impacts (after Mitigation)	Time Scale of Impacts
Cultural Heritage **(Construction)**	Tai Kwong Yuen	• Mitigation measures for indirect impact resulting from the construction works are recommended. Monitoring points (settlement markers) will be installed by the Contractor under the supervision of the Engineer within the boundary of the works area at the edge closest to Tai Kwong Yuen (main hall and garden pavilion) to monitor the possible ground settlement induced by the construction works. If the ground settlement is found to be exceeded during construction, the works will be immediately suspended and structural conditions appraisal will be carried out by structural engineering experts. The works would only be resumed after the rectification proposal submitted by the Contractor has been accepted by the Engineer. Relevant clauses will be included in the contract documents requiring works to be carried out as unintrusively as possible	N/A	N/A
Ecology (Construction); **Natural Rivers and Streams**	**Outside works boundary** Adverse impacts arising from construction works; dust, site run-off etc. Impact: Insignificant/ Low	Precautionary measures implemented according to Technical Circular (Works) No. 5/2005 "*Protection of natural streams / rivers from adverse impacts arising from construction works*" Fencing boundaries of works area General mitigation measures to control site run-off and dust.	No residual impacts would be envisaged	N/A

Environmental Aspect	Key Impacts (without Mitigation Measures)	Proposed Mitigation Measures	Residual Impacts (after Mitigation)	Time Scale of Impacts
	Within works boundary Loss of habitat of low ecological value river meander (90 m) Impact: Low	Live capture and relocation of tadpoles, frogs and fish to nearby undisturbed meander or river channel. All the measures proposed for sites outside boundary works.	Acceptable with mitigation measures	Permanent
Ecology (Construction); **Grassland**	Habitat loss within works boundary to low ecological value grassland.	Minimise the clearance of land required to accommodate the highway widening Fencing boundaries of works area	Acceptable with mitigation measures	Permanent
Ecology (Construction); **Natural Woodland**	**Outside works boundary** Adverse impacts arising from construction works; human disturbance, dust, etc Impact: Insignificant/ Low	Fencing boundaries of works area General mitigation measures to control site run-off and dust.	No residual impacts would be envisaged	N/A
	Within works boundary Loss of habitat of moderate ecological value natural woodland Impact: Moderate	Identification and preservation of mature trees Replanting with native species along the highway corridor including 5.5ha ecological compensatory planting. Where possible with linkage to existing woodland All the measures proposed for sites outside boundary works.	Acceptable with mitigation measures	Long term, reversible

Environmental Aspect	Key Impacts (without Mitigation Measures)	Proposed Mitigation Measures	Residual Impacts (after Mitigation)	Time Scale of Impacts
Ecology (Construction); **Plantation woodland**	**Outside works boundary** Adverse impacts arising from construction works; human disturbance, dust, etc Impact: Insignificant/ Low	Fencing boundaries of works area General mitigation measures to control site run-off and dust.	No residual impacts would be envisaged	N/A
	Within works boundary Loss of habitat of moderate ecological value plantation woodland Impact: Moderate	Replanting with native species along the highway corridor. Where possible with linkage to existing woodland. All the measures proposed for sites outside boundary works.	Acceptable with mitigation measures	Medium to Long term, reversible
Ecology (Operational); **Avifauna**	Potential problems with birds colliding with transparent noise barriers Impact: Low	Pattern/ colored strips will be added to the panel as suggested in "Guidelines on Design of Noise Barriers" by Highways Department.	No residual impacts would be envisaged	N/A

Table 11-2 Ecology – Schedule of Recommended Mitigation Measures

Impact	Proposed Mitigation Measures	ERR Clause	Timing	Responsibility
Ecology (Construction)	**Relocation of Aquatic Life** Live capture and relocation of tadpoles, frogs and fish to nearby undisturbed meander or river channel.	8.4.2.6.6.1	Prior to Ma Wat River meander works	Contractor
	Compensatory Ecological Planting Replanting including native species along the highway corridor with 5.5ha ecological compensatory planting. Specific planting details are given in 'Tree Removal Application 2008'.	8.5.9.5	During construction and operation	Contractor during construction, HyD and LCSD during operation.[1]
	Accurate Delineation of Works Area Boundaries of proposed works areas shall be clearly identified and separated from external areas by a physical barrier to prevent encroachment of adjacent habitats. Individual trees which fall within the works areas but which work plans do not require removal are to be retained and fenced off to maximize protection.	8.5.3 & 8.5.4	During construction	Contractor

[1] The division of vegetation planting and maintenance responsibilities within Government shall follow the guidelines stipulated in Environment, Transport and Works Bureau (ETWB) Technical Circular (Works) No.2/2004

Impact	Proposed Mitigation Measures	ERR Clause	Timing	Responsibility
	Protection of Natural Rivers and Streams Precautionary measures will be implemented according to the guidelines and precautionary measures in Technical Circular (Works) No. 5/2005 "Protection of natural streams / rivers from adverse impacts arising from construction works", including the following key measures: ▪ Construction debris and spoil should be covered up and/or properly disposed of as soon as possible to avoid being washed into nearby rivers/streams by rain. ▪ Proper locations for discharge outlets of wastewater treatment facilities well away from the natural streams/rivers should be identified. ▪ The proposed works site inside or in the proximity of natural rivers and streams should be temporarily isolated, such as by placing of sandbags or silt curtains with lead edge at bottom and properly supported props, to prevent adverse impacts on the stream water qualities. Other protective measures should also be taken to ensure that no pollution or siltation occurs to the water gathering grounds of the work site.	8.4.3.1 & 8.5.8.1	During construction	Contractor

Impact	Proposed Mitigation Measures	ERR Clause	Timing	Responsibility
	Measures against Dust Generation There are a number of measures which shall be taken as specified in the Air Pollution Control (Construction Dust) Regulation on 'Dust Control Requirements', including the following key measures to be applied during construction: ▪ vehicle washing facilities to be provided at every discernible or designated vehicle exit point; ▪ all temporary site access roads shall be sprayed with water to suppress dust as necessary; ▪ all dusty materials should be sprayed with water immediately prior to any handling; and ▪ all debris should be covered entirely by impervious sheeting or stored in a sheltered debris collection area.	8.5.5.1	During construction	Contractor
	Surface Run-off Mitigation measures shall be in accordance with ProPECC PN1/94 on ' Construction Site Drainage'. Key measures include: ▪ Bund and cover stock piles to avoid run-off; ▪ Channel any run-off through a system of oil, grease and sediment / silt traps and reuse water on site where ever practical; ▪ All vehicle maintenance to be undertaken within a bunded area; and ▪ Maximise vegetation retention on-site to maximise absorption (minimise transport).	8.5.6	During construction	Contractor

Impact	Proposed Mitigation Measures	ERR Clause	Timing	Responsibility
	Measures against Avifauna Collisions with Noise Barriers Pattern/ colored strips will be added to the panel as suggested in "Guidelines on Design of Noise Barriers" by Highways Department (Practice Note No. BSTR/PN/003 – Revision B) to reduce bird collisions with the noise barriers.	8.4.3.2	During construction	Contractor
	Precautions with Vegetation Clearance ▪ No fires shall be lit within the works area for the purpose of burning cleared vegetation. ▪ The Contractor shall give consideration to mulching the cleared vegetation for recycling within the works area / adjacent land.	8.5.7	During construction	Contractor