Kowloon Canton Railway Corporation

KSL GSA 5100 Environmental Impact Assessment & Associated Services

Environmental Impact Assessment Report

Kowloon Canton Railway Corporation

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Environmental Impact Assessment Report – Volume 1

Main Report

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Ove Arup & Partners Hong Kong Ltd
Level 5, Festival Walk, 80 Tat Chee Avenue, Kowloon Tong, Kowloon, Hong Kong
Tel +852 2528 3031 Fax +852 2268 3950
www.arup.com

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ABBREVIATION

ABWF	Architectural and builders works & finishes
ADWF	Average dry weather flow
AEL	Airport Express Line
AMO	Antiquities and Monuments Office
ANL	Acceptable Noise Level
APCO	Air Pollution Control Ordinance
AQO	Air Quality Objectives
Arup	Ove Arup and Partners Hong Kong Ltd
ASR	Air Sensitive Receiver
BMP	Best Management Practice
BNL	Basic Noise Level
BOD_5	5-day Biochemical Oxygen Demand
BTEX	Benzene, Toluen, Ethylbenzene and Xylene
C&D	Construction and Demolition
CAR	Canton Road Station
CAP	Contamination Assessment Plan
CDG	Completely Decomposed Granite
CEDD	Civil Engineering and Development Department
CLP	China Light Power
CNP	Construction Noise Permit
CRPB	Canton Road Plant Building
CWTC	Chemical Waste Treatment Centre
D-wall	Diaphragm wall
DO	Dissolved Oxygen
EAP	Emergency assembly point
ECS	Environmental Control System
EEP	Emergency Egress Point
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance
EM	Environmental Manager
EMP	Environmental Management Plan
EMIS	Environmental Mitigation Implementation Schedule
EM&A	Environmental Monitoring and Audit
EMU	Electric Multiple Units
E&M	Electrical and mechanical
EP	Environmental Permit
EPD	Environmental Protection Department
ER	Engineer's Representative
ERE	East Rail Extension
ET	Environmental Team
ETS	East Tsim Sha Tsui
ETWBTC	Environment, Transport and Works Bureau Technical Circular
FDM	Fugitive Dust Model
FMPHQ	Former Marine Police Headquarters
FSD	Fire Services Department
FTA	Federal Transit Administration
GEO	Geotechnical Engineering Office
GI	Ground Investigation
HyD	Highways Department
HAC	Harbour City
HKCC	Hong Kong Cultural Centre
HKPSG	Hong Kong Planning Standards and Guidelines
HKSAR	Hong Kong Special Administration Region
HKSM	Hong Kong Space Museum
HOKLAS	Hong Kong Laboratory Accreditation Scheme
ICOMOS	International Charter for the Conservation and Restoration of Monuments and Sites
IEC	Independent Environmental Checker
ITR	Indirect Technical Remedies

KCRC	Kowloon Canton Railway Corporation
KPDCP	Kowloon Park Drive Children's Playground
KSL	Kowloon Southern Link
LCSD	Leisure and Cultural Services Department
Mbgl	Metre Below Ground Level
MTRC	Mass Transit Railway Corporation
MDG	Moderately Decomposed Granite
1⁄3 NAC	Nam Cheong
NCO	Noise Control Ordinance
NSRs	Noise Sensitive Receivers
OFSB	Old Fire Station Buildings
OZP	Outline Zoning Plan
PAH	Polyaromatic Hydrocarbon
PCW	Prescribed Construction Work
PFA	Pulverised Fuel Ash
PlanD	Planning Department
PME	Powered Mechanical Equipment
ProPECC	Practice Note for Professional Persons
RAP	Remediation Action Plan
RBSL	Risk-based Screening Level
RDS-2	Second Railway Development Study
SDG	Slightly Decomposed Granite
SPME	Specified Powered Mechanical Equipment
SS	Suspended Solid
STC	Sound Transmission Class
SWL	Sound Power Level
TBM	Tunnel Boring Machine
TCLP	Toxicity Characteristic Leaching Procedure
TIN	Total Inorganic Nitrogen
TL	Transmission Loss
TMs	Technical Memoranda
TM-GW	Technical Memorandum on Noise from Construction Work other than Percussive Piling
TM-DA	Technical Memorandum on Noise from Construction Work in Designated Areas
TM-EIA	Technical Memorandum on Environmental Impact Assessment Process
TM-Places	Technical Memorandum on Noise from Places other than Domestic Premises, Public Places or Construction Sites
TM-PP	Technical Memorandum on Noise from Percussive Piling
TM-Water	Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
TPH	Total Petroleum Hydrocarbon
TSP	Total Suspended Particulates
TST	Tsim Sha Tsui
USEPA	United State Environmental Protection Agency
VHWCZ	Victoria Harbour Water Control Zone
VSR	Visually Sensitive Receivers
WBTC	Works Branch Technical Circular
WDO	Waste Disposal Ordinance
WKCD	West Kowloon Cultural District
WKN	West Kowloon Station
WMP	Waste Management Plan
WPCO	Water Pollution Control Ordinance
WQO	Water Quality Objective
WR	West Rail
WSD	Water Services Department
WSR	Water Sensitive Receiver
YMT	Yau Ma Tei
ZVI	Zone of Visual Influence

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1. INTRODUCTION

Ove Arup & Partners (Arup) was commissioned by Kowloon Canton Railway Corporation (the Project Proponent) to undertake an Environmental Impact Assessment (EIA) of the proposed Kowloon Southern Link (KSL).

1.1 EIA Study Brief

The proposed KSL project is classified as a designated project under Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO). In accordance with the requirements of Section 5(1) of the EIAO, a project profile (No. PP-160/2002) [1-1] was submitted to Environmental Protection Department (EPD) for the application of an EIA Study Brief on 21 January 2002. Pursuant to Section 5(7)(a) of the EIAO, EPD issued to the Project Proponent a study brief (ref: EIA Study Brief No: ESB-097/2002 dated March 2002) [1-2] to carry out an EIA study.

1.2 Background Information & Previous Studies

A preliminary assessment of the environmental issues of KSL and a study of the pros and cons of the 4 alignment options were provided in a Preliminary Project Feasibility Study of KSL completed in 2001[1-3] & [1-4]. The key environmental issues of the proposed project and the considerations on the alignment options have been further elaborated and reviewed in this EIA Report (see **Chapter 3**).

1.3 Project Description

1.3.1 *Key Elements*

The Project Proponent proposes to construct and operate a new railway line as shown in **Figure 1-1** to improve the accessibility to Tsim Sha Tsui (TST) and West Kowloon districts. The proposed 3.7km underground railway will connect the new KCRC East TST Station to the current West Rail (WR) Nam Cheong (NAC) Station, with its alignment running under Salisbury Road, Canton Road and the West Kowloon Reclamation area.

There were two stations originally planned along the KSL alignment, namely the Canton Road Station (CAR) and the West Kowloon Station (WKN). The plan for CAR has been deferred and there is also no confirmed implementation plan for any topside property development for the WKN. In addition, the originally proposed subway under Haiphong Road and/or Peking Road for connection between the existing MTR TST Station and the CAR has been shelved. Any future incorporation of a station at Canton Road shall be subject to consideration of material change to a designated project. If any Essential Project Infrastructure Works, such as subway connection, is to be implemented in the future as part of the railway upgrade, the EIAO framework will apply to determine whether it constitutes a material change.

Two ventilation / plant buildings would be required along the alignment to provide tunnel cooling and ventilation: Yau Mai Tei (YMT) Ventilation Building is located between the WKN and the WR NAC; and Canton Road Plant Building (CRPB) is located at the junction of Kowloon Park Drive and Canton Road. Necessary mechanical plant items will be accommodated within the WKN and at the ventilation / plant buildings.

In addition, a freshwater cooling facility will be provided to serve the environmental control requirements for WKN and the tunnels. Neither reclamation nor dredging works are anticipated for KSL at this stage.

Detailed descriptions of the project elements and their corresponding construction methodologies are presented in **Chapter 4**.

1.3.2 *Construction Programme*

The construction work will commence in early 2005 and is scheduled to be completed by late 2007. Testing and commissioning of the railway system will immediately follow with target completion for operation in late 2008 / early 2009.

1.3.3 *Train Services*

Upon completion of KSL, the WR train service will terminate at Hung Hom. Train services will extend through the nighttime period on special occasions to cater for the needs during festivals (for example, Christmas Eve, Chinese New Year, etc.). WR type Electric Multiple Units (EMUs) will be deployed on KSL to serve passengers. Maintenance trains are organised only for emergency and during scheduled services.

1.4 Scenarios for With and Without the Project

The project will create an efficient transportation link between the West Kowloon area and TST, and provide access for the public to an environmental friendly transport system for travel connection between WR, East Rail and MTR. It offers an alternative route for cross-harbour passengers originated from the North West New Territories and will greatly enhance the public transport infrastructure network of Sham Shui Po and Yau Tsim Mong districts. Population from these two districts as well as tourists travelling from the TST area will be directly benefited.

Inevitably, temporary environmental impacts will be induced on the existing environment along the alignment from some of the construction activities. Environmental friendly construction methodologies and appropriate mitigation measures will be implemented to ensure all the impacts are minimized to acceptable levels (see **Chapters 4 –12** for details).

When completed and in operation, permanent changes to the environment and controlled acceptable impacts may be experienced by individuals. However, in the absence of KSL, passengers travelling between WR NAC and TST will solely rely on road-based transport, which will result in increasing road traffic and contribution to additional noise and air pollution issues local to the districts. Also, cross-harbour passengers originated from Northwest New Territories community on East Rail will suffer a longer journey time on travelling.

1.5 Concurrent Projects & Essential Public Infrastructure Works

There are several confirmed projects in the vicinity of KSL works area, as summarised in Table 1-1. At this stage, consideration of concurrent projects for cumulative environmental impacts will only take into account those with confirmed implementation programme.

Table 1-1 : Confirmed projects identified in the vicinity of KSL works area and key dates

Project	Key Date for Construction	
	Commencement	Completion
KCRC East Rail Extension	Jan 2001 [1]	Mid 2004 [1]
Salisbury Road Underpass and Associated Road Improvement Works including Middle Road Circulation System	Early 2002 [2]	Late 2004 [2]

Project	Key Date for Construction	
	Commencement	Completion
Modifications to MTRC TST Station	April 2002	End 2005 [3]
FMPHQ	Early 2004 [4]	Mid 2006 [4]
WKCD	April 2007[5]	2011-2013[5]
Post Secondary College at junction of Hoi Ting Road & Hoi Wang Road	2005/2006[6]	Not available
Cultural Square Development at Salisbury Road	2005 [7]	2007[7]
Pedestrian Piazza	2007[8]	2008[8]
Road D1/D1A (potentially entrusted to KCRC projects)	Tentatively in late 2007[7]	-
Road D12 (eastern section to be potentially entrusted to KCRC projects)	Tentatively in late 2007 (for potentially entrusted work) [7]	-
Hong Kong Girl Guides Association Headquarter	Early 2005[8]	Late 2007[8]
Secondary school at Yau Cheung Road	2007/08[8]	2009/10[8]
China Light Power Electricity Substation	Late 2004[8]	2007[8]

Note:
[1] It is confirmed by the Project Proponent that all construction of ERE will be completed before commencement of the KSL.
[2] It is confirmed by HyD that all Salisbury Road widening works have been completed in August 2002. Construction of the entrusted works to KCRC ERE will be completed before commencement of the KSL.
[3] Information as extracted from EIAO web site.
[4] Reference has been made to Project Profile DIR-094/2003 submitted for application for direct EP for FMPHQ.
[5] Based on "Invitation for Proposal" for West Kowloon Cultural District.
[6] The commencement date was advised by Education and Manpower Bureau.
[7] The tentative programme was advised by the Project Proponent.
[8] Based on discussion with the respective project proponents.

It is noted that the civil construction works for the following three projects will be completed before commencement of the construction of KSL and hence there will be no concurrent activities.

(1) KCRC East Rail Extension

- KCRC East Rail Extension will be completed before commencement of KSL works.

(2) Salisbury Road underpass

- For Salisbury Road underpass, the major excavation works are entrusted to KCRC East Rail Extension (ERE), which will be completed before commencement of the KSL while the remaining Salisbury Road widening works have already been completed by Highways Department (HyD) in August 2002.

(3) Modification to MTRC TST Station

- According to the latest information from the approved EIA of the "Modification to MTRC TST Station"[1-5], all backfilling and road reinstatement work for the MTR Station in Nathan Road will be completed by late 2004. The remaining works are electrical and mechanical (E&M) fitting out, and architectural and builders works & finishes (ABWF) for concourses only which will be completed by end of 2005. Overlapping of civil construction works with KSL is not anticipated.

There are ten possible concurrent projects and they are described as follows (see **Figures 1-2-1** and **1-2-2**). Their cumulative environmental impacts are addressed in the respective chapters of this report.

(1) Former Marine Police Headquarters

- According to the recent approved Project Profile (DIR-094/2003) submitted for application for direct EP for the "*Development at Former Marine Police Headquarters*

KIL11161" [1-6], the proposed construction period of the FMPHQ site is planned for 30 months and will commence in early 2004. It will overlap with the KSL construction.

- A summary of the construction activities during the overlapping period of the two projects is given in Table 1-2.

Table 1-2: Construction activities during the overlapping construction period with FMPHQ

Period	Construction Activities	
	KSL [1]	FMPHQ
Mar 05 – May 05	Utilities diversion along Salisbury Road & at the Emergency Egress Point (EEP) and construction of access shaft	Remaining excavation
Jun 05 – Mar 06	Remaining utilities diversion work at EEP and construction of access shaft Temporary wall & decking along Salisbury Road & at EEP and construction of access shaft Excavation at EEP and construction of access shaft	Remaining excavation + Superstructure work
Apr 06 – Oct 06	Excavation along Salisbury Road	Superstructure work

Note:
[1] Refer to **Chapter 4** for the construction programme and methodology.

(2) West Kowloon Cultural District (WKCD)

- The latest information for WKCD at the time of preparing this EIA is available from the government website. It is noted that the proposal for WKCD has been submitted in middle of June 2004. According to Addendum No. 3 to the Invitation for Proposal for the WKCD [1-7] issued on 30 March 2004, the construction of the WKCD is anticipated to commence in April 2007, with completion and operation of the core arts and cultural facilities in phases by 2011 to 2013. There is currently no available information on the construction programme / methododlogy / phasing and its cumulative environmental impacts will be addressed by reasonable assumptions.

- The major KSL construction activities in the vicinity of WKCD are the construction of WKN which will be undertaken from March 2005 to December 2007. In accordance with the construction programme of KSL, all excavation works for WKN will be completed by September 2006. The remaining works are construction of superstructure (to be completed by September 2007) and station fit-out works. Hence, the overlapping period between the WKCD and the superstructure construction of WKN would be relatively short from May to Sept 2007 (and possibly shorter or even without overlapping at all in consideration of 2-3 months of mobilisation period of WKCD Contractor to be on site).

(3) Post-secondary College

- It is advised by Education and Manpower Bureau that construction of the Post-secondary College at junction of Hoi Ting Road and Hoi Wang Road will commence in 2005/2006. It will overlap with the construction of WKN northern tunnel for KSL. Similar to WKCD, there currently is no available information on construction programme and methododology, its cumulative environmental impacts will be addressed by making reasonable assumptions.

(4) Cultural Square Development

- The proposed Cultural Square Development is located at Salisbury Road and it is noted that the project will be constructed concurrently with the Salisbury Road tunnel section of the KSL from 2005 to 2007. There is currently no available information on construction programme and methodology, and its cumulative environmental impacts will be addressed by reasonable assumptions.

(5) Pedestrian Piazza

- The proposed pedestrian piazza is located at the existing Star Ferry Public Transport Interchange (PTI). Subject to the relocation of the Star Ferry PTI in 2006/2007, the works for the open plaza would commence in 2007 for completion in 2008. Its construction will be undertaken concurrently with the Salisbury Road tunnel section of the KSL in 2007. There is currently no available information on construction programme and methodology, and its cumulative environmental impacts will be addressed by reasonable assumptions.

(6) Road D12

- The proposed Road D12 would come into operation at the same time as KSL in 2008/2009. There is no currently available information on construction programme and methodology, and its cumulative environmental impacts will be addressed by reasonable assumptions. However, for the eastern section of Road D12, which lies partially within the gazettal boundary of the KSL project, it is advised that the construction work will potentially be entrusted to KCRC as a separate project, subject to confirmation. A separate Environmental Permit (EP) will be applied from EPD for construction and operation of the roadworks. The Project Proponent would schedule the construction works and allow programme phrasing to avoid major concurrent activities to be undertaken simultaneously in the vicinity. Construction of roadworks is likely to commence in late 2007 when all civil works of WKN are completed. Cumulative impacts are therefore not anticipated.

- The roadwork for the western section of Road D12 has already completed.

(7) Road D1/D1A

- The proposed Road D1/D1A would come into operation at the same time as KSL in 2008/2009. There is currently no available information on construction programme and methodology, and its cumulative environmental impacts will be addressed by reasonable assumptions. However, it is advised that the construction work will potentially be entrusted to KCRC as a separate project subject to confirmation. A separate Environmental Permit (EP) will be applied from EPD for construction and operation of the roadworks. The Project Proponent would schedule the construction works and allow programme phasing to avoid major concurrent activities to be undertaken simultaneously in the vicinity. Construction of roadworks is likely to commence in late 2007 when all civil works of WKN and the nearest tunnel section are completed.

(8) Hong Kong Girl Guides Association Headquarter

- The proposed Hong Kong Girl Guides Association Headquarter is located at the junction of Jordon Road and Ferry Street. It is anticipated that the construction works will be undertaken concurrently with the construction of WKN and the northern tunnel of KSL from 2005 to 2007. There is currently no available information on construction programme and methodology, and its cumulative environmental impacts will be addressed by reasonable assumptions.

(9) Secondary School

- The proposed secondary school is located at the junction of Hoi Wang Road and Yau Cheung Road. The construction is scheduled to commence in 2007/08 and for completion by 2009/10. In accordance with the construction programme of KSL, all excavation works of the WKN northern tunnel for this section will be completed in September 2006, and the remaining works are only superstructure, backfilling and road reinstatement which will be completed by May 2007. Taking into account 2 months mobilisation period for the school project, the constructions are very unlikely to be concurrent with that of KSL.

(10) China Light Power Electricity Substation

- The China Light Power (CLP) electricity substation is planned at Lai Cheung Road. It is scheduled to be constructed in late 2004 for completion in 2007, and hence will overlap with the construction of northern tunnel of KSL. It is anticipated that most of the construction activities for this concurrent project would be superstructure works.

1.6 Structure of EIA Report

The structure of this EIA report is outlined below for easy reference:

Chapter	Title	Aims
1	Introduction	Introduces the background information and the layout of the EIA report
2	Study Scope	Outlines the objectives and scope for various environmental aspects
3	Selection of the Preferred Alignment	Summaries the options considered and presents the associated benefits and disbenefits
4	Construction Methodologies for the Selected Route Alignment	Summaries the construction programme and methodologies for the selected alignment option
5	Construction Dust Impact Assessment	Presents the legislation, methodology, assessment and recommendations for air quality impacts during construction phase
6	Airborne Noise Impact Assessment	Presents the legislation, methodology, assessment and recommendations for airborne noise impacts
7	Groundborne Noise Impact Assessment	Presents the legislation, methodology and assessment for groundborne noise impacts
8	Water Quality Impact Assessment	Presents the legislation, methodology, assessment and recommendations for water quality impacts
9	Waste Management Implications	Presents the legislation, methodology, assessment and recommendations for waste management
10	Land Contamination Assessment	Presents the legislation, methodology, assessment and recommendations for land contamination
11	Landscape and Visual Impact Assessment	Presents the legislation, methodology, assessment and recommendations for landscape and visual impacts
12	Cultural Heritage Impact Assessment	Presents the legislation, methodology, assessment and recommendations for cultural heritage

Chapter	Title	Aims
	Assessment	recommendations for cultural heritage
13	Hazard Assessment	Presents the legislation, methodology and requirements
14	Environmental Monitoring and Auditing Requirements	Presents the requirements for EM&A
15	Summary of Environmental Outcomes	Summarises environmental outcomes and benefits
16	Conclusions	Summarises the findings
17	References	Presents the relevant reference information

2. STUDY SCOPE

According to the Study Brief, the EIA should address the following:

- The considerations on alternative rail alignments, station designs and associated structures;
- The considerations on alternative tunnel construction methods, and the assumptions, uncertainties and risks implicit to each tunnel construction methods with respect to potential impacts on sensitive receivers during construction and operational phases;
- The considerations on the adverse effects due to the construction and operation of the proposed railway on the operational performance of the affected sensitive receivers including the Hong Kong Space Museum (HKSM) and the Hong Kong Cultural Centre (HKCC). The study will address the details of the construction programme, the construction methodologies, with an assessment of the extent to which the technologies to be employed are the best available proven technologies in order to avoid or mitigate potential adverse impacts to the maximum practicable extent;
- The construction and operational groundborne noise impacts on HKSM and HKCC;
- The potential airborne and dust impacts arising from the construction activities on the neighbouring sensitive receivers including residential units and schools;
- The operational noise impacts of the proposed ventilation shafts on the receivers;
- The potential cultural heritage impacts on the monuments and graded buildings including, but not limited to FMPHQ, KCR Terminus Clock Tower, Old Fire Station Buildings (OFSB), Peninsula Hotel;
- The potential impacts associated with the spoil generation and its transportation, stockpiling and disposal arrangements during the construction phase;
- The potential contamination impacts caused by the soil, marine deposit underneath the existing fill material during excavation works;
- The potential landscape and visual impacts of the construction activities, works area, ventilation shafts and other major structures above ground level, and also the impacts on the landscape elements including Champion trees and protected species;
- The cumulative environmental impacts caused by other concurrent projects;
- The environmental impacts of the Project including its alignment and ancillary infrastructures on the existing and planned uses and the likely environmental benefits of the rail.

3. SELECTION OF THE PREFERRED ALIGNMENT

3.1 Alignment Options Considered

The alignment is divided into two main sections due north and south with respect to the proposed West Kowloon Station (WKN). The northern section runs almost parallel to the existing Airport Express Line leading to the WR NAC. It basically follows the alignment proposed in the Railway Development Strategy 2000 (RDS-2000) [3-1]. The alignment in this northern section runs in the narrow corridor between the existing Airport Express Line, West Kowloon Expressway and various planned developments in the vicinity. All these constraints prohibit any alternative corridors or even very minor deviations to the alignment proposed in the RDS-2000 Report.

The original southern portion of the RDS-2000 alignment assumed the implementation of the Kowloon Point Reclamation and the location of the Kowloon Point Station on the reclaimed land. However, as the Kowloon Point Reclamation will not be implemented, it is impossible to adopt the original RDS-2000 alignment. Alternative alignments have therefore been identified.

The developments along the southern portion of the alignment comprise of mainly high-rise buildings with piled foundations. Engineering constraints prevent any alignment options passing underneath these buildings to minimise impacts thereon (refer to the following sections and **Figures 3-3 to 3-5**). Accordingly, alternative alignments that follow the existing main road corridors were developed since they would have minimal impact on the neighbouring buildings. The following 4 alignment options have therefore been investigated (**Figure 3-1**).

A summary of the alignment options is given below:

Table 3-1 : Alignment options

Alignment Option	Description	Inland	Seaward	Remarks
1	Canton Road Scheme	Yes		**Figures 3-2-1 to 3-2-3**
2	Kowloon Park Drive Scheme	Yes		**Figures 3-3-1 to 3-3-3**
3	Kowloon Point Scheme (Note 1)		Yes	**Figures 3-4-1 to 3-4-3**
4	Harbour City Scheme		Yes	**Figures 3-5–1 to 3-5-3**

Note 1 The original alignment in the RDS-2000 followed Middle Road instead of Salisbury Road. Further study of the Middle Road option in the ER Extension between TST and Hung Hom [ref. East Rail - Extension - Hung Hom To Tsim Sha Tsui – EIA, EIA-036/1999] revealed that a section of Signal Hill would need to be removed for construction of the ETS station. As such, the Project Proponent adopted the Salisbury Road option and subsequently EIA report was approved under the EIAO in 2000.

3.1.1 *Alignment Option 1: The Canton Road Scheme*

Commencing from East Tsim Sha Tsui Station (ETS) the route runs westwards along Salisbury Road, and then turns northwards with a tight radius curve underneath the site of the FMPHQ into the Canton Road corridor (**Figures 3-2-1 to 3-2-3**).

The Canton Road Station (CAR) originally proposed in the EIA Study Brief was approximately centred on the junction of Canton Road and Haiphong Road. The tunnels then pass beneath the Kowloon Park Drive Flyover and then turn to the northwest at the TST Fire Station into the West Kowloon reclamation area. However, the CAR has been deferred and there is currently no

programme for its implementation. Any additional future station would require an environmental permit to be applied separately under the EIAO.

3.1.2 *Alignment Option 2 : The Kowloon Park Drive Scheme*

The Kowloon Park Drive Scheme is another inland route option roughly parallel to the Canton Road Scheme. This alignment takes the same route as the Canton Road alignment along Salisbury Road, then takes a very tight radius curve beneath the YMCA Building into Kowloon Park Drive (**Figures 3-3-1 to 3-3-3**).

The proposed Kowloon Park Station would be situated partly below the existing Haiphong Road Temporary Market and partly under Kowloon Park and the Kowloon Park Drive Children's Playground (KPDCP). At the north of Kowloon Park Station the approach tunnels avoid Kowloon Park Drive Flyover by being routed under Kowloon Park before turning northwest into the West Kowloon reclamation area at the TST Fire Station.

3.1.3 *Alignment Option 3 : The Kowloon Point Scheme*

The Kowloon Point Scheme is based on the route proposed in the RDS-2000. However, the scheme has been modified to suit the current location of the ETS with alignment along Salisbury Road instead of running beneath Middle Road and under Ocean Centre (**Figures 3-4-1 to 3-4-3**).

Again, following the same route as the Canton Road alignment along Salisbury Road, the tunnels descend at maximum gradient after passing over the MTR Tsuen Wan Line tunnels before entering the harbour near the Star Ferry Piers. The tunnel section in the harbour would probably involve immersed tube construction beneath the seabed.

The proposed Kowloon Point Station would be located in the Kowloon Point Reclamation. At the north of the site for Kowloon Point Station the alignment runs due north before connecting with the West Kowloon Reclamation and WKN. However, the Kowloon Point Reclamation which is required for the construction of Kowloon Point Station, will not be implemented.

3.1.4 *Alignment Option 4: The Harbour City Scheme*

The alignment runs along Salisbury Road and then turns with a tight curve underneath Star House and the Marco Polo Hong Kong Hotel, continuing northwards adjacent to the Harbour City seawall (**Figures 3-5-1 to 3-5-3**).

The proposed Harbour City Station would be located adjacent and parallel to the existing seawall outside the Gateway commercial tower blocks. At the north of Harbour City Station, the alignment continues alongside the China Hong Kong City into the West Kowloon Reclamation and then to WKN.

3.2 Selection of the Preferred Alignment

3.2.1 *Reasoning for Choosing the Preferred Alignment*

The 4 alignment options were evaluated on the basis of the critical factors that dictated the route selection process [3-2] which include:

Engineering Factors :

- Resumption of buildings
- Accessibility and connectivity

- Reclamation

Environmental Factors :

- Landscape resources
- Construction noise and dust
- Visual impacts
- Heritage buildings
- Waste generation
- Groundborne noise & vibration
- Impacts on parks
- Ecology and water quality

Other Factors :

- Disruption to harbour activities
- Commercial and cultural activities

3.2.1.1 *Resumption of Buildings*

The resumption requirements for the 4 alignment options are summarised in Table 3-2 below.

Table 3-2: Resumption requirements

Alignment Option	Description	Resumption requirements
1	Canton Road Scheme	• Not required
2	Kowloon Park Drive Scheme	• YMCA Building • Fuk Tak Koo Temple
3	Kowloon Point Scheme	• Not required
4	Harbour City Scheme	• Star House • Marco Polo Hong Kong Hotel (unless underpinning can be achieved with a deeper rail alignment)

Careful design and planning of the Canton Road Scheme has eliminated the need for temporary possession of the Haiphong Road Temporary Market during construction period and thus avoid any impact on Fuk Tak Koo Temple (see **Chapter 4**). Both Canton Road and Kowloon Point Schemes therefore do not require resumption of private buildings.

Unlike the Canton Road and Kowloon Point Schemes, the Kowloon Park Drive and Harbour City Schemes would require resumption of buildings. The piled foundations of the buildings have imposed constraints on the alignment of the railway in such a way that unless the buildings are resumed, a feasible alignment beneath the buildings is not possible. Specific for Kowloon Park Drive Scheme, it would likely require temporary or permanent possession of the Haiphong Road Temporary Market and resumption of the Fuk Tak Koo Temple, in addition to the YMCA Building, which is a recently renovated hostel providing accommodation (about 360 rooms) for tourists in the TST area.

Similarly, the Harbour City Scheme would require resumption of Star House and Marco Polo Hong Kong Hotel. Star House is a commercial building owned by multiple owners. Its plot ratio is near to the permissible limit and hence there is little incentive for redevelopment. Marco Polo Hong Kong Hotel is a well-established hotel located next to Ocean Terminal providing over 600 rooms and suites for accommodation. Although underpinning for the Marco Polo HK Hotel is feasible, a strata resumption would be required which will severely constrain the flexibility for redevelopment on this lot.

The YMCA Building, Star House and the Marco Polo Hong Kong Hotels are located within the business area of TST which is one of the locations favoured by tourists. These guestrooms and commercial buildings have great significance for the tourism industry. The lead-time for resumption of these private buildings is anticipated to be long, given the likelihood of objections from the tenants and the landlords. This obviously imposes an implicit programming risk which would critically impact the construction programme and the subsequent project completion date. As such, it is desirable to avoid such a risk as far as practicable. Kowloon Park Drive and Harbour City Schemes are therefore comparably less practicable to Canton Road and Kowloon Point Schemes in this respect.

3.2.1.2 *Accessibility and Connectivity*

Latest design for Canton Road Scheme (see **Chapter 4**) has included only one station at West Kowloon with a design provision for future CAR. In order to provide a meaningful comparison of accessibility and connectivity with the other three schemes of two stations, the deferred CAR for Canton Road Scheme has been included in the evaluation. Any future incorporation of a station at Canton Road shall require consideration of material change to a designated project.

Both the Canton Road and Kowloon Park Drive Schemes are strategically located between Nathan Road and Canton Road which are the key business areas in TST. Passengers will be greatly benefited by the good accessibility of these two schemes.

However, there can be no connection to the proposed Kowloon Point Station under the Kowloon Point Scheme until completion of the Kowloon Point Reclamation, which will not be implemented in future. It is therefore not possible to proceed with the Kowloon Point Scheme (including the Kowloon Point Station) at this time. If the Kowloon Point Scheme were to be built without the Kowloon Point Station, the entire railway will not be able to serve the large patronage anticipated from the commercial activities along Canton Road. This option is therefore not desirable from a transport planning perspective.

The Harbour City scheme will require the Harbour City Station to be placed parallel to the seawall. Accessibility to the Harbour City Station would not be favourable by the passengers from the areas between Nathan Road and Canton Road. The Harbour City Station will also be approximately 200m further away from the MTR TST Station as compared to the Kowloon Park Station for the Kowloon Park Drive Scheme.

A summary of the accessibility and connectivity issues is given in Table 3-3.

Table 3-3 : Issues relating to accessibility & connectivity

Alignment Option	Description	Issues
1	Canton Road Scheme	• Good accessibility & connectivity [1]
2	Kowloon Park Drive Scheme	• Good accessibility & connectivity • Kowloon Park Station can be linked to MTR TST Station
3	Kowloon Point Scheme	• No access to Kowloon Point Station at this time • Not favourable in terms of accessibility and connectivity
4	Harbour City Scheme	• Not favourable in terms of accessibility and connectivity

Note:
[1] Good when assuming there is the CAR station.

Nonetheless, since CAR is deferred at this stage, the Canton Road Scheme is comparably less attractive than Kowloon Park Drive Scheme in consideration of accessibility & connectivity.

3.2.1.3 *Reclamation*

It has been assumed in the Kowloon Point Scheme that reclamation in Kowloon Point would be implemented. This is however inconsistent with the general principle of the "Protection of Harbour Ordinance" that stipulates the presumption against reclamation works unless with overriding public need, and encourages protection and preservation of the harbour as a special public asset and a natural heritage of Hong Kong.

According to the Court of Final Appeal judgement, the presumption against reclamation under the Protection of Harbour Ordinance can only be rebutted by establishing an overriding public need for reclamation, with public needs being the community needs including economic, environmental and social needs. In addition, the Government has announced that there will be no more reclamation other than South East Kowloon Development, Central Reclamation Phase III and Wanchai Reclamation Phase II. As such, the Kowloon Point Scheme is not preferred as compared to the Canton Road and Kowloon Park Schemes.

3.2.2 *Environmental Factors*

3.2.2.1 *Landscape Resources*

Trees in the KPDCP would be affected by the Kowloon Park Drive Scheme. It is also likely to encroach into Kowloon Park during construction and therefore may also affect some of the trees (including the Champion trees along Haiphong Road) and plantation in the park.

Possession of KPDCP is not required for Canton Road (except for a relatively small open space at the junction of Canton Road and Kowloon Park Drive), Kowloon Point and Harbour City schemes, and hence would have no impacts on the Champion trees along Haiphong Road. For Canton Road Scheme in particular, the original Haiphong Road subway has been shelved (see **S1.3.1**) and hence the impacts on Champion trees along Haiphong Road have been avoided. There would be however relatively minor potential impacts on trees along Salisbury Road and West Kowloon which are less sensitive areas as compared to the KPDCP. Besides, the construction of an emergency egress point in front of the existing retaining wall for the FMPHQ under the gazettal for the current Canton Road Scheme does not require any modifications to the wall and will therefore have no impact on these landscape resources. In short, Kowloon Park Drive Scheme is less favourable in this respect.

3.2.2.2 *Construction Noise and Dust*

All of the schemes would have similar alignments along Salisbury Road and hence the construction noise and fugitive dust impacts on the neighbouring area would be similar. Both the Kowloon Point and Harbour City Schemes are located further away from residential units along Canton Road that are sensitive to construction noise and dust. The alignment of the Kowloon Point Scheme would however be much closer to the existing residential development atop the AEL Kowloon Station. These residential buildings are sensitive to both construction noise and fugitive dust.

The current design of the Canton Road Scheme will adopt bored tunnelling method (ie using a tunnel boring machine, see **Chapter 4**). By using bored tunnelling, a more environmental friendly method, most of the construction activities will be conducted underground except some construction plant items near to the mucking out locations. This will minimise the construction noise and dust impacts on the sensitive uses along Canton Road to the maximum practicable extent during the construction period.

The construction phase environmental impacts caused by Kowloon Park Drive Scheme would be similar to Canton Road Scheme if bored tunnelling could also be adopted. However, if there are other constraints that dictate the use of cut-&-cover construction techniques, it is anticipated that the associated environmental impacts would be higher, especially for the residential units in Hankow Centre along Ashley Road.

3.2.2.3 *Visual Impacts*

All of the alignment options would have similar temporary visual impacts during construction phase on the section along Salisbury Road, which is one of the strategic locations for tourists and cultural events.

The Canton Road Scheme will have no visual impacts during construction of the tunnels along Canton Road (also a popular spot for tourists) by adopting bored tunnelling, except at locations near to the launching shaft and recovery shaft (please refer the location to **Figure 4-1-1**). Similar to construction noise and dust as described in **S3.2.2.2**, the construction phase visual impacts caused by Kowloon Park Drive Scheme would be similar to Canton Road Scheme if bored tunnelling could also be adopted. However, if there are other constraints that dictate the use of cut-&-cover construction techniques, it is anticipated that the associated visual impacts would be higher, especially for the residential units in Hankow Centre along Ashley Road.

Both the Kowloon Point and Harbour City Schemes would require reclamation and dredging in the harbour which is an important visual asset for people in Hong Kong and tourists. These reclamation works and dredging would inevitably require construction vessels to operate within the harbour. This would then have impacts on the attractiveness and visual appeal of the harbour as a result of the marine based construction activities. Hence, the Kowloon Point and Harbour City Scheme are not preferred in this respect.

During the operational phase, the Canton Road, Kowloon Point and Harbour City Schemes would have similar degree of impacts caused by above ground structures including plant buildings, station entrance, etc. As the Kowloon Park Drive Scheme would likely affect the Champion trees along Haiphong Road (see **S3.2.2.1**) and the Kowloon Park (see **S3.2.2.7**), it is anticipated that the associated visual impacts would be higher than other schemes. Hence, Kowloon Park Drive is less preferred in this respect.

3.2.2.4 *Heritage Buildings*

The status of key heritage buildings within the study areas for the 4 alignment options is identified in Table 3-4 below.

Table 3-4 : Status of heritage buildings

Heritage Resources	Status
FMPHQ (including old fire station accommodation block)	Declared monument
Former Kowloon-Canton Railway Clock Tower	Declared monument
Peninsula Hotel	Historical building (not yet graded)
Whitfield Barracks (Blocks S4, 58, S61 and S62)	Grade III buildings
Old Fire Station Main Hall	Grade III buildings
Kowloon West II Battery of the Former Whitfield Barracks	Grade I buildings
Saint Andrew's Church	Grade II building

Direct impact on the heritage buildings: KCR Clock Tower, Peninsula Hotel, Whitfield Barracks, and Kowloon West II Battery can be avoided from all alignment options.

The Canton Road Scheme will however run underneath the Old Fire Station Buildings (OFSB) on the FMPHQ site which is being redeveloped. A vertical clearance of 6 – 16m will be maintained between these buildings and the top of KSL tunnels to minimise any impacts. The construction methodology (ie mined tunnelling in **Chapter 4**) will avoid physical contact with the OFSB, and hence the OFSB will be kept intact during the construction period (see **Chapter 4**).

3.2.2.5 *Waste Generation*

The Kowloon Point Scheme and Harbour City Scheme would inevitably require dredging of marine sediment around the harbour area. Depending on the level of contamination, the sediment would need to be disposed of either in open sea or in confined mud pits. It is unlikely that these dredged sediments can be re-used in this or other construction projects. On this basis, the Kowloon Point Scheme and Harbour City Scheme are less preferred when compared to the Canton Road and Kowloon Park Drive Schemes.

The bulk volume of excavated material requiring disposal for the Canton Road Scheme (using bored tunnelling) is up to approximately 0.99 M m^3 (see **Chapter 9**) while the Kowloon Park Drive Scheme would generate about 1.4M m^3, including the waste from the demolition of YMCA Building. The total volume of waste generated from the Kowloon Park Drive Scheme would be about 40% higher than that of the Canton Road Scheme. Hence, Canton Road Scheme is preferred when compared to the Kowloon Park Drive Scheme.

3.2.2.6 *Groundborne Noise & Vibration*

The Kowloon Park Drive Scheme tunnels would need to negotiate a very tight curve of 180m near the junction between Salisbury Road and Kowloon Park Drive. Such a tight curve is far below the acceptable design limit and would have impact on the line capacity. On the other hand, the curvatures for other Schemes would satisfy the acceptable design limit and hence would not affect the line capacity.

Moreover, from operational viewpoint, the tight curvature for Kowloon Park Drive Scheme will increase the unbalanced force of the wheel-rail interaction and give rise to serious noise and vibration problems at the most sensitive area near HKCC and HKSM. Passenger comfort will also be compromised due to lateral vibration instability of the train. Frequent maintenance (due to rapid abrasion of tracks and wheels) and high energy consumption will also impact the services.

Details of the operational groundborne noise impacts on the FMPHQ and other sensitive receivers (including hotels, schools and residential buildings) for the Canton Road Scheme are given in **Chapter 7**. The operational groundborne noise assessment has demonstrated that, by using special trackform, all the statutory requirements for operational groundborne noise impacts for the Canton Road Scheme could be met. Since the curvature of the Harbour City Scheme and Kowloon Point Scheme are less than Canton Road Scheme, it is anticipated any groundborne noise issues could also be resolved in a similar approach. Hence, there would be no preference on Canton Road Scheme, Kowloon Point Scheme and Harbour City Scheme from groundborne noise & vibration perspective.

3.2.2.7 *Impacts on Parks*

All four alignments would affect Nam Cheong Park to the same extent. No other parks or children playgrounds will be encroached or affected by Kowloon Point and Harbour City Schemes.

The Canton Road Scheme would affect a relatively small open space at the junction of Canton Road and Kowloon Park Drive, which forms part of the Kowloon Park Drive Children's Playground.

The Kowloon Park Drive Scheme will need temporary possession of the KPDCP and, inevitably, a certain portion of the Kowloon Park near the ex-Museum of History, which is a very popular leisure area for not just the local residents but also the general public of Hong Kong. Kowloon Park Drive Scheme is therefore less desirable than the other three schemes in this respect.

3.2.2.8 *Ecology and Water Quality*

All the 4 alignment options would run along urban areas and there are no land based ecological sensitive areas in the vicinity. Tree felling will be avoided as far as practicable for all alignment options. Any trees that need to be felled/transplanted will require separate approval from relevant government departments.

For Kowloon Point and Harbour City Schemes which inevitably require dredging in the harbour, any suspended solids generated from the dredging activities will cause certain water quality impacts. Hence, the Canton Road and Kowloon Park Drive Schemes are preferred in this respect.

3.2.3 *Other Factors*

3.2.3.1 *Disruption to Harbour Activities*

Both the Kowloon Point and Harbour City Schemes would inevitably require construction activities in the harbour area directly in front of Harbour City and Star Ferry. This area is one of the busiest marine areas in HK and has both domestic and cross boundary ferry terminals.

Construction of the Kowloon Point Scheme would make use of the immersed tube method as well as requiring the underpinning of Ocean Terminal. Both construction methods are likely to disrupt this harbour area. It would also have adverse impacts on the operation of the Star Ferry which is one of the busiest locations for cross harbour commuting between Hong Kong Island and Kowloon Peninsula. It would also require extensive underpinning of Ocean Terminal and hence shipping operations at Ocean Terminal would be severely disrupted. Reprovision of the terminal deck and underpinning would create unacceptable disruption to the operations of these premises.

The Harbour City Station for the Harbour City Scheme will require protection for ship collision and hence substantial marine fenders would be necessary west of the station box. This would likely reduce the fairway areas. In addition, the station would require significant underpinning of or shortening / alteration to the existing piers. The existing seawater cooling pump house serving Harbour City Station would also require re-provisioning. Disruption to harbour activities in the vicinity would be inevitable.

Canton Road and Kowloon Park Drive Schemes are in-land routes and therefore would not involve any marine or dredging work and thus would avoid any disruption to the harbour activities.

3.2.3.2 *Commercial and Cultural Activities*

All of the 4 alignment options would inevitably affect the operation of several commercial and cultural premises alongside the alignments. These premises include performance venues, hotels and retails as summarised in Table 3-5 below:

Table 3-5 : Commercial premises and cultural venues that could possibly be affected

Alignment Option	Description	Issues
1	Canton Road Scheme	• Hotels along Salisbury Road and Canton Road • HKCC & HKSM
2	Kowloon Park Drive Scheme	• Hotels along Salisbury Road and Kowloon Park Drive • HKCC & HKSM & ex-Museum of History (to be re-opened as the Hong Kong Heritage Resource Centre) • Retail areas along Kowloon Park Drive
3	Kowloon Point Scheme	• Hotels along Salisbury Road • HKCC [1] & HKSM • Retail areas in Star House
4	Harbour City Scheme	• Hotels along Salisbury Road & Canton Road • HKCC [1] & HKSM

Note:
[1] The alignment in this option(s) is closer to the venues of the HKCC

The separation distances between alignment and HKSM for the 4 schemes are similar. However, the alignments of Kowloon Point and Harbour City Schemes would be closer to the HKCC than the Canton Road and Kowloon Park Drive Schemes. While the Kowloon Park Drive Scheme would be further away from HKCC as compared to the Canton Road Scheme, it would inevitably affect the ex-Museum of History (to be opened as the Hong Kong Heritage Resource Centre in late 2004) in Kowloon Park. The Canton Road Scheme would not affect the ex-Museum of History.

It is anticipated that careful planning and measures would be required to minimise disruptions on the operations (e.g. accessibility, loading / unloading etc) of these commercial premises and cultural venues. With the CAR for the Canton Road Scheme deferred and bored tunnelling along Canton Road adopted, disruption to the commercial premises alongside Canton Road are minimised as far as practicable.

3.2.4 *Summary of Reasoning for Route Selection*

A summary of the reasoning that has been considered during the route selection process is given below.

Table 3-6 : Summary of reasoning for route alignment selection

Criteria	Route Alignment Options			
	#1: Canton Road Scheme	#2: Kowloon Park Drive Scheme	#3: Kowloon Point Scheme	#4: Harbour City Scheme
Engineering Factors Resumption of Buildings	• Resumption of private buildings not required	• Resumption of YMCA Building (Not feasible) • Resumption of Fuk Tak Koo Temple	• Not required	• Resumption of Star House & Marco Polo HK Hotel (Not feasible)
Accessibility & Connectivity	• Less attractive with CAR deferred • Good with CAR in place	• Good	• Not desirable • No connection to Kowloon Point Station	• Not desirable
Reclamation	• Not required	• Not required	• Required (reclamation will not be implemented since it is inconsistent with the Protection of Harbour Ordinance)	• Not required
Environmental Factors				
Landscape resources	• Less impact • No impacts on champion trees	• Higher impact • Champion trees may be affected	• Less impact • No impacts on champion trees	• Less impact • No impacts on champion trees

Criteria	Route Alignment Options			
	#1: Canton Road Scheme	#2: Kowloon Park Drive Scheme	#3: Kowloon Point Scheme	#4: Harbour City Scheme
Construction noise and dust	• Minimal impact, use of bored tunnelling along Canton Road will minimize the construction noise and dust impacts, and other disruptions to the commercial premises.	• High impact if cut-&-cover needs to be adopted • Similar impacts as Canton Road Scheme if bored tunnelling is adopted	• Minimal impact (but acceptable with mitigation measures)	• Minimal impact (but acceptable with mitigation measures)
Visual impacts	• Minimal impact, use of bored tunnelling along Canton Road will minimize the visual.	• High impact if cut-&-cover needs to be adopted • Similar impacts as Canton Road Scheme if bored tunnelling is adopted	• Construction vessels will affect the attractiveness and visual appeal of the harbour	• Construction vessels will affect the attractiveness and visual appeal of the harbour
Heritage Buildings	• FMPHQ and OFSB protected by no contact construction methodology	• No impact	• No impact	• No impact
Waste generation	• No polluted sediment generation • Use of bored tunnelling can minimize the amount of excavated materials	• More excavated materials	• Potential release of polluted marine sediment	• Potential release of polluted marine sediment
Groundborne Noise & Vibration	• Operational noise & vibration can be mitigated • Train service & passenger comfort not compromised	• Unacceptable impact on the line capacity due to tight curvature of the track near the junction between Salisbury Road and Kowloon Park Drive; • More severe operational noise and vibration problems • Train services & passenger comfort compromised	• Operational noise & vibration can be mitigated • Train service & passenger comfort not compromised	• Operational noise & vibration can be mitigated • Train service & passenger comfort not compromised
Impacts on parks	• No impact on Kowloon Park • Encroach onto a relatively small open space at junction of Canton Road and Kowloon Park Drive	• Higher impact • Temporary possession of KPDCP • Encroachment into Kowloon Park	• No impact on KPDCP & Kowloon Park	• No impact on KPDCP & Kowloon Park
Ecology & Water Quality	• No ecological impact • No water quality impact	• No ecological impact • No water quality impact	• No terrestrial ecological impact • Dredging will affect water quality	• No terrestrial ecological impact • Dredging will affect water quality
Other Factors				
Disruption to harbour activities	• No impact	• No impact	• Affect harbour activities • Affect Star Ferry	• Affect harbour activities
Commercial & Cultural Activities	• Disruptions to commercial premises along Canton Road will be minimized by using bored tunnelling	• Several hotels affected • Alignment furthest away from HKCC • Ex-Museum of History would be affected	• Several hotels affected but alignment closer to the HKCC	• Several hotels affected but alignment closer to the HKCC

3.3 Conclusion

Four route alignment options were evaluated during the route selection process. A summary of the reasoning that has been considered in the route selection process is presented.

3.3.1 *Overall Summary for the Four Alignment Schemes Considered*

3.3.1.1 *Kowloon Point and Harbour City Schemes (ie the Sea-based Alignments)*

Both of these routes raise significant issues of constructability and disruption. The Harbour City Scheme is least attractive given the significant disruption to Ocean Centre, Ocean Terminal, the associated piers and the requirement for resumption of Star House and Marco Polo Hong Kong Hotel.

Kowloon Point Scheme whilst technically possible would involve large scale underpinning of Ocean Terminal and unacceptable disruption to the operations of commercial premises (including Star Ferry). Re-provisioning of the Terminal will cause adverse effect on the harbour activities.

Both of these options are not viable given the current engineering constraints with regard to disruption/resumption of buildings and ferry, protection of the harbour and the likelihood that Kowloon Point Reclamation will not proceed in the near future. These engineering constraints would in turn impose a relatively higher cost than the land based alignment options.

The dredging activities associated with these sea-based alignments will cause adverse water quality impact. Kowloon Point Scheme involves reclamation works which are also not consistent with the general principle of the "Protection of Harbour Ordinance" that stipulates the presumption against reclamation works unless with overriding public need, and encourages protection and preservation of the harbour as a special asset and a natural heritage of Hong Kong. These sea-based alignments are therefore not recommended.

3.3.1.2 *Canton Road and Kowloon Park Drive Scheme (ie Land Based Alignments)*

The Kowloon Park Drive Scheme is less favourable since it requires resumption of the YMCA building. The tight curvature of the track near the junction between Salisbury Road and Kowloon Park Drive will also impose unacceptable impact on the line capacity and cause higher train induced groundborne noise and vibration impacts on the HKCC. This scheme would also encroach into Kowloon Park and the KPDCP and hence some of the champion trees along Haiphong Road would inevitably be affected.

Latest engineering design of the Canton Road Scheme has confirmed the feasibility of adopting bored tunnelling along Canton Road without the need for resumption of private buildings. As most of the construction activities for the tunnels along Canton Road would be conducted underground, impacts from construction noise, fugitive dust, visual and disruption to the retails alongside Canton Road would be minimised during the construction phase. All the champion trees along Haiphong Roads would be kept intact and there is no requirement for temporary dismantling of the OFSB for construction. Canton Road Scheme is therefore considered to be the preferred option.

3.3.2 *Summary of Environmental Justifications for the Preferred Alignment Option*

Landscape

- The Canton Road Scheme would not encroach onto the Kowloon Park which is an important landscape and leisure asset for the local residents.

Champion trees	• The Canton Road Scheme can avoid impacts on the Champion trees along Haiphong Roads. All the Champion trees will be kept intact during both the construction and operational stages. It is better than the Kowloon Park Drive Scheme which would inevitably affect the trees along Haiphong Road, and the Kowloon Park.
Visual impacts	• Bored tunnelling will be adopted along Canton Road for the Canton Road Scheme. Most of the construction works will be conducted underground except at the mucking out locations. The visual impacts have therefore been minimised as far as practicable by using a more environmental friendly construction method. • Since the Canton Road Scheme does not require any marine works, the attractiveness and appeals of the harbour can therefore be preserved.
Construction noise & dust	• Similar to visual impacts, the use of bored tunnelling will minimise the construction noise and dust impacts as far as practicable.
Waste generation	• The Canton Road Scheme will generate less C&D materials and create no polluted marine sediment. • Due to the need for resumption of the YMCA building, the C&D waste generated from Kowloon Park Drive Scheme would be more than the Canton Road Scheme.
Ecology & water quality	• Unlike the Kowloon Point and Harbour City Schemes, the Canton Road Scheme does not require dredging of marine sediment in the Victoria Harbour. Hence, it would be much more environmental friendly in terms of marine ecology and water quality.

After reviewing all the environmental justifications, it is apparent that the Canton Road Scheme presents the most environmental friendly route put forwards for EIA study of this project.

4. CONSTRUCTION METHODOLOGIES FOR THE SELECTED ROUTE ALIGNMENT

This section outlines the details of the construction methodologies for the selected route alignment along Canton Road corridor (see **Chapter 3**). The environmental benefits and disbenefits of the construction methodologies considered are also presented.

4.1 Overview

4.1.1 *Alignment*

The KSL will complete the rail link between WR NAC Station and ER ETS Station (**Figures 4-1-1 to 4-1-3**). The alignment commences from ETS Station along Salisbury Road and enters the Canton Road corridor under the FMPHQ. It is heavily constrained both vertically and horizontally by existing buildings including HKCC, YMCA, and No 1 Peking Road, and the underground structures such as subways, MTR tunnels and highway bridge foundations, and also many utilities including drainage.

After the Canton Road corridor, the alignment runs due north to the WKN. It then passes under the western corner of Man Wui Street, under Yau Ma Tei (YMT) Interchange, Cherry Street and finally joins the NAC overrun tunnel near the Prince Edward Roundabout. The alignment is also constrained by the narrow corridor between the existing Airport Express Line / Tung Chung Line, West Kowloon Expressway and various planned development in the vicinity.

Figures 4-1-1 to 4-1-3 and **4-2-1 to 4-2-2** show the proposed alignment, station location, station entrances and connections. Other than the above-grade portion of the station, entrances to the station and ventilation / plant buildings, and a short section of tunnel near Nam Cheong Park to interface with WR, the alignment and other ancillary facilities will be underground.

The location, level and approximate dimensions of the short interface tunnel section with WR are illustrated in **Figure 4-3**. Since this section has to interface with the existing WR, there are no alternative locations outside the Nam Cheong Park. The tunnel box will be covered with topsoil and provided with landscape elements and form an integral part of the Nam Cheong Park (see **Chapter 11** for details).

4.1.2 *Train Station*

West Kowloon Station (WKN) will be located at West Kowloon on the west side of Canton Road between Austin Road and Jordan Road. The originally planned Canton Road Station (CAR) at Canton Road has been deferred and there is currently no implementation programme for this station. However, the track and tunnels are maintained horizontally for a length of 220m centred on Haiphong Road with sufficient vertical separation for the future construction of CAR. In case the CAR is confirmed in the future, it will constitute a separate EIA or variation of EP, and a separate approval under the EIAO is required.

4.1.3 *Ventilation / Plant Buildings*

The current design of the ventilation/plant building has avoided temporary possession of the KPDCP (except for a relatively small open space at the junction of Canton Road and Kowloon Park Drive) and the Haiphong Road Temporary Market by relocating the mechanical plant and other facilities to the WKN. Hence all the champion trees along Haiphong Road will not be affected. The current design has 2 ventilation / plant buildings for the KSL as follows:

- YMT ventilation / plant building located at Hoi Ting Road, and between YMT Interchange and Cherry Street (**Figure 4-4**); and
- Canton Road Plant Building (CRPB) at the junction of Kowloon Park Drive and Canton Road (**Figure 4-5**).

The selection of YMT ventilation building location was a result of agreement made with various government departments. Various locations were considered during the selection process. Location to the south of GI/C site is deemed not feasible due to future government developments. Areas near YMT Interchange are not feasible since it was reserved for the proposed Central Kowloon Route. In addition, there are no available lands for the ventilation building north of the proposed site.

The current location of YMT ventilation building is optimised such that it is halfway between Nam Cheong Station and West Kowloon Station and the emergency assembly point (EAP) is also located within the ventilation building thus minimising further land intake.

The ventilation shafts for WKN will be located at the two ends of the station (**Figures 4-2-1 and 4-2-2**). Necessary plant items will be accommodated in the ventilation / plant buildings, including transformers, water-cooled chillers, air compressors, water meters, gas cylinders, telecom, battery etc.

The latest scheme designs of the ventilation shafts have been incorporated in this EIA for visual impact assessment (see **Chapter 11**). Details (e.g. orientation) of the ventilation shafts will be further developed by the Design-&-Built Contractor. Assessment of noise impact from the ventilation building / shafts have taken account of all four different orientations and recommendation for corresponding maximum allowable sound power levels have been made.

4.1.4 *Cooling Facility*

Alternatives to conventional air-cooled system have been considered in order to increase operation energy efficiency. Both seawater and freshwater cooling systems have been studied.

Seawater cooling plant is typically 20-25% more energy efficient than conventional air-cooled system. However, the use of seawater cooling requires a pumping station and associated pipework within the WKCD site. Since the WKCD development is still in the tendering period, imposing a seawater cooling facility within the WKCD site would pose severe design constraints on the development and planning of WKCD and hence would not be acceptable. Fresh water-cooling plant is approximately 50% more energy efficient than conventional air-cooled system. Plant space occupied by the fresh water-cooling system is also much less than the conventional air-cooling system and can therefore be easily integrated within the WKN. In addition, the WKN location also falls within the zone of pilot scheme for freshwater cooling promoted by the Water Services Department (WSD). It is therefore natural to adopt freshwater cooling system the project.

The current design has allowed for a centralised fresh-water cooling facility located within the WKN to serve both the station and the tunnel (see **Figure 4-2-1** for location and approximate dimensions). Provision is also made for expansion of capacity to cater for the future CAR. The nearest existing sensitive receivers are located at more than 150m away. Operational noise impact of this facility is given in **S6.2.**

4.2 Construction Areas and Work Sites

4.2.1 *Construction Areas*

Preliminary engineering design has identified the locations of major construction areas along the alignment during the construction period (**Figures 4-1-1 to 4-1-3**). Some of the areas will be used as site offices, storage yards etc while others will be used for the construction of railway structures.

4.2.2 *Key Construction Elments*

A summary of the work sites and the key construction elements along the alignment is given in the Table 4-1 below and illustrated in **Figures 4-1-1 to 4-1-3**.

Table 4.1 : Summary of construction elements for individual worksites

Worksites		Description / Key Construction Elements
Ref	**Location**	
1	Salisbury Road	• Tunnels under Salisbury Road • Reprovisioning of New World Subway No 1
2	FMPHQ	• Tunnels beneath the existing FMPHQ
3	Between WKN and Canton Road	• Tunnels under Canton Road • CRPB, the ventilation shafts • Emergency Egress Point and Construction Access Shaft
4	WKN	• WKN • Station entrances & associated facilities.
5	WKN to Cherry Street	• YMT ventilation building • Tunnel to the north of WKN up to Cherry Street • Local culvert diversion (for culverts JR, PS, WR and DS) at locations in conflicts with the tunnel alignment. • Footbridge FB14 modification
6	Cherry Street	• Tunnel section underneath Cherry Street • Underpinning of the foundations of Footbridges A & A1, & culverts
7	Between Cherry Street and WR NAC Station	• Underground tunnels ascending to the at-grade section near Nam Cheong.

4.3 Construction Methodologies

A number of construction methodologies have been considered for construction during the design process. These include:

- Cut-&-cover tunnelling;
- Bored tunnelling; and
- Mined tunnelling.

Appendix 4-1 presents a general description of these methodologies, the key work stages (e.g. install temporary walls / D-walls, grouting, install temporary traffic decks, excavation, tunnel construction and reinstatement), typical construction plant items involved, and the associated environmental benefits and disbenefits in terms of dust, noise, vibration, waste etc. The following sections describe the construction methods recommended for various worksites and their respective relevant construction issues.

4.3.1 *Work Site 1 (Salisbury Road) (**Figure 4-1-1**)*

4.3.1.1 *Tunnels*

Bored Tunnelling

Construction of this section by bored tunnelling has been considered during the design stage and concluded unlikely to be practicable due to various constraints including East Rail Extension, subways, existing MTR etc, as summarised below.

Table 4.2: Summary of constraints along Salisbury Road

Items	Engineering Constraints
East Rail	• The KSL must match with the level gradient and cant of the overrun tunnel at the end of the ER extension
New World Subway No 1 (**Figure 4-7**)	• The KSL has to pass under the existing subway
MTR Tsuen Wan Line tunnels and box culvert in Nathan Road (**Figure 4-7**)	• The KSL must pass over the MTR Tsuen Wan Line Tunnels and pass under the DSD box culvert which runs down Nathan Road
Kowloon Park Drive Pedestrian Subway	• The KSL must pass under the Kowloon Park Drive Pedestrian Subway
Railway vertical gradient	• 3% maximum

Minimum soil cover required for safe bored tunnelling operation will be equivalent to two tunnel diameters such that arching effect for safe bored tunnelling operation could be achieved in accordance with the approved EIA Report for the East Rail Extension, Hung Hom to Tsim Sha Tsui (ref EIA036/1999). The Worksite 1 is actually a continuation of the East Rail Extension along Salisbury Road and thus the minimum two diameter soil cover is also required in KSL.

The external diameter of each tunnel would be about 8.2m, which is designed for special trackform to protect the HKCC, HKSM and other premises along Salisbury Road (see **Chapter 7**) from operational groundborne noise. As such, the soil cover required would be at least 16m. However, due to the constraints described in the above table, the soil cover for most of the areas along Salisbury Road is less than 10m. It is therefore not feasible to adopt bored tunnelling along Salisbury Road.

Microtunnelling uses horizontal pipe piles to support the ground around the excavation. Launching and reception pits are required for drilling in the horizontal piles. These pits would need to be separated at approximately 30m. Hence, there would be approximately 6-7 launching and reception pits for construction of the tunnel section along Salisbury Road. These pits would result in significant disruption to the traffic. Thus, the microtunnelling technique would not have advantages over the cut-&-cover construction methodology. In addition, the construction period for using microtunnelling would also be 12 months longer than using the cut-&-cover methodology.

This prolonged construction period will unnecessarily increase the duration for which the locals and tourists will be affected by the environmental nuisance (including construction noise, fugitive dust, visual etc) caused by the construction works at the launching and reception pits. In addition, the commercial areas in the vicinity would be deprived of the immediate economic benefits from the early completion of the KSL.

The use of microtunnelling would have the benefit of generating less construction waste materials as compared to Cut-&-Cover tunnelling. However, since the difference in the amount of waste generated for the section along Salisbury Road would be relatively small as compared to the total

amount of waste generated by the entire project, the overall benefits of reducing the waste by using microtunnelling at this worksite is not considered to be significant.

Mined Tunnelling

Mined tunnelling was also considered for construction of the tunnel section along Salisbury Road. However, it was ruled out due to the following reasons:

- Given the relatively shallow soil cover along Salisbury Road (especially for the interface section with ER ETS Station), there could be risk of collapse during mined tunnelling. Temporary traffic decks would be required to ensure safe movement of traffic above the tunnels whilst they are under construction. The construction of such a deck along Salisbury Road will negate the advantages that would otherwise be achieved from avoiding cut-&-cover tunnelling.
- In addition, there are a number of major utilities and services buried beneath Salisbury Road. These include private water mains to hotels in Tsim Sha Tsui; cooling mains supplying three of the MTR stations in Nathan Road; water, gas, and electricity supply to all the buildings in Salisbury Road; and sewerage and drainage serving much of the West side of the Kowloon peninsula. Damage to any of these would have major implications and would likely affect many very prominent properties in the area for extended period of time. Mined tunnelling beneath or grouting ground adjacent to these utilities and services will require extensive protection works including, to the worst case, exposing all these utilities and services to ensure that they are not damaged by drilling and the like. The process of exposing and protecting these services and utilities will negate the environmental advantages over cut-&-cover tunnelling.
- A cut-&-cover shaft in Salisbury Road would still be required for access and spoil removal and a longer construction period (approximately 4 months longer than cut-&-cover tunnel construction). This would result in extended disruption (e.g. traffic) along Salisbury Road. This prolonged construction period will unnecessarily increase the duration which the locals and tourists will be affected by the environmental nuisance (including construction noise, fugitive dust, visual etc) caused by the construction works at the construction access shaft.
- The use of mined tunnelling would have the benefit of generating less construction waste materials as compared to Cut-&-Cover tunnelling. However, since the difference in the amount of waste generated for the section along Salisbury Road would be relatively small as compared to the total amount of waste generated by the entire project, the overall benefits of reducing the waste by using mined tunnelling is not considered to be significant.

Cut-&-Cover

Cut-&-cover construction is therefore the only feasible option for constructing the Salisbury Road tunnels but mined tunnel will be incorporated for short sections where the constraints demand this method. Mucking-out areas will be located along Salisbury Road where temporary traffic diversions and road decking are required to maintain traffic flow during construction. There is no need for diversion of the trunk sewer underneath Salisbury Road.

4.3.1.2 *Reprovision of New World Subway No 1*

The existing New World Subway No 1 will be reprovisioned on a new alignment on a temporary basis before removal of part of the existing subway for construction of the railway tunnels (**Figure 4-7**).

4.3.2 *Work Site 2 (FMPHQ) (**Figure 4-1-1**)*

Construction of this section by bored tunnelling has been considered during the design stage but is not preferred because of the geometry of the railway tracks which have minimum radius curves and are converging. The railway alignment beneath the FMPHQ site is such that the proximity of the tracks would result in insufficient clearance between the tunnels if this section of the alignment was constructed by bored methods. This in combination with potential difficulties due to the low rock cover above the upper track makes the bored option not preferred.

From environmental perspective, the use of bored tunnelling underneath FMPHQ will require a retrieval shaft near to the junction of Salisbury and Kowloon Park Drive. Since this shaft has to be constructed by cut-&-cover method, using bored tunnelling underneath FMPHQ will not have significant environmental benefits since the tunnel along Salisbury needs to be constructed by cut-&-cover anyway. Cut-&-cover tunnelling in this work site is also considered not feasible as it would cause adverse impacts on the monuments including the FMPHQ building and the OFSB.

The use of chemical splitting or Penetrating Cone Fracture (PCF) system will require the use of hydraulic breakers to break the rock into manageable size before transporting out from the tunnel. Hence, it has no significant environmental benefits as compared to drill & blast. In addition, the use of chemical splitting or PCF system will require a longer construction period and hence extended disturbance from the mucking out locations.

Mined tunnelling (drill-and-blast) will therefore be adopted. The access shaft (see **S4.3.3**) will be located at the junction of Canton Road and Peking Road (A4 in **Figure 4-1-1**). A clear separation of about 6m between the tunnels and the OFSB, and 16m from the Main Building will be maintained. Neither resumption nor temporary dismantling of the OFSB is required.

4.3.3 *Work Sites 3 (WKN to South of Canton Road) (**Figure 4-1-1**)*

4.3.3.1 *Tunnels*

The use of cut-&-cover tunnelling will cause adverse impacts (including traffic, disruption, construction dust and noise etc) on the sensitive receivers and commercial premises along Canton Road and hence is not adopted for this section. Bored tunnelling, a more environmental friendly construction method, will therefore be adopted along Canton Road.

The geological nature (ie soft ground) of the Canton Road corridor requires ground treatment ahead of the TBM drives to stabilise the zone between the two tunnels and adjacent building foundations. The ground treatment will be working from north to south on two fronts down Canton Road, with one from WKN to CRPB (A5 in **Figure 4-1-1**) and the other from CRPB to the access shaft at south of Canton Road (A4 in **Figure 4-1-1**). Each section is approximately 400m long and will take approximately 2 months for each 50m sub-section. However, the detailed design will be conducted by the Design & Build Contactor at a later stage, and he would further review the need for ground treatment for the section along Canton Road, taking into account any specific construction methodology for the bored tunnelling.

Given that most of the construction activities for bored tunnelling will be conducted underground (except for ground treatment and construction of shafts), the associated construction noise and

dust impacts caused will be much less than the conventional cut-&-cover method. Disruption to the retail business along Canton Road is not anticipated except some relatively minor and local disruption during ground treatment and construction of the shafts. A Construction Traffic Impact Assessment Report will be separately submitted to the relevant authorities for approval.

4.3.3.2 *Launching Shaft*

The shaft will be located at the southern end of WKN (**Figure 4-1-1**). Walls of the shaft will be constructed by D- walls or similar techniques. The TBM will be assembled inside the launching shaft and all tunnel linings will be delivered through this shaft. In order to meet the programme, the TBM will need to operate 24 hours a day. Traffic decks are not envisaged to be required during the construction period except for the small section underneath Road D12. However, a noise insulating cover will be installed for the launching shaft. After structural completion, the launching shaft will be backfilled or integrated with WKCD.

During daytime period, the conveyor at the launching shaft will transfer the spoil from the tunnel portal to neighbouring construction area A7 (about 20m long) (**Figure 4-1-2**), and then transported by lorries to the barging facility (A6 in **Figure 4-1-2**). The conveyor system will be used to lift up the spoil from the bottom of the launching shaft to the ground level only (about 20m tall). The feeding point is at the bottom of the launching shaft and the discharge point will be located at the grade level of Area A7. The feeding point and the discharge point will be connected by a conveyor belt driven by motors and gears. The whole system will be supported by steel structure. The tentative location of conveyor belt is indicated in **Figure 4-1-2**, but is still subject to the detailed design. However, it is anticipated that the conveyor belt system would have the following features as standard good practices:

- Conveyor system will be fully enclosed to suppress dust emission
- Conveyor transfer points and hopper discharge areas will be enclosed to control dust emission
- At the fixed transfer point, a three-sided roofed enclosure with a flexible curtain at the entrance point would be provided. Exhaust fans shall be provided for this enclosure and vented to a suitable fabric filter system.

During normal hours, the noise insulating cover at the launching shaft will be opened to facilitate tunnel construction. During restricted hours, the noise insulating cover will be closed in order to enclose all the noise generating plant items (e.g. diesel train, mortar car, TBM etc) inside the shaft and minimise the construction noise impacts on the neighbouring noise sensitive receivers (refer to **Chapter 6**).

Details of the noise assessments during daytime and restricted hours are given in **Chapter 6.** The need for a separate application of Construction Noise Permit (CNP) for works during restricted hours is also highlighted in **Chapter 6**.

4.3.3.3 *Emergency Egress Point and Construction Access Shaft*

The shaft (A4 in **Figure 4-1-1**) is located near the southern end of Canton Road at the junction with Peking Road. Cut-&-Cover method using pipe pile walls or similar techniques would be required for this shaft. Temporary traffic decks will be installed during the excavation and tunnel construction periods. Mucking out would be required for the construction of this shaft. An Emergency Egress Point (EEP) will also be located at the Construction Access Shaft (**Figures 4-8 & 11-5-33**). Most of the important retaining walls along the western boundary of the FMPHQ will be demolished as part of its redevelopment, according to the Project Profile of FMPHQ. The

western boundary will be converted to different uses including E&M, commercial, entry etc. The historical tunnel to be preserved to the southern end of Canton Road is more than 100m away from the EEP. It is therefore anticipated that there will be no impacts of this structure on any historic retaining walls.

The location of the EEP is dictated by fire safety requirements (requiring either cross-passage for tunnels at maximum spacing of 240m or escape to ground level every 762m). Since cross passages cannot be provided for the tunnel section near the FMPHQ and south of Canton Road where stack arrangement is adopted, exits at ground level must be provided. Relocating the EEP to other locations will compromise the safety for the passengers. Alternative option of locating the EEP within the FMPHQ site would alleviate concerns with respect to a constraint to footpath widths, however, the current railway reserve stipulated in the lease conditions of FMPHQ has not covered the provision for an EEP within the FMPHQ site, it is considered that resumption of space within the FMPHQ site for the EEP might incur legal actions being taken against the Government by the developer. As such, this alternative site option for EEP was not recommended to be pursued. Since the EEP will be constructed by the cut-&-cover technique, in consideration of environmental performance of the various EEP locations, the construction noise, dust and visual impacts will be of similar extent.

4.3.3.4 *Plant Building (A5 in **Figure 4-1-1**)*

The CRPB (**Figures 4-1-1 & 4-5**) will be constructed using cut-&-cover with pipe pile walls, or similar techniques. Superstructure will be constructed by in-situ concreting. Temporary traffic decks will be installed during the excavation. Mucking out would be required for the construction of this plant building.

4.3.4 *Work Site 4 (WKN) (**Figure 4-1-2**)*

The station box of WKN (**Figures 4-1-2, 4-2-1 & 4-2-2**) will be constructed by cut-&-cover using D-wall or similar techniques. Sequenced construction and temporary decking will be necessary to maintain existing roads and footpaths across the excavated site. The construction would be approximately divided into three sections which will be progressed at a similar rate.

4.3.5 *Work Site 5 (WKN to Cherry Street) (**Figures 4-1-2 & 4-1-3**)*

4.3.5.1 *Tunnels*

The use of TBM as a method of construction for the tunnels between WKN and Cherry Street was assessed during the early stage and was ruled out for the following reasons;

- There is a requirement for a pocket track to the north of WKN for stabling disabled trains and this section cannot be constructed using a TBM. It reduces the length of possible tunnel between WKN and Cherry Street that could be constructed using TBM to approximately 800m.
- The need for diversion of the sewerage box culverts (JR, PS, DS & WR) to the north of pocket track supports the use of cut -&-cover method (**Figure 4-9**).
- There are also space constraints on the approach to and beneath Cherry Street, to the west adjacent to the MTRC Airport Express Line (AEL) and to the east adjacent to the Olympian City II development. The available width between these constraints would mean that TBM tunnels would be too close with a separation of significantly less than the minimum of one tunnel diameter width required. In addition, under the Cherry Street Culverts and Underpass, even closely spaced TBM tunnels would conflict with the AEL

Station and Olympian City II foundations which would otherwise require extremely complex underpinning works. However, due to the constrained location, it is very difficult to underpin these structures, particularly for the footbridge foundation near Olympic Station as the foundation is situated between two narrowly spaced box culvert underneath Cherry Street. Nevertheless, the underpinning of the foundation cannot be avoided even if the spacing is narrowed to 0.5 TBM diameter. It is not recommended that the spacing of the TBM to be less than one diameter since the soil is basically reclamation sandfill, which is not ideal soil material for using TBM. In addition, the low cover of the four box culverts and Cherry Street Underpass to KSL tunnel will further impose difficulty to perform ground treatment. Therefore the TBM section would need to stop before reaching Cherry Street. Taking into account the length required to converge the alignment into a box section, the reception shaft would have to be located close to the Yau Ma Tei Ventilation Building (see **S4.3.5.3**). This reduces the length of possible bored tunnel further to 500m.

- As the length of possible TBM tunnel is within an area of largely reclaimed land, there is a high risk of obstructions (e.g. sea walls, abandoned sheet piles) along the tunnel length that would be difficult and time consuming to deal with.
- The duration for just the procurement of a TBM would be at least 13 months. In addition, there are only limited sensitive receivers around the 500m tunnel section. Thus, bored tunnel is not viable both from an economical and a programme point of view.

Therefore, it was concluded that TBM is not a viable solution due to all the constraints identified in the Cherry Street area. Cut-and-cover approach is recommended for this area. The tunnel will be constructed from both the southern and northern ends towards the middle, in relatively short sections (about 100m long). The installation of D-wall or other similar techniques will be commenced in the first sub-section. After finishing the D-wall construction, the plant items will be moved to the adjoining sub-section. At the same time, soil excavation and concreting will be commenced in the first sub-section. This arrangement will be repeated until all the sub-sections along the work site are completed. The spoil will be transported by lorries to the barging facility.

It should be noted that the KSL construction will be undertaken under Design-and-Build contracts and thus the Contractor is ultimately responsible for the temporary works depending on his past experience and available plant and resources.

4.3.5.2 *Footbridges*

Other construction works in this section include the modification of the Footbridge FB14 and the construction of a new footbridge (**Figure 4-9**). Temporary decking for traffic management will be provided to maintain existing roads and footpaths.

4.3.5.3 *YMT Ventilation Building (**Figure 4-4**)*

The YMT ventilation building will be constructed using cut-&-cover with D-wall or other similar techniques. Superstructure will be constructed by in-situ concreting.

4.3.6 *Work Site 6 (Cherry Street Underpass) (**Figure 4-1-3**)*

The use of bored tunnelling in this tunnel section is precluded due to the constraints imposed by the foundations of Footbridges A & A1 (connecting Olympic Station with both Olympic City II and HSBC Centre) and the limited options for effective underpinning of these piers. Open cut

with a short section of mined tunnelling is therefore proposed for this short tunnel section (about 100m long). **Figure 4-10** illustrates the location of these footbridges.

4.3.7 *Work Site 7 (Between Cherry Street and WR NAC Station) (**Figure 4-1-3**)*

The underground tunnel from Cherry Street will ascend to at-grade level to integrate with the WR overrun section to the south of NAC Station (**Figures 4-1-3 & 4-3**). Bored tunnelling is not practicable for this interface section because of insufficient soil cover (maximum 14m for this section). The relatively high gradient is also not favourable for bored tunnelling and hence cut-&-cover method is required.

4.4 Other Construction Issues

4.4.1 *Construction Programme & Plant Inventory*

The construction work will commence in early 2005 and is scheduled to be completed by late 2007. Testing and commissioning of the railway system will then be conducted for target completion for operation in late 2008 / early 2009. Most of the construction works will be undertaken in normal working hours to complete from 7:00 am to 7:00 pm, except the 24-hour TBM operation (see **S4.3.3.1**). The construction plant inventory for the entire KSL is given in **Appendix 4-2**. A tentative construction programme with the associated construction activities at each work site is given in **Appendix 4-3**.

The Contractor, when developing their own construction programme and methodology, shall take into account the design, work areas, scheme boundary, mitigation measures etc described in this EIA Report. The need and extent of the mitigation measures shall be updated by the Contractor and seek approval from the relevant authorities. If the Contractor wants to include more work areas which are not included in this EIA, he shall apply for a variation of EP under the EIAO.

4.4.2 *Barging Facility*

The current design is to have all the public fill materials transported by lorries to the barging facility. The barging facility will be located in West Kowloon reclamation area with two barge loading ramps. This facility will also be used for delivery of materials such as tunnel segments etc. The design of the facility will be similar to the one being used in the East Rail Extension Project in Hung Hom Bay, with the following features:

- All road surfaces within the barging facility will be paved.
- Dust enclosures will be provided along the loading ramps to avoid dust dispersion.
- Vehicles will be required to pass through designated wheel washing facilities before leaving the barging facility.

Chapters 5 & 6 address the secondary environmental impacts of this facility and recommend the required mitigation measures.

4.4.3 *Stockpiles*

In order to reduce the amount of spoil to be disposed, it is proposed that certain portion of the excavated spoil will be stockpiled (about 5m high) in various parts within the scheme boundary (**Figures 4-1-1 to 4-1-3**) for later reuse as backfilling (see **Chapter 9** for the amount of reusing

C&D material). **Chapters 5 & 6** address the secondary environmental impacts of these temporary stockpiles and recommend the required mitigation measures.

4.4.4 *Work Area in Shek Mun*

There is another storage area located in Shek Mun in Shatin. This area is currently used by the MOS Rail construction and will be handed over to the KSL Contractor for general storage / office.

5. CONSTRUCTION DUST IMPACT ASSESSMENT

5.1 Legislation and Standards

The principal legislation for controlling air pollutants is the Air Pollution Control Ordinance (APCO) (Cap 311)[5-1] and its subsidiary regulations, which define statutory Air Quality Objective (AQOs) for 7 common air pollutants. The AQOs for these air pollutants are tabulated in Table 5-1 below.

Table 5-1: Hong Kong Air Quality Objectives

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

Notes:
[1] Measured at 298K(25 ^{o}C) and 101.325 kPa (one atmosphere).
[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 mean suspended particles in air with nominal aerodynamic diameter of 10 micrometres or smaller.
[6] Photochemical oxidants are determined by measurement of ozone only.
[7] Not an AQO. Suggested short term averaging level for 1 hour is 500 μg/m3. There is no exceedance allowance for 1-hour TSP guideline level.

For construction dust impact, reference shall also be made to the TM-EIA[5-2]. An hourly averaged Total Suspended Particulates (TSP) concentration of 500 μg/m^3 shall not be exceeded.

5.2 Air Sensitive Receivers

The landuses in the vicinity of the proposed alignment consist of commercial buildings, hotels, residential premises, educational institutions and open space. Site surveys have been carried out to identify Air Sensitive Receptors (ASRs) within 500m from the site boundary in accordance with TM-EIA [5-2] Annex 12 and Hong Kong Planning Standards and Guidelines (HKPSG) [5-3]. The worst affected ASRs during the construction phase of the proposed works have been considered.

A list of the key representative ASRs for construction dust assessment and their distances to the nearest worksites are provided in **Figure 5-1**. Their respective locations are illustrated in **Figures**

5-2-1 to 5-2-3. Currently there is no plan for topside developments on the WKN. Other sensitive uses within 500m from the site boundary include playgrounds, open space and urban parks etc.

5.3 Potential Sources and Emission Inventory

5.3.1 *Potential Sources of Dust*

The running tunnels will be constructed by cut-and-cover, bored tunnelling and mined tunnelling methods respectively at different sections and the WKN will be constructed by cut-&-cover method. Locations of worksites, access shaft, stockpiles and barging facility are illustrated in **Figure 5-3**.

Prior to any bulk excavation, temporary road decks will be installed along Salisbury Road, shaft areas and the tunnel section between Lin Cheung Road and Lai Cheung Road to maintain traffic flow during construction, and reduce the dust dispersion to the vicinity of the site. As most of the works for the bored tunnelling will be performed underground, dust will only be generated during excavation and reinstatement of the access shafts. Details of construction methodology are given in **Chapter 4**.

Specifically, construction dust will be potentially generated from the following activities:

- Soil excavation activities;
- Backfilling;
- Wind erosion;
- Temporary storage of spoil on site;
- Transportation / handling of spoil;
- Underground blasting activities; and
- Loading and unloading of excavated materials at barging facility.

Since excavation and backfilling activities will involve large quantities of earthworks and silty material handling, it is anticipated that there will be significant dust impact as a result of these activities if no appropriate mitigation measures are implemented. On the other hand, the drill-&-blast activities underneath the FMPHQ will be undertaken underground and therefore only small quantity of dust will be generated if proper watering facilities are provided. Spoil will be transported by lorries and uploaded to the barging facility which will be designed to handle the predicted usage of 43 vehicles per hour during peak hour. The sensitive receiver nearest to the barging facility is the existing Kowloon Station topside residential development located at approximately 200m away and 28m above the local ground. This receiver has been included in the dust assessment.

5.3.2 *Emission Inventory*

Dust impact assessments have been carried out based on conservative assumption of the general construction activities which include the following:

- Heavy construction activities including site clearance, ground excavation, cut and fill operations, construction of the associated facilities, drill-and-blasting, as well as all construction traffic and hauling over the sites;

- Wind erosion of all open sites, including stockpile and barging area;
- An active operating area of 30% is assumed at any one time;
- Construction working periods of 26 days a month and 12 hours a day; and
- Loading/unloading from trucks at barging area and stockpiles.

The dust emission factors for different construction activities were extracted from the USEPA "Compilation of Air Pollution Emission Factors (AP-42)", 5th Edition[5-4]. Calculation of dust emission factors is given in **Appendix 5-1** and the key assumptions are summarised in Table 5-2 below. For easy reference, the locations of ASRs assessment points and worksites, and the dust emission rates input into the model are presented in **Appendix 5-2**.

Table 5-2: Calculation of Dust Emission Factors

Activities	Reference [Note 1]	Operating Sites (see Figure 5-3)	Equations & Assumptions [Note 1] (see Appendix 5-1 for details)
Heavy construction activities including land clearing, ground excavation, cut and fill operations, construction of the facilities, drill & blast, equipment traffic and hauling over the site areas	S.13.2.3.3	All construction and excavation sites	E = 1.2 tons/acre/month of activity or = 2.69Mg/hectare/month of activity
Wind Erosion	S.11.9, Table 11.9.4	All construction sites, stockpile areas, barging area (all open sites)	E = 0.85 Mg/hectare/yr (24 hour emission)
Loading/Unloading at barging points and stockpile	S13.2.4	Barging point and stockpiles	$E = k(0.0016)\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}(kg/megagram)$ k is particle size multiplier U is average wind speed M is material moisture content

[Note 1] Extracted from USEPA Compilation of Air Pollution Emission Factors (AP-42)

Dust emission from construction vehicle movement will be limited within the confined worksites area and the equation in AP-42 S.13.2.3.3 has taken this factor into account. Watering facilities will be provided at every designated vehicle exit point. Since all vehicles will be washed at exit points and vehicle loaded with the dusty materials will be covered entirely by impervious sheeting before leaving the construction site, dust nuisance from construction vehicle movement outside the worksites is unlikely to be significant.

The loaded vehicles will move to the stockpiling areas where C&D materials will be unloaded immediately. The vehicles will then be washed again before leaving the stockpiles in order to minimise generation of dusty materials. Vehicles movement within the stockpiling areas will be very limited and dust emission from vehicle hauling at these areas will therefore be insignificant. The major dust generating activities at stockpiling areas will be originated mainly from wind erosion and loading/unloading of materials; and these have been assumed in the FDM.

The design of the barging facility will be similar to the one being used in the East Rail Extension Project in Hung Hom Bay, with the following features:

- All road surfaces within the barging facility will be paved;
- Dust enclosures will be provided along the loading ramps to avoid dust dispersion;
- Vehicles will be required to pass through designated wheel washing facilities before leaving the barging facility.

The vehicles will transport to the barging facilities, unload the C&D materials under the dust enclosure, and then be washed before leaving to avoid dispersion of dust. Vehicles movement within the barging areas will also be very limited and dust emission will be insignificant. Similar to the stockpiling areas, it has assumed in the FDM that the major dust generating activities at barging areas will be originated mainly from wind erosion and loading/unloading of materials.

5.4 Assessment Methodology

Dust impact assessment has been undertaken using the Fugitive Dust Model (FDM) as approved by USEPA and EPD. It is a well-known Gaussian Plume model designed for computing air dispersion model for fugitive dust sources. Modelling parameters including dust emission factors, particles size distributions, surface roughness, etc are referred to in EPD's "Guideline on choice of models and model parameters" [5-5] and USEPA's AP-42. The density of dust is assumed to be 2.5gm^{-3}. A background TSP concentration is taken as 98 µgm^{-3} in accordance with the "urban" category in EPD's Guidelines on Assessing "TOTAL" Air Quality Impacts [5-6]. A surface roughness of 100cm is assumed in the model to represent the terrain.

Real meteorological data on wind direction, wind speed, temperature and stability were collected from the nearest weather station, the Hong Kong Observatory Station, for Year 1999 to 2001. The anemometer height at Hong Kong Observatory Station is 42m above ground.

Fugitive dust modelling has been conducted at heights 1.5m, 5m, 10m, 15m, 20m and 25m above local ground level for each year. The maximum cumulative 1-hour and 24-hour averaged TSP concentrations at the selected ASRs were determined. A 20x20m grid contour was employed on the study area to investigate the general pollutant distribution for the worst assessment year.

5.5 Assessment Results

The worst-case scenarios at each respective ASR will occur under different meteorological conditions (e.g. different wind directions). Assessment results of the dust impact from KSL alone and cumulative impact from concurrent project are presented as follows:

1) Dust impacts from construction of KSL only (unmitigated scenario);

2) Dust impacts from construction of KSL only (mitigated scenario); and

3) Cumulative dust impacts from both KSL and concurrent project (mitigated scenario).

5.5.1 *"Unmitigated" Scenario for Construction of KSL*

The maximum predicted 1-hour and 24-hour TSP levels for construction of KSL are summarised in Table 5-3. Dust impacts are high at ASRs under the "unmitigated" scenario, and the predicted hourly and 24-hour averaged TSP concentrations exceed TM-EIA requirements at some sensitive receivers. The maximum predicted TSP hourly concentration is 889.5µg/m^3 at Lai Chack Middle School (A36). Details of the assessment results are given in **Appendix 5-3**.

Table 5-3 : Predicted 1-hour and 24 hour TSP concentrations at 1.5m above the local ground (worst affected Scenario) under the "unmitigated" scenario for construction of KSL

		Unmitigated Scenario	
ASR No	**ASR Description**	**Predicted 1-hr TSP conc[1]**	**Predicted 24-hr TSP conc[2]**
1	New World Centre	299.7	118.1
2	New World Centre (The Amazon)	438.3	215.4
3	Sheraton Hong Kong Hotel	**610.0**	**348.2**
4	The Peninsula Hotel	430.2	253.1
5	Hong Kong Space Museum	354.1	240.7
6	YMCA of Hong Kong	**520.7**	**290.6**
7	Old Fire Station Building	**635.6**	240.4
8	Hong Kong Cultural Centre	413.1	235.9
9	Star House	296.9	154.3
10	The Marco Polo Hong Kong Hotel	330.7	165.3
11	Former Marine Police Headquarters	237.9	133.2
12	Hankow Centre	212.6	147.8
13	No.1 Peking Road	412.2	**265.3**
14	Consumer Education Information Centre	225.8	130.1
15	No. 11-39 Ashley Road	229.0	132.6
16	No.2-12 Canton Road	316.8	163.8
17	No.4-8 Canton Road	254.8	134.1
18	Lippo Sun Plaza	267.6	124.3
19	Silvercord Centre	294.2	128.2
20	No.30-41 Haiphong Road	283.2	144.4
21	Imperial Building (facing Canton Road)	336.7	134.8
22	Imperial Building (facing KPDCP)	344.5	133.1
23	Ocean Centre, New T&T and World Commercial Center	252.0	125.3
24	Marco Polo Gateway Hotel	289.3	132.0
25	Harbour City & World Finance Center	338.5	141.1
26	Hanley Building (facing Canton Road)	371.1	141.3
27	Hanley Building (facing KPDCP)	382.2	140.9
28	The Marco Polo Prince Hotel	374.0	149.0
29	Manley Building	423.2	158.2
30	The Gateway	427.5	161.8
31	The Royal Pacific Hotel and Towers	498.1	167.6
32	China Hong Kong City	489.2	185.0
33	Tsim Sha Tsui Fire Station	**733.3**	251.5
34	FSD Kowloon South Divisional HQ	**816.9**	**298.2**
35	Canton Road Government School	**724.4**	**275.1**
36	Lai Chack Middle School	**889.5**	**312.8**
37	Victoria Tower	**879.6**	**295.6**
38	No.1-3A Austin Road, Wai On Building	**546.6**	232.7
39	The Harbour Side	182.0	138.0
40	The Waterfront	255.6	179.0
41	Sorrento	284.5	189.8
42	No.51 Jordan Road, Lee Kiu Building	376.9	237.5
43	New Headquarters for the Hong Kong Girl Guides Association with hostels	**669.5**	**356.0**
44	Man King Building	**813.6**	**429.4**
45	Yau Ma Tei Catholic Primary School	322.2	166.3
46	HKMA David Li Kwok Po College	372.2	162.9
47	Charming Garden	**761.0**	255.2
48	Park Avenue	248.3	155.3
49	Central Park	327.3	193.4
50	Island Harbourview	208.3	134.9

ASR No	ASR Description	Unmitigated Scenario	
		Predicted 1-hr TSP conc[1]	Predicted 24-hr TSP conc[2]
51	Olympian City One	242.4	157.4
52	HSBC Centre	468.0	**287.8**
53	Skyway House	448.8	**260.3**
54	Olympic Station Phase 3 Project and Olympian City Phase 3 (Under construction)	**631.0**	**326.5**
55	Tai Kok Tsui Catholic Primary School (Hoi Fan Road)	177.3	125.6
56	Sir Ellis Kadoorie Secondary School (West Kowloon)	172.0	115.6
57	West Kowloon Disciplined Services Quarters	196.4	135.4
58	Metro Harbourview (Under construction)	183.8	125.4
59	Nam Cheong Estate	221.7	130.5
60	Fu Cheong Estate	189.5	116.1

Notes
[1] An hourly averaged TSP concentration of 500μg/m^3 should not be exceeded
[2] A 24-hour averaged TSP concentration of 260μg/m^3 should not be exceeded
[3] Bold figures indicate the predicted TSP levels has exceeded EPD's standards

5.5.2 *"Mitigated" Scenario for Construction of KSL*

The unmitigated TSP concentrations (in Table 5-3) above are high at ASRs along Canton Road and near WKN. However, under a good site practice with regular watering, dust suppression could be achieved. In accordance with USEPA AP-42, watering twice a day could generally reduce dust emission by half and hence the dust concentration by 50%.

With proper watering (at least four times a day for WKN and twice a day for the remaining sections) throughout the construction phase (**Figure 5-4**), the 1-hour and 24-hour TSP levels are predicted as shown in Table 5-4. Details of the assessment results are given in **Appendix 5-4**.

Table 5-4 : Predicted 1-hour and 24 hour TSP concentrations at 1.5m above the local ground (worst affected level) under the "mitigated" scenario for construction of KSL (Watering at least four times a day for WKN and at least twice a day for the remaining sections)

ASR No	ASR Description	Mitigated Scenario	
		Predicted 1-hr TSP conc[1]	Predicted 24-hr TSP conc[2]
1	New World Centre	198.8	105.8
2	New World Centre (The Amazon)	268.2	153.4
3	Sheraton Hong Kong Hotel	354.0	223.1
4	The Peninsula Hotel	264.1	175.5
5	Hong Kong Space Museum	220.3	168.7
6	YMCA of Hong Kong	309.3	194.3
7	Old Fire Station Building	366.8	169.2
8	Hong Kong Cultural Centre	255.6	167.0
9	Star House	197.4	126.1
10	The Marco Polo Hong Kong Hotel	214.4	131.6
11	Former Marine Police Headquarters	161.1	114.5
12	Hankow Centre	147.2	122.9
13	No.1 Peking Road	255.1	181.6
14	Consumer Education Information Centre	142.4	114.1
15	No. 11-39 Ashley Road	142.8	110.2
16	No.2-12 Canton Road	207.4	130.9
17	No.4-8 Canton Road	161.5	116.1
18	Lippo Sun Plaza	158.9	108.7
19	Silvercord Centre	166.8	108.3

ASR No	ASR Description	Mitigated Scenario	
		Predicted 1-hr TSP conc[1]	Predicted 24-hr TSP conc[2]
20	No.30-41 Haiphong Road	160.3	113.7
21	Imperial Building (facing Canton Road)	179.0	110.4
22	Imperial Building (facing KPDCP)	180.8	110.4
23	Ocean Centre, New T&T and World Commercial Center	155.4	107.4
24	Marco Polo Gateway Hotel	166.8	109.4
25	Harbour City & World Finance Center	180.9	112.2
26	Hanley Building (facing Canton Road)	188.7	112.6
27	Hanley Building (facing KPDCP)	192.8	113.2
28	The Marco Polo Prince Hotel	190.8	115.1
29	Manley Building	203.1	120.1
30	The Gateway	205.2	119.5
31	The Royal Pacific Hotel and Towers	223.9	119.2
32	China Hong Kong City	224.9	123.9
33	Tsim Sha Tsui Fire Station	288.3	141.1
34	FSD Kowloon South Divisional HQ	310.8	153.1
35	Canton Road Government School	277.0	149.1
36	Lai Chack Middle School	323.6	159.0
37	Victoria Tower	327.6	154.4
38	No.1-3A Austin Road, Wai On Building	223.7	133.2
39	The Harbour Side	149.7	121.8
40	The Waterfront	176.4	135.5
41	Sorrento	191.2	143.9
42	No.51 Jordan Road, Lee Kiu Building	191.5	134.7
43	New Headquarters for the Hong Kong Girl Guides Association with hostels	280.6	172.9
44	Man King building	411.8	245.0
45	Yau Ma Tei Catholic Primary School	200.6	129.9
46	HKMA David Li Kwok Po College	235.1	128.3
47	Charming Garden	429.5	176.6
48	Park Avenue	173.1	125.3
49	Central Park	211.0	144.4
50	Island Harbourview	145.3	116.3
51	Olympian City One	164.1	127.7
52	HSBC Centre	279.5	185.9
53	Skyway House	260.2	177.3
54	Olympic Station Phase 3 Project and Olympian City Phase 3 (Under construction)	355.3	211.1
55	Tai Kok Tsui Catholic Primary School (Hoi Fan Road)	132.3	111.8
56	Sir Ellis Kadoorie Secondary School (West Kowloon)	129.8	106.8
57	West Kowloon Disciplined Services Quarters	144.7	115.9
58	Metro Harbourview (Under construction)	138.4	111.0
59	Nam Cheong Estate	154.5	113.7
60	Fu Cheong Estate	140.9	106.4

Notes
[1] An hourly averaged TSP concentration of 500μg/m^3 should not be exceeded
[2] A 24-hour averaged TSP concentration of 260μg/m^3 should not be exceeded

Results indicate that by increasing frequency of watering to at least four times a day for the WKN (reducing the dust emission by 75%;) and by watering twice a day for the remaining section

(reducing the dust emission by 50%), the predicted 1-hour and 24-hour TSP levels at all ASRs will comply with the TM-EIA. There would be no adverse dust impact caused by the construction of KSL.

5.5.3 *Cumulative Dust Impacts from Concurrent Projects*

5.5.3.1 *West Kowloon Cultural District*

(a) <u>During the Overlapping Period with Construction of KSL Tunnel & Station</u>

The location of WKCD is indicated in **Figure 1-2-2**. The latest information for WKCD at the time of preparing this EIA is available from the government website. It is noted that the proposal for WKCD has been submitted in mid June 2004. According to Addendum No. 3 to the Invitation for Proposal for the WKCD [5-7] issued on 30 March 2004, the construction of the WKCD is anticipated to commence in April 2007. There is currently no available information on construction programme / method / phasing.

The cumulative dust impacts from WKCD are considered to be insignificant and short term only due to the following reasons:

- There are no major KSL construction activities in the vicinity of WKCD. In accordance with the construction programme of KSL, all excavation works for WKN will be completed by September 2006. The remaining works are construction of superstructure and station fitting out works of which insignificant dust impacts are anticipated. The overlapping period for the major excavation (if any) of WKCD and the superstructure construction of WKN would be relatively short from May to Sept 2007 (and possibly shorter or even no overlapping at all taking into account 2-3 months of mobilisation period of WKCD on site).
- The site formation work for WKCD has been completed. Except for the construction of basements (e.g. carparks), other major excavations are not expected and most of the construction activities would be superstructure and fitting out works which would only generate insignificant dust. Its cumulative dust impacts on KSL during the interfacing period would be minor.

(b) <u>During the Overlapping Period with Operation of Barging Facility and Stockpiles for KSL</u>

The barging facility and two stockpiles (at south of the WKN) in the vicinity of WKCD will be operated from January 2005 to end of 2007. The ASRs that would most likely be affected by cumulative dust impacts are the topside residential towers (The Harbour Side and The Waterfront) at MTRC Kowloon Station, for which the podium level is at about 28m above the local ground.

These two works areas are located at 150-250m from the nearest ASRs. There will be no construction activities except for loading and unloading of C&D materials (only 43 trucks per hour transporting from work sites to barging facility and 6 trucks per hour transporting from work sites to each of the two stockpiles). The stockpiles will be covered by impervious sheet; while the loading ramps in the barging facility will be designed with dust enclosures. Dust impacts on these ASRs due to the operation of these two works areas are therefore anticipated to be minor. It can be seen in **Appendix 5-4** that the predicted hourly TSP levels at The Harbour Side and The Waterfront at 25m high as a result of the construction of KSL project are 116 μgm^{-3} and 119

μgm^{-3}, respectively with 98μgm^{-3} TSP background concentration. Hence, the contribution of KSL to the cumulative dust impacts during the overlapping period with WKCD from May to end of 2007 would be insignificant only. In addition, since all excavation works of KSL will be completed by commencement of the construction of WKCD, it is also expected that the operation of the barging facility and two stockpiles will be reduced during the concurrent period.

5.5.3.2 *Post Secondary College & China Light Power Electricity Substation*

The proposed post-secondary college (**Figure 1-2-2**) is located at the junction of Hoi Ting Road and Hoi Wang Road and will be constructed in 2005/2006. The China Light Power (CLP) electricity substation is planned at Lai Cheung Road (**Figure 1-2-2**) and is scheduled to be constructed in late 2004 for completion in 2007. The ASR that would most likely be affected by the cumulative dust impacts is Yau Ma Tei Catholic Primary School, which is about 150m at the east of KSL and about 100m at the north-west of post-secondary college and 150m at the north of the CLP electricity substation. It is anticipated that most of the construction activities for these two concurrent projects would be superstructure works, which would not generate significant dust. Its cumulative dust impacts on KSL are therefore considered to be insignificant.

5.5.3.3 *Secondary School*

The proposed secondary school (**Figure 1-2-2**) is located at the junction of Hoi Wang Road and Yau Cheung Road. The construction is scheduled to commence in 2007/08 and for completion by 2009/10. There is no other information available on construction programme / method / phasing at this stage. In accordance with the construction programme of KSL, all excavation works for this section of the WKN northern tunnel will be completed by 2007, and the remaining superstructure, backfilling and road reinstatement work will be taken from December 2006 to May 2007. Taking into account 2 months of mobilisation period of the school project, the constructions are very unlikely to be undertaken concurrently. Nevertheless, it is also anticipated that the construction activities for the secondary school would mainly be superstructure works, which would not generate significant dust. Its cumulative dust impacts on KSL, if any, are therefore considered to be insignificant.

5.5.3.4 *Cultural Square Development & Hong Kong Girl Guides Association Headquarter*

The proposed Cultural Square Development is located at Salisbury Road (**Figure 1-2-1)** and Hong Kong Girl Guides Association Headquarter is located at the junction of Jordon Road and Ferry street (**Figure 1-2-2)**. Both projects will be constructed concurrently with KSL from 2005 to 2007. Similarly, since the construction activities for these two projects would mainly be superstructure works only, they would not generate significant dust. Cumulative dust impacts on KSL are therefore considered to be insignificant.

5.5.3.5 *Pedestrian Piazza*

The proposed pedestrian piazza is located at the existing Star Ferry Public Transport Interchange (PTI) (**Figure 1-2-1)** and the works for the open plaza would commence in 2007 for completion in 2008. Its construction will likely be undertaken concurrently with the construction of Salisbury Road tunnel section and the reinstatement works of the TBM retrieval shaft of KSL in 2007. There is no available information on construction programme and method at this stage. However, since the construction activities for pedestrian piazza would mainly be superstructure works only, they would not generate significant dust. Cumulative dust impacts on KSL are therefore considered to be insignificant.

5.5.3.6 *Proposed Roads D12 (Eastern Section), D1 and D1A*

It was noted that the proposed Road D12, D1 and D1A would come into operation at the same time with that of KSL in 2008. There is no available information on construction programme / method / phasing at this stage. However, it is advised that the construction work will be potentially entrusted to KCRC as a separate project, subject to confirmation (**Figure 1-2-2**). A separate Environmental Permit (EP) will be applied from EPD for construction and operation of the roadworks.

Subject to the confirmation on the potential entrustment of these roadworks to KCRC, the Project Proponent could schedule the construction works and allow programme phasing to avoid the concurrent activities to be undertaken in the vicinity. The construction of roadworks is likely to be commenced in late 2007 when all civil works of KSL are completed. Hence, there will be no cumulative dust impacts at the potentially sensitive receivers including Lai Chack Middle School, Victoria Tower and Wai On Building (ref. FSD Kowloon South Divisional Headquarter will be relocated at that time due to the construction of WKCD).

5.5.3.7 *Redevelopment of FMPHQ*

The construction of KSL will overlap with the redevelopment of FMPHQ. Cumulative dust impacts have been assessed based on the latest information from the approved Project Profile for FMPHQ. The construction of FMPHQ is tentatively divided into six stages of works: 1) tree retaining wall installation, retaining wall installation for main building, open cut excavation; 2) retaining wall installation for main building, open cut excavation; 3) Retaining wall installation for main building; 4) remaining excavation; 5) foundation work; and 6) superstructure work. Bulk excavation during site formation stage is anticipated to generate the most significant dust impact. A summary of the construction activities during the overlapping period of the two projects is given in Table 5-5.

Table 5-5 : Construction activities during the Overlapping Construction Period with FMPHQ

Period	Construction Activities	
	KSL	**FMPHQ**
Mar 05 – May 05	Utilities diversion along Salisbury Road and at EEP and construction access shaft	Remaining excavation
Jun 05 – Mar 06	Remaining utilities diversion work at EEP and construction access shaft Temp wall & decking along Salisbury Road and at EEP and construction access shaft Excavation at EEP and construction access shaft	Remaining excavation + Superstructure work
Apr 06 – Oct 06	Excavation along Salisbury Road	Superstructure work

According to the programme for FMPHQ, bulk excavation is scheduled between mid 2004 and 2nd quarter of 2005. Activities contributing to the fugitive dust impact during bulk excavation are identified as excavation, loading of materials to trucks for disposal at public filling area, transportation of materials and wind erosion. It is confirmed that watering of at least 4 times per day on all exposed worksites will be implemented for FMPHQ project; and the dust emission will be reduced by 75%.

The cumulative impacts have been modelled by taking the FMPHQ's dust emission factors as provided by the project EIA consultant. Results indicate that with proper watering throughout the construction of KSL and FMPHQ projects, there will be no adverse cumulative dust impact. The

following frequencies of watering are recommended and agreed by the respective project proponents:

- Four times a day for WKN for KSL project;
- Twice a day for the remaining section for KSL project; and
- Four times a day for the FMPHQ project.

A summary of mitigated cumulative 1-hour and 24-hour TSP concentrations is showed in Table 5-6. Contours of maximum cumulative 1-hour and 24-hour averaged TSP concentration for the worst scenario are presented in **Figures 5-5 and 5-6**. Results identified that all ASRs are within the TM-EIA limits, and there are no other ASR and sensitive uses within the exceedance areas. Details of the assessment results are given in **Appendix 5-5**.

Table 5-6 : Predicted Cumulative 1-hour and 24-hour TSP concentrations at 1.5m above the local ground at the worst meteorological hour under the "Mitigated" scenario

ASR No	ASR Description	Cumulative Dust Impact (Mitigated Scenario)	
		Cumulative 1-hr TSP conc[1]	Cumulative 24-hr TSP conc[2]
1	New World Centre	216.3	107.0
2	New World Centre (The Amazon)	295.2	153.5
3	Sheraton Hong Kong Hotel	354.0	223.1
4	The Peninsula Hotel	264.1	175.5
5	Hong Kong Space Museum	268.4	169.7
6	YMCA of Hong Kong	309.3	194.3
7	Old Fire Station Building [3]	*ASR 7 is not an ASR during FMPHQ project construction*	
8	Hong Kong Cultural Centre	255.6	167.0
9	Star House	259.9	164.3
10	The Marco Polo Hong Kong Hotel	308.1	154.7
11	Former Marine Police Headquarters [3]	*ASR 11 is not an ASR during FMPHQ project construction*	
12	Hankow Centre	190.5	143.1
13	No.1 Peking Road	255.1	190.3
14	Consumer Education Information Centre	199.9	146.7
15	No. 11-39 Ashley Road	164.4	117.2
16	No.2-12 Canton Road	214.5	164.4
17	No.4-8 Canton Road	199.0	147.9
18	Lippo Sun Plaza	170.8	130.8
19	Silvercord Centre	166.8	116.0
20	No.30-41 Haiphong Road	160.3	113.7
21	Imperial Building (facing Canton Road)	179.0	110.4
22	Imperial Building (facing KPDCP)	180.8	110.4
23	Ocean Centre, New T&T and World Commercial Center	180.1	122.5
24	Marco Polo Gateway Hotel	166.8	110.4
25	Harbour City & World Finance Center	180.9	112.2
26	Hanley Building (facing Canton Road)	188.7	112.6
27	Hanley Building (facing KPDCP)	192.8	113.2
28	The Marco Polo Prince Hotel	190.8	115.1
29	Manley Building	203.1	120.1
30	The Gateway	205.2	119.5
31	The Royal Pacific Hotel and Towers	223.9	119.2
32	China Hong Kong City	224.9	123.9
33	Tsim Sha Tsui Fire Station	288.3	141.1
34	FSD Kowloon South Divisional HQ	310.8	153.1
35	Canton Road Government School	277.0	149.1

ASR No	ASR Description	Cumulative Dust Impact (Mitigated Scenario)	
		Cumulative 1-hr TSP conc[1]	Cumulative 24-hr TSP conc[2]
36	Lai Chack Middle School	323.6	159.0
37	Victoria Tower	327.6	154.4
38	No.1-3A Austin Road, Wai On Building	223.7	133.2
39	The Harbour Side	149.7	121.8
40	The Waterfront	176.4	135.5
41	Sorrento	191.2	143.9
42	No.51 Jordan Road, Lee Kiu Building	191.5	134.7
43	New Headquarters for the Hong Kong Girl Guides Association with hostels	280.6	172.9
44	Man King building	411.8	245.4
45	Yau Ma Tei Catholic Primary School	200.9	130.1
46	HKMA David Li Kwok Po College	235.1	128.5
47	Charming Garden	429.5	176.6
48	Park Avenue	173.1	125.5
49	Central Park	211.2	144.5
50	Island Harbourview	146.0	116.3
51	Olympian City One	164.5	127.7
52	HSBC Centre	279.5	186.0
53	Skyway House	260.8	177.4
54	Olympic Station Phase 3 Project and Olympian City Phase 3 (Under construction)	356.2	211.2
55	Tai Kok Tsui Catholic Primary School (Hoi Fan Road)	132.9	111.8
56	Sir Ellis Kadoorie Secondary School (West Kowloon)	130.4	106.8
57	West Kowloon Disciplined Services Quarters	144.8	116.0
58	Metro Harbourview (Under construction)	138.6	111.1
59	Nam Cheong Estate	155.2	113.7
60	Fu Cheong Estate	141.2	106.5

Notes
[1] An hourly averaged TSP concentration of 500μg/m^3 should not be exceeded
[2] A 24-hour averaged TSP concentration of 260μg/m^3 should not be exceeded
[3] ASRs 7 & 11 are part of the FMPHQ redevelopment site. They are therefore not considered as ASRs during the construction of FMPHQ development. They are however considered as ASRs after the completion FMPHQ development.

5.6 Recommended Mitigation Measures

The Contractor is obliged to follow the procedures and requirements given in the Air Pollution Control (Construction Dust) Regulation[5-8]. It stipulates the construction dust control requirements for both Notifiable (e.g. site formation) and Regulatory (e.g. road opening) Works to be carried out by the Contractor.

In accordance with the Air Pollution Control (Construction Dust) Regulation, the following dust suppression measures should also be incorporated by the Contractor to control the dust nuisance throughout the construction phase:

- Any excavated or stockpile of dusty material should be covered entirely by impervious sheeting or sprayed with water to maintain the entire surface wet and then removed or backfilled or reinstated where practicable within 24 hours of the excavation or unloading;

- Any dusty materials remaining after a stockpile is removed should be wetted with water and cleared from the surface of roads or streets;
- A stockpile of dusty material should not be extend beyond the pedestrian barriers, fencing or traffic cones;
- The load of dusty materials on a vehicle leaving a construction site should be covered entirely by impervious sheeting to ensure that the dusty materials do not leak from the vehicle;
- Where practicable, vehicle washing facilities with high pressure water jet should be provided at every discernible or designated vehicle exit point. The area where vehicle washing takes place and the road section between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores;
- When there are open excavation and reinstatement works, hoarding of not less than 2.4m high should be provided as far as practicable along the site boundary with provision for public crossing. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period;
- All main haul roads should be paved with concrete, bituminous materials, hardcores or metal plates, and kept clear of dusty materials; or sprayed with water or a dust suppression chemical so as to maintain the entire road surface wet;
- The portion of any road leading only to construction site that is within 30m of a vehicle entrance or exit should be kept clear of dusty materials;
- Surfaces where any pneumatic or power-driven drilling, cutting, polishing or other mechanical breaking operation takes place should be sprayed with water or a dust suppression chemical continuously;
- Any area that involves demolition activities should be sprayed with water or a dust suppression chemical immediately prior to, during and immediately after the activities so as to maintain the entire surface wet;
- Where a scaffolding is erected around the perimeter of a building under construction, effective dust screens, sheeting or netting should be provided to enclose the scaffolding from the ground floor level of the building, or a canopy should be provided from the first floor level up to the highest level of the scaffolding;
- Any skip hoist for material transport should be totally enclosed by impervious sheeting;
- Every stock of more than 20 bags of cement or dry pulverised fuel ash (PFA) should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides;
- Cement or dry PFA delivered in bulk should be stored in a closed silo fitted with an audible high level alarm which is interlocked with the material filling line and no overfilling is allowed;
- Loading, unloading, transfer, handling or storage of bulk cement or dry PFA should be carried out in a totally enclosed system or facility, and any vent or exhaust should be fitted with an effective fabric filter or equivalent air pollution control system;
- Exposed earth should be properly treated by compaction, turfing, hydroseeding, vegetation planting or sealing with latex, vinyl, bitumen, shotcrete or other suitable surface stabiliser

within six months after the last construction activity on the construction site or part of the construction site where the exposed earth lies;

- The areas within 30m from the blasting area should be wetted with water prior to blasting;
- No blasting should be carried out when strong wind signal or tropical cyclone warning signal no. 3 or higher is hoisted.

By implementing these control measures and with good construction site practice, it is anticipated that dust impacts will be insignificant. It is recommended that the Contractor should undertake proper watering on all exposed spoil (with at least 4 times per day for WKN and 2 times per day for the remaining sections) throughout the construction phase. The barging facility should be designed with dust enclosures along the loading ramps to avoid dust dispersion. All road surfaces within the barging facility should be paved. Watering should be undertaken twice a day over the work area and all vehicles are required to pass through designated wheel washing facilities before leaving the barging facility. **Figure 5-4** illustrates the locations and extent for the implementation of dust control measures.

These requirements should be incorporated into the Contract Specification for the civil work. In addition, an audit and monitoring programme during the construction phase should be implemented by the Contractor to ensure that the construction dust impacts are controlled to within the HKAQO. Detailed requirements for the audit and monitoring programme is given separately in the EM&A manual.

5.7 Residual Impacts

No residual dust impacts are expected if appropriate dust mitigation measures are adopted and incorporated during the construction phase.

5.8 Conclusion

Key representative ASRs for construction dust impacts have been identified. They comprise of residential uses, hotels, and schools. Other sensitive uses within 500m from the site boundary include playgrounds, open space, parks etc. Currently there is no plan for topside developments on the proposed station.

Potential dust impact would be generated from the soil excavation activities, backfilling, site erosion, storage of spoil on site, transportation of soil, as well as underground blasting activities during the construction phase. Quantitative fugitive dust assessments have been conducted, taking into account the cumulative impact caused by nearby concurrent projects.

It is identified that there are concurrent projects that would potentially cause cumulative dust impacts. The likely impacts from most of the projects are considered to be only minor and insignificant, except for the contribution from redevelopment of FMPHQ which has been taken into consideration in the assessment. Results indicate that, with proper watering of at least 4 times per day for WKN and 2 times per day for the remaining sections throughout the construction phase of KSL and also watering of at least 4 times a day for FMPHQ project, the predicted TSP concentrations will comply with the statutory requirements. Effective dust control can also be achieved by implementing the procedures and requirements given in the Air Pollution Control (Construction Dust) Regulation and the EM&A programme during construction. With the implementation of dust suppression control and good site practice, adverse fugitive dust impact is not anticipated.

During operational phase, only Electric Multiple Units (EMUs) will be deployed during normal operation. It is anticipated that there will be no operational air quality impacts for the proposed KSL development. However, as a good design practice, it is recommended that exhaust louvres should be located away from air sensitive receivers. Intakes louvers would not have any adverse air quality impacts on neighbouring receivers.

6. AIRBORNE NOISE IMPACT ASSESSMENT

6.1 Construction Phase

6.1.1 *Legislation and Standards*

Control over construction noise is governed by the Noise Control Ordinance (NCO) (Cap 400) [6-1] and the EIAO and their subsidiary requirements. Various Technical Memoranda (TMs) have been issued under the NCO and the EIAO to stipulate control approaches and criteria. These TMs prescribe the maximum permitted noise levels for the use of Powered Mechanical Equipment (PME) and certain construction activities and processes, according to the type of equipment or activity, the perceived noise climate of the area, and the working hours of equipment operation and usage. The TMs applicable to the control of noise from construction activities in the current proposed KSL works are:

- TM on Noise from Construction Work other than Percussive Piling (TM-GW) [6-2];
- TM on Noise from Construction Work in Designated Areas (TM-DA) [6-3];
- TM on Environmental Impact Assessment Process (TM-EIAO) [6-4];
- TM on Noise from Percussive Piling (TM-PP) [6-5].

It is noted that use of any percussive sheet piling is governed under the TM-PP and separate application to EPD for Construction Noise Permit (CNP) would be required.

6.1.1.1 *Noise Standards for Daytime*

Noise arising from general construction works during daytime is governed by the TM-EIAO under the EIAO. Table 6-1 presents the recommended noise standards.

Table 6-1 : Noise standards for daytime (0700 to 1900 hours) construction activities

Uses	Acceptable Noise Standards $L_{eq\ (30mins)}$, dB(A)
All domestic premises including temporary housing accommodation	75
Hotels and hostels	75
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required HKCC and HKSM [note]	70 65 (during school examinations)

Note: The above standards apply to uses which rely on open windows for ventilation. Performance art centers (e.g. HKCC and HKSM) are also considered as NSRs according to the TM-EIAO and hence need to be considered. Since noise sensitivity of the HKCC and HKSM is regarded as similar to schools as mentioned in S7.1.1, a noise standard of 70dB(A) for daytime construction noise is therefore adopted.

In accordance with the TM-EIAO, the noise criteria as laid down in Table 6-1 for the construction of designated projects shall be met as far as practicable. All practicable mitigation measures shall be exhausted to avoid residual impacts to the maximum possible extent.

6.1.1.2 *Noise Standards for Restricted Hours*

The NCO provides statutory controls on general construction works during the restricted hours (ie 1900 to 0700 hours from Monday to Saturday and at any time on Sundays or public holidays). The use of PME for construction works during the restricted hours would require a CNP. The TM-GW details the procedures adopted by EPD for assessing such application. The granting of a

CNP is subject to conditions stated in the permit and it may be revoked at any time for failure to comply with the permit conditions.

In addition to the general controls on the use of PME during the restricted hours, the use of Specified Powered Mechanical Equipment (SPME) and the undertaking of Prescribed Construction Work (PCW) during the restricted hours in a designated area are controlled by the TM-DA. Construction plant or equipment classified as SPME under the TM-DA includes hand-held breakers, bulldozers, concrete mixer lorries, dump trucks and poker vibrators. PCW includes the erection or dismantling of formwork or scaffolding, hammering, handling of rubble, wooden boards, steel bars, or scaffolding material, and the disposal of rubble through plastic chutes.

The TM-DA details the procedures that should generally be adopted by EPD for assessing the use of SPME during the restricted hours and for determining whether a CNP would be issued.

Maximum noise levels from construction activities during restricted hours at affected NSRs are controlled under the TMs and shall not exceed the specified Acceptable Noise Levels (ANLs). These ANLs are stipulated in accordance with the Area Sensitivity Ratings established for the NSRs. The ANLs for construction works in designated areas are more stringent than those given in the TM-GW, as reflected from the corresponding Basic Noise Levels (BNLs) stated in Table 6-2.

Table 6-2 : BNLs for construction noise other than percussive piling

Time Period	Basic Noise Levels for Area Sensitivity Ratings, dB(A)		
	A	B	C
All weekdays during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day and evening (0700 to 2300 hours)	60 (45)	65 (50)	70 (55)
All days during the night-time (2300 to 0700 hours)	45 (30)	50 (35)	55 (40)

Note: Figures in brackets are BNLs for SPME construction work in designated areas

As defined in the Noise Control Designated Area Plan no. EPD/NP/KLN-01a, the whole KSL alignment and work sites are within the Designated Area.

6.1.1.3 *Construction Noise Permits*

Despite any description or assessment made in this EIA Report on construction noise aspects, there is no guarantee that a CNP will be issued for the project construction. The Noise Control Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant TMs issued under the NCO.

The Noise Control Authority will take into account contemporary conditions / situations of adjoining land uses and any previous complaints against construction activities at the site before making a decision in granting a CNP. Nothing in the EIA report shall bind the Noise Control Authority in making a decision. If a CNP is to be issued, the Noise Control Authority shall include in it any conditions demand. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution action under the NCO.

6.1.1.4 *Blasting*

There are no statutory procedures and criteria under the NCO and EIAO for assessing the blasting impacts and are therefore beyond the scope of the EIA. However, the administrative and procedural control of all blasting operations in Hong Kong is vested in the Mines Division of the Civil Engineering and Development Department (CEDD). The Dangerous Goods (General) Regulations, Chapter 295 also stipulates that no person shall carry out blasting unless he

possesses a valid mine blasting certificate to be issued by the Mines Division of CEDD. The Superintendent of Mines will review the application on a case-by-case basis before issuing the Mine Blasting Certificate.

6.1.2 *Noise Assessment Methodology*

6.1.2.1 *Summary of Construction Methodology*

The construction programme, sequence, methodology and plant inventory adopted for this assessment were provided by the Design Team. The construction work will commence in early 2005 and is scheduled to be completed by late 2007. Testing and commissioning of the railway system will then be conducted for target completion for operation in late 2008 / early 2009.

Tunnels along Salisbury Road will be constructed using cut-&-cover technique. Bored tunnelling will be adopted from south of WKN along Canton Road. For the tunnels to the north of WKN, cut-&-cover technique will be adopted. The construction activities will commence in the first 100m worksite sub-section, and after completion, the plant items will be relocated to the next sub-section. The spoil from all mucking-out locations will be transported by dump trucks to the barging facility at West Kowloon.

Detailed description on the construction methodologies for each work site is given in **Chapter 4** and the associated construction plant inventory is given in **Appendix 4-2**.

6.1.2.2 *General Assessment Procedures*

Construction noise assessment will be conducted based on the following procedures:

- Determine the assessment area;
- Identify and locate representative NSRs that may be affected by the works;
- Obtain the construction method and work sequence for the construction period;
- Obtain the plant items for each corresponding construction work sequence;
- Determine the sound power levels of the plant items according to the information stated in the TM-GW or other recognised sources of reference, where appropriate;
- Calculate the correction factors based on the distance between the NSRs and the notional noise source positions of the work sites;
- Apply corrections for façade, distance, barrier attenuation, acoustic reflection where applicable;
- Predict construction noise levels at the NSRs;
- Quantify the level of impact at the NSRs, in accordance with TM-GW; and
- Predict the cumulative noise impacts for any concurrent construction works in the vicinity of the proposed work.

6.1.2.3 *Determination of Assessment Area*

The study area for the noise impact assessment includes all NSRs within 300m from the boundary of the project and its works sites. With the shielding from the first row of building blocks, the second row of NSRs will generally be protected. The assessment therefore focuses on the first row of NSRs that have direct line of sight within the project boundary and works sites.

6.1.2.4 *Noise Sensitive Receivers*

NSRs are chosen in accordance with Annex 13 of the TM-EIAO. Both existing and future planned uses during the construction period of KSL are included as appropriate. The existing NSRs are identified through desktop review and site surveys while the planned NSRs are identified from the latest Outline Zoning Plans [6-6 to 6-10], Outline Development Plans and Layout Plans.

The landuses in the vicinity of the proposed alignment and station include schools, residential developments, commercial buildings and hotels. All hotels and performance venues are air-conditioned and do not rely on openable windows for ventilation. The key representative NSRs for noise assessment are given in **Figure 6-1** and their respective locations are shown in **Figures 6-2-1 to 6-2-3**.

6.1.2.5 *Construction Plant Inventory & Emission Inventory*

Chapter 4 presents a detailed description of the key construction works required for each of the work site. The major construction works would include the following activities:

- Site clearance and formation activities;
- Structure dismantling;
- Station construction;
- Tunnel construction (including bored tunnelling);
- Installation of diaphragm walls or pipe pile walls;
- Underpinning of subway, piers and footbridge;
- Diversion of box culverts;
- Spoils removal from underground works & stockpiling;
- Backfilling and reinstatement works; and
- Barging activities.

The above construction activities would require Powered Mechanical Equipment (PME) including breakers, pipe pile rigs, excavators, lorries, mobile cranes, concrete pumps, concrete mixers, pokers, rollers, etc. The Sound Power Levels (SWLs) for each PME without mitigation measures are given in **Appendix 6-1**.

The construction of the proposed works involves different construction activities and plant items at different stages. For cut-&-cover sections along Salisbury Road, at shaft areas, and between Lin Cheung Road and Lai Cheung Road where temporary decking will be installed for traffic management, most of excavation works and tunnel construction will be undertaken beneath the deck. After installing the decking for cut-&-cover sections, the PMEs remaining at grade are assumed at the notional source position of the nearest worksite from the NSRs for worst-case assessment.

The plant inventory provided in **Appendix 4-2** indicates the total number of PME for each route section along the railway alignment. For assessment purpose, it has been assumed that all PME items are evenly distributed over that area (unless otherwise specified), and the worksites were

divided into a number of notional sources having a length to width ratio of approximately 5:1 for calculation. Locations of notional source and distance for NSRs are given in **Appendix 6-2**.

6.1.2.6 *Utilisation Rates of Powered Mechanical Equipment*

Practically, the PMEs will not be operating for all times within a work site. In this assessment, similar utilisation rates adopted in other approved EIA report [6-11] have been assumed. These are summarized below:

Table 6-3 : Utilisation rates of PME

PME	Utilisation Rate
Asphalt paver and roller	50%
Auger	65%
Circular saw	50%
Hand-held breaker, hydraulic breaker	80%
Lorries, excavators and crane lorries	65%
Mobile crane, crawler crane	30%
Pipe pile rigs and chisels	65%

6.1.2.7 *Operation of the TBM Launching Shaft*

The plant inventory for operation of the launching shaft is given in **Appendix 4-2**. Some of the construction plant items including TBM, diesel trains etc would be normally operating inside tunnels, except during the initial stage when the TBM just commences operation.

The TBM will operate 24 hours and the TBM launching shaft will be provided with a noise insulating cover which will be closed during restricted hours to shelter the plant items (see **Chapter 4**). The conveyor belt at the launching shaft will transfer the spoil from the bored tunnel to the adjoining Construction Area A7 (see **S4.3.3**). The conveyor system will be used to lift up the spoil from the bottom of the launching shaft to the ground level only (about 20m tall). The tentative location of conveyor belt is indicated in **Figure 4-1-2**, but is still subject to the detailed design. Spoil from A7 will then be transported by dump trucks to the barging facility in West Kowloon during the daytime.

When the TBM runs about 100m in the tunnel, the diesel train and mortar car will need to travel to and from along the tunnel to facilitate the tunnelling work. For conservative assessment, it is assumed that the TBM, diesel train and mortar car will be operating simultaneously. The following assumptions are made for the calculations for the unmitigated scenario.

- The noise insulating cover for the launching shaft will be closed during night-time and can achieve an overall noise reduction of 22dB(A). Typical configuration of acoustic panels that can achieve this insulation requirement is 1.5mm GS outer skin, 100mm acoustic infill (e.g. fibreglass) with 80kg/m^3, and an inner perforated sheet (see **Figure 6-3**). Typical transmission loss at different frequency bands are 19dB at 125Hz, 25dB at 250Hz, 30dB at 500Hz, 35dB at 1000Hz, and 35dB at 2000Hz.;
- The ventilation fan will be installed with an sound attenuator (e.g. silencer) to reduce the noise impacts by 15dB(A);
- Enclosures with 10dB(A) reduction will be installed for conveyor belt and water pump;
- The motor of the gantry will be screened to provide a noise reduction of 5dB(A);
- The TBM noise emanating from the tunnelling will diminish when the TBM goes further to the south of the tunnel. However, for conservative assessment, such attenuation is not taken into consideration; and

- Since the TM-GW does not include noise data for TBM, diesel train and mortar car, reference has been made to the Sheung Shui to Lok Ma Chau Spur Line CNP application (ref GW-TN0374-03 dated Nov 2003) in this assessment.

6.1.2.8 *Noise Assessment Tool*

An in-house program has been used for the analysis of the construction noise calculations. The initial program runs were conducted without any mitigation measures. Where noise level exceedance were identified, further runs would be made assuming different combinations of mitigation measures to be incorporated.

6.1.3 *Assessment Results for "Unmitigated" Scenario During Daytime*

Assessment results indicate that, under "unmitigated" scenario, the construction noise impacts at some of the NSRs would exceed the criteria. The maximum unmitigated noise levels, including noise contribution from the construction plant in the launching shaft, and the exceedance over the criteria at the NSRs are shown in Table 6-4. Detailed results of construction noise assessment are given in **Appendix 6-3**.

The most affected residential building is Man King Building (N19), with a noise exceedance of 15dB(A), during the construction of WKN and northern tunnel. Canton Road Government School (N11) and Lai Chack Middle School (N12) would also be exposed to noise exceedance of 16dB(A).

Table 6-4 : Predicted maximum construction noise levels at the NSRs – "unmitigated" scenario

NSR No.	NSR Description	Unmitigated Scenario	
		Max Predicted Noise Level, dB(A)	Exceedance, dB(A)[1]
N1	Hong Kong Space Museum	**82**	12
N2	Hong Kong Cultural Centre	**79**	9
N3	Hankow Centre	72	0
N4	Not used		
N5	Not used		
N6	No.4-8 Canton Road	**86**	11
N7	Imperial Building (facing Canton Road)	**82**	7
N8	Hanley Building (facing Canton Road)	**81**	6
N9	Manley Building (facing Canton Road)	**86**	11
N10	FSD Kowloon South Divisional HQ	**85**	10
N11	Canton Road Government School	**86**	16
N12	Lai Chack Middle School	**86**	16
N13	Victoria Tower	**78**	3
N14	No.1-3A Austin Road, Wai On Building	**81**	6
N15	The Harbour Side	61 [4]	0
N16	The Waterfront	**76**	1
N17	Sorrento	**78**	3
N18	No.51 Jordan Road, Lee Kiu Building	**80**	5
N19	Man King Building	**90**	15
N20	Man Fai Building	**86**	11
N21	Man Yiu Building	**83**	8
N22	Man Cheong Building	**82**	7
N23	Man Wah Building	**80**	5
N24	Yau Ma Tei Catholic Primary School	**77**	7
N25	HKMA David Li Kwok Po College	**78**	8
N26	Charming Garden	**84**	9
N27	Park Avenue	75	0

NSR No.	NSR Description	Unmitigated Scenario	
		Max Predicted Noise Level, dB(A)	Exceedance, dB(A)[1]
N28	Central Park	**84**	9
N29	Island Harbourview	**77**	2
N30	Olympic Station Phase 3 Project and Olympian City Phase 3 (Under construction)	**84**	9
N31	Tai Kok Tsui Catholic Primary School (Hoi Fan Road)	**71**	1
N32	Sir Ellis Kadoorie Secondary School (West Kowloon)	69	0
N33	West Kowloon Disciplined Services Quarters	71	0
N34	Metro Harbourview (Under construction)	69	0
N35	Nam Cheong Estate	68	0

Note:
[1] Exceedance for schools are deducted from comparison with the normal noise criterion of 70dB(A)
[2] Bold figures indicate that the predicted noise levels have exceeded the criteria in TM-EIAO.
[3] The HKSM and HKCC are provided with central A/C and hence the predicted noise levels are for information only.
[4] Prediction of noise level at Harbour Side has included the contribution of haul road (i.e. 56dB(A)).

It is anticipated that there will be a total of about 43 lorries per hour transporting the spoils from the entire work sites to the barging facility. Noise contribution from the additional construction traffic to the existing roads would be very minimal. It is estimated that the noise level on the nearest NSR, i.e. The Harbour Side, due to the operation of dump trucks on haul road is only 56dB(A) (**Appendix 6-3**). Adverse noise impacts are therefore not anticipated. Details on timing for disposal, transportation routings of the trucks, locations of temporary stockpiles and barging facility, and location of disposal sites are presented in **Chapter 9**.

6.1.4 *"Good Practice" Mitigation Measures*

The predicted noise levels show that unmitigated construction activities could exceed the daytime noise criteria at some of the NSRs. Noise mitigation measures are therefore required to alleviate the noise impacts. Noise emissions from construction sites could be minimised by the following means:

- Good site practices to limit noise emissions at the source;
- Use of quiet plant and working methods;
- Use of site hoarding as noise barrier to screen noise at ground level of NSRs;
- Use of shrouds / temporary noise barriers to screen noise from relatively static PMEs;
- Scheduling of construction works outside school examination periods in critical area; and
- Alternative use of plant items within one worksite, wherever practicable.

The above mitigation measures would need to be implemented in all work sites as good practices. Detailed descriptions of these mitigation measures are given in the following sections.

6.1.4.1 *Good Site Practices and Noise Management Techniques*

Good site practice and noise management techniques could considerably reduce the noise impact from construction site activities on nearby NSRs. The following measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- machines and plant (such as trucks, cranes) 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, where possible, be orientated so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be properly fitted and maintained during the construction works;
- mobile plant should be sited as far away from NSRs as possible and practicable; and
- material stockpiles, site office and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

The benefits of these techniques can vary according to specific site conditions and operations. The environmental noise climate would certainly be improved through these control practices, although the improvement can only be quantified during implementation when specific site parameters are known.

6.1.4.2 *Use of Site Hoarding*

Purpose built temporary noise barriers of 2.4m high located on the site boundaries between noisy construction activities and NSRs could generally reduce noise levels at low-level zone of NSRs through partial screening. In general this would provide minimum 5 dB(A) attenuation for the low level receivers. It would be possible for the Contractor to provide these in the form of site hoardings to achieve this attenuation effect, provided that the barriers have no openings or gaps and have a superficial surface density of at least 14kg/m^2. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period. For conservative assessments, however, the site hoarding has not been taken into consideration in the construction noise assessments.

6.1.4.3 *Use of Movable Noise Barrier & Full Enclosure for Relatively Static Plants*

Movable temporary noise barriers that can be located close to noisy plant and be moved iteratively with the plant along a worksite can be very effective for screening noise from NSRs. A typical design which has been used locally is a wooden framed barrier with a small cantilevered upper portion of superficial density no less than 14kg/m^2 on a skid footing with 25mm thick internal sound absorptive lining. This measure is particularly effective for low level zone of NSRs. A cantilevered top cover would be required to achieve screening benefits at upper floors of NSRs.

Movable barriers or flexible acoustic mat (shrouds) will be used for some PME (e.g. pipe pile rigs, auger). It is anticipated that suitably designed barriers /acoustic mats could achieve at least 5 - 10dB(A) reduction. For a conservative assessment, only a reduction of 5dB(A) is assumed.

The use of full enclosure has been considered in this assessment to shelter relatively static plant including air compressor, generator, grout pump. These enclosures can provide about 10dB(A) noise reduction. A sketch of typical noise enclosure /temporary barrier is attached in **Figure 6-3**.

A summary of the barrier, enclosure, and acoustic mat adopted for PMEs, and the associated noise reduction is given in **Appendix 6-4**.

6.1.4.4 *Scheduling of Construction Works Outside School Examination Period*

During school examination periods, the daytime construction noise criterion is 65dB(A) which is lower than the normal daytime school criterion of 70dB(A). Scheduling of construction works outside school examination period to less intrusive periods would definitely reduce the overall noise impacts at the NSRs for ensuring compliance with the construction noise criterion.

The Contractor shall liaise with the school representative(s) including, but not limited to Lai Chak Middle, Canton Road Government, Yau Ma Tei Catholic Primary, HKMA David Li Kwok Po College, and the planned schools that would receive student intake during the construction of the KSL (e.g. secondary school at junction of Hoi Wang Road and post secondary college at junction of Hoi Ting Road and Hoi Wang Road), to obtain the examination schedule and avoid noisy construction activities during school examination period.

6.1.4.5 *Use of "Quiet" Plant and Working Methods*

The use of quiet plant is a feasible solution to tackle adverse noise impacts associated with the construction works. It is generally known (supported by field measurement) that particular models of construction equipment are quieter than standard types given in the TM-GW. Whilst it is generally considered too restrictive to specify that the Contractor has to use specific models or items of plant, it is reasonable and practicable to set plant noise performance specifications for specific PME so that some flexibility in selection of plant is allowed. A pragmatic approach would be to request that the Contractor independently verifies the noise level of the plant proposed to be used and demonstrates through furnishing of these results, that the plant proposed to be used on the site meets the requirements.

The use of quiet plant associated with the construction works is prescribed in British Standard "Noise Control on Construction and Open Sites, BS5228: Part 1: 1997" which contains the SWLs for specific quiet PME. The SWLs for quiet PMEs adopted for the assessment are detailed in **Appendix 6-5**. It should be noted that while various types of silenced equipment could be found in Hong Kong, EPD when processing a CNP application for evening or night time works may apply the noise levels specified in the TM-GW and TM-DA. CNP applications which contain sufficient details of any particularly quiet items of PME or any special noise control measures which the CNP applicant proposes to employ on the site may be given special consideration by the Noise Control Authority.

6.1.4.6 *Sequencing Operation of Construction Plant Equipment*

In practice, some plant items will operate sequentially within the same work site, and certain reduction of the predicted noise impacts could be achieved. However, any additional control on the sequencing of plant will impose a restrictive constraint to the Contractor on the operation and planning of plant items, and the implementation of the requirement would be difficult to be monitored. Hence, sequencing operation of PME has not been taken into consideration in the construction noise assessments, except those specified in **S6.1.2.6** for which the realistic operating time has been incorporated.

6.1.4.7 *Use of Quieter Plants at TBM Launching Shaft*

It is proposed to use quieter plant to alleviate the noise impacts at the launching shaft. The noise data for quieter compressor and ventilation fan used in the Spur Line Construction CNP application is also adopted (see **Appendix 6-6** for details).

6.1.5 *Assessment Results for "Mitigated" Scenario During Daytime - "Good Practice" Mitigation Measures*

Noise reduction from the use of mitigation measures including quiet plant, noise barrier, acoustic mat and enclosure for construction plants as described in **S6.1.4** has been applied in the assessment. However, no screening correction for site hoarding has been assumed in the model for conservative analysis. Detailed results of construction noise assessment for "mitigated" scenario (with contributions from the launching shaft) are given in **Appendix 6-6**. The predicted noise levels and the exceedance over daytime construction noise criteria are summarised in the following Table 6-5.

Table 6-5 : Predicted maximum construction noise levels at the NSRs – "mitigated" scenario – with good practices

NSR No.	NSR Description	Mitigated Scenario	
		Max Predicted Noise Level, dB(A)	Exceedance, dB(A)[1]
N1	Hong Kong Space Museum	**71**	1
N2	Hong Kong Cultural Centre	69	0
N3	Hankow Centre	62	0
N4	Not used		
N5	Not used		
N6	No. 4-8 Canton Road	75	0
N7	Imperial Building (facing Canton Road)	71	0
N8	Hanley Building (facing Canton Road)	70	0
N9	Manley Building (facing Canton Road)	75	0
N10	FSD Kowloon South Divisional HQ	75	0
N11	Canton Road Government School	**74**	4
N12	Lai Chack Middle School	**74**	4
N13	Victoria Tower	72	0
N14	No.1-3A Austin Road, Wai On Building	75	0
N15	The Harbour Side	59 [4]	0
N16	The Waterfront	69	0
N17	Sorrento	71	0
N18	No.51 Jordan Road, Lee Kiu Building	73	0
N19	Man King Building	**81**	6
N20	Man Fai Building	**77**	2
N21	Man Yiu Building	75	0
N22	Man Cheong Building	74	0
N23	Man Wah Building	73	0
N24	Yau Ma Tei Catholic Primary School	69	0
N25	HKMA David Li Kwok Po College	69	0
N26	Charming Garden	75	0
N27	Park Avenue	67	0
N28	Central Park	75	0
N29	Island Harbourview	68	0
N30	Olympic Station Phase 3 Project and Olympian City Phase 3 (Under construction)	**76**	1
N31	Tai Kok Tsui Catholic Primary School (Hoi Fan Road)	64	0
N32	Sir Ellis Kadoorie Secondary School (West Kowloon)	62	0
N33	West Kowloon Disciplined Services Quarters	64	0
N34	Metro Harbourview (Under construction)	62	0
N35	Nam Cheong Estate	61	0

Note:
[1] Exceedance for schools are deducted from comparison with the normal noise criterion of 70dB(A)
[2] Bold figures indicate that the predicted noise levels have exceeded the NCO criteria.
[3] The HKSM and HKCC are provided with central A/C and hence the predicted noise levels are for information only.
[4] Prediction of noise level at Harbour Side has included the contribution of haul road (i.e. 56dB(A)).

With the use of recommended noise mitigation measures described in **S6.1.4**, construction noise impacts at the NSRs could be reduced but still there will be exceedances at some of the NSRs over daytime construction criteria. A maximum noise level of 81dB(A) is found at Man King Building (N19) and 74dB(A) at Canton Road Government School (N11) and Lai Chack Middle School (N12), respectively.

6.1.6 *Further Specific Mitigation Measures Considered*

Further specific mitigation measures have been investigated in order to reduce the noise impacts to the maximum practicable extent at the remaining affected NSRs, including the Canton Road Government School (N11), Lai Chack Middle School (N12), Man King Building (N19), Man Fai Building (N20), and Olympian City Phase 3 (N30). Details of the results are presented separately for each NSR in the following sections and summarized in **Appendix 6-7**.

6.1.6.1 *Schools*

Assessment results indicate that the noise impacts at the two schools are caused by the ground treatment works for the bored tunnel sections in front of them. The total duration for the noise exceedance over the 70dB(A) criterion is 2 months. Noise contributions from other construction works, such as the launching shaft and the WKN which are much further away, are less significant. The current assessment has assumed the worst case that ground treatment would be required (i.e. approximately 2 months for each 50m sub-section). The detailed design will be conducted by the Design & Build Contactor at a later stage, and he would further review the need for ground treatment for the section along Canton Road, taking into account any specific construction methodology for the bored tunnelling. If the construction methodology developed by the Design & Build Contractor confirms that the less ground treatment is required, the actual environmental impacts would be less than that predicted in this EIA Report.

(a) Specific Mitigation Measures 1 : Temporary Noise Barrier for Particular PME

The ground treatment work would require drill hole machine, grout pump, crane lorry and air compressor. Since the use of quiet plants and movable barrier/enclosure for drill hole machine, grout pump and air compressor have been already recommended in **S6.1.4**, a possible effective mitigation measures for further investigation is the use of temporary noise barrier for the crane lorry during ground treatment.

It is found that the use of temporary noise barrier for the crane lorry is not effective to reduce the noise impacts at the two schools. The predicted noise impacts and the duration of exceedance are given in Table 6-6.

Table 6-6 : Noise impacts at schools – with temporary noise barrier for particular PME

NSR	Description	Noise Impacts, dB(A)			Duration in different noise band (Month)[1]		
		Criterion	Max Impacts	Exceedance	71 – 75 dB(A)[2]	76 – 79 dB(A)	80 – 84 dB(A)
N11	Canton Road Government School	70	**74**	4	2	0	0
N12	Lai Chack Middle School	70	**74**	4	2	0	0

Note:
[1] Total duration of noise exceedance (i.e. the sum of individual exceedance duration for all activities) is given.
[2] The noise level band between 71 dB(A) and 75 dB(A) applies to schools only.

(b) Specific Mitigation Measures 2 : Large Full Enclosure

Another possible mitigation measures is the use of large full enclosure for all noisy plants during the ground treatment work. A larger full enclosure would provide better noise attenuation than the use of temporary noise barriers / acoustic mats. However, the height of the enclosure would need to be at least 7m in order to accommodate all the plant. Given the nature of Canton Road, having such a tall barrier would impose adverse visual impacts to the neighbouring receptors and pedestrians, especially for the Canton Road Government School and the Lai Chack Middle School which their boundaries would be within 10m. Together with potential nuisance / impacts on the access to the schools, the use of large enclosure would cause significant impacts and hence is considered as not practicable. It is therefore not recommended to implement such a measure for the relatively short duration of noise exceedance (i.e. 2 months) during the construction period.

(c) Specific Mitigation Measures 3 : Scheduling of Works

The noise exceedance could possibly be avoided at the schools if the ground treatment work is scheduled to be carried out during the insensitive period, e.g. summer vacation. However, this mitigation measures will pose a constraint on the construction programme to the Contractor and thus prolonging the overall construction duration as well as nuisance to the schools. It is also considered that there may be supplementary classes or extra-curriculum activities during the school vacation and hence scheduling of the works may not be practicable. However, it is still recommended the Contractor to consult with the school representatives to confirm the practicality of scheduling such works to tie in with long school vacations and the arrangement of summer courses during this period.

All noise mitigation measures, whichever practicable and effective, have been exhaustively investigated. Residual noise impacts for the schools are described in **S6.1.7**.

6.1.6.2 *Man King Building and Man Fai Building*

The predicted noise impacts at Man King Building and Man Fai Building, after implementing the "good practice" mitigation measures described in **S6.1.4** are 81dB(A) for a duration of 17 months and 77dB(A) for a duration of 10 months (refer to **Table 6-5 & Appendix 6-6**). The remaining affected dwelling is the southern and western facades facing the tunnel section immediately to the north of the WKN. The major noise contributing sources are emanated from the construction activities of the tunnelling work and diversion of box culvert in front of the Man King Building. In order to further reduce the noise impacts, the following mitigation measures have been further considered.

(a) Specific Mitigation Measures 1 : Temporary Noise Barrier for Particular PME

Since most of the relatively static plants have already been sheltered by either a movable barrier, acoustic mats or enclosure (**S6.1.4**), the remaining noisy sources from the worksite in front of the Man King Building are hydraulic breaker, lorry/dump truck, concrete lorry mixer, concrete pump truck for tunnelling work and diversion of box culvert. The use of temporary noise barrier for these plant items has therefore been investigated. The following table summarises the predicted noise impacts for the scenario with installation of the temporary noise barrier for these particular PME at this section (**Figure 6-4**).

Table 6-7 : Noise impacts at Man King and Man Fai Buildings – with temporary noise barrier for particular PME

NSR	Description	Noise Impacts, dB(A)			Duration in different noise band (Month)[1]		
		Criterion	Max Impacts	Exceedance	71 – 75 dB(A)[2]	76 – 79 dB(A)	80 – 84 dB(A)
N19	Man King Building	75	**80**	5	NA	15	0
N20	Man Fai Building	75	75	0	NA	0	0

Note:
[1] Total duration of noise exceedance (i.e. the sum of individual exceedance duration for all activities) is given.
[2] The noise level band between 71 dB(A) and 75 dB(A) applies to schools only.

It can be seen that the use of temporary noise barrier for mitigating noise generated from hydraulic breaker, lorry, concrete lorry mixer for the tunnel section to the south of Man King Building will reduce the noise impacts by 1dB(A) from 81dB(A) to 80dB(A), and the duration of exceedance will be reduced from 17 months to 15 months; and the associated noise impacts at Man Fai Building will be reduced to within the noise criterion. Detailed results of the noise assessment are given in **Appendix 6-7.**

(b) Specific Mitigation Measures 2 : Sequencing of Construction Activities

Since movable temporary barriers have been used for all noisy PMEs as far as practicable, sequencing of construction activities for tunnelling work at the nearest worksite in front of Man King Building is investigated. The tunnel section will be originally constructed from both the southern and northern ends towards the middle in relatively short sections of about 100m long. Discussion with the Design Team suggests that it is feasible to construct the 100m long tunnel immediately in front of Man King Building in 2 sub-sections sequentially (**Figure 6-4**). This approach will reduce the total amount of PMEs operating within that area and hence the associated noise impacts. **Appendix 6-7** shows the PME inventory, work programme and a sketch showing the approximate demarcation of the 2 sub-sections, and the noise prediction results.

Assessment results indicate that, after sequencing the construction activities, the noise impact will be reduced to 77dB(A) with only 2dB(A) exceedance for a duration of 4 months at Man King Building (see **Appendix 6-7**).

(c) Specific Mitigation Measures 3 : Large Full Noise Enclosure

The use of large full enclosures or large cantilevered noise barriers to screen the entire tunnel section has also been studied in order to further reduce the noise impacts. However, to ensure the construction plant items can move and transverse freely inside the enclosures or large cantilevered noise barrier, the minimum height should be as high as about 9m and for a length of about 100m.

Given the close proximity of the enclosure / large cantilevered noise barrier to the NSRs, such a massive structure would cause adverse visual impacts to the residents in Man King Building. It is also estimated that the foundation construction for such an extensive enclosure / large cantilevered barrier would be about 2-3 months. The foundation works of the enclosure / large cantilevered noise barrier would require piling rigs to be located relatively close to Man King Building, the noise impacts caused by the piling rigs on Man King Building would also be significant. It is noted that Man King Building does not have a podium and the lowest residential

floor is only about 3-4 m above the local ground. Hence, the visual impacts on the low level receivers, especially those in north-west corner of Man King Building, will be very significant. On this basis, the use of large full noise enclosure is not considered as practicable. In addition, implementing such a noise enclosure can only benefit for 2dB(A) for a period of 1-2 months. The environmental benefits are only minimal and hence it is not recommended to implement this large full enclosure.

6.1.6.3 *Olympian City Phase 3*

The predicted noise impacts at Olympian City Phase 3, after implementing the "good practice" mitigation measures as described in **S6.1.4**, is 76dB(A) for a duration of 4 months (refer to **Table 6-5 & Appendix 6-6**). The dominant noise sources are caused by the construction activities during the installation of D-wall for tunnelling work. Further mitigation measures have been considered to mitigate the noise impacts.

(a) Specific Mitigation Measures 1 : Temporary Noise Barrier for Particular PME

Use of temporary noise barrier for mitigating noise generated from concrete lorry mixer, concrete pump truck, lorries/dump truck at the tunnel section immediately in front of the Olympian City Phase 3 development (**Figure 6-4)** has been found to be effective in reducing the construction noise impacts to within noise criterion (**Table 6-8**). No residual impact is anticipated.

Table 6-8 : Noise impacts at Man King Building – with temporary noise barrier for particular PME

NSR	Description	Noise Impacts, dB(A)			Duration in different noise band (Month)[1]		
		Criterion	Max Impacts	Exceedance	71 – 75 dB(A)[2]	76 – 79 dB(A)	80 – 84 dB(A)
N30	Olympian City Phase 3	75	75	0	NA	0	0

Note:
[1] Total duration of noise exceedance (i.e. the sum of individual exceedance duration for all activities) is given.
[2] The noise level band between 71 dB(A) and 75 dB(A) applies to schools only.

Olympian City Phase 3 development is being constructed up to the lower residential floors during the time of preparing this EIA. It would take about 1-2 years for the completion of construction, fitting out and subsequent issue of the occupation permit. The above assessment has assumed that the NSR will be occupied during KSL construction as the worst-case assessment. In case it is not occupied at the time of KSL construction at this tunnel section, the Contractor should revisit the need of the proposed mitigation measures before the actual construction activities commence.

6.1.7 *Residual Impacts During Daytime*

All practicable direct mitigation measures including use of temporary barrier for particular plant items, large full enclosure, scheduling of construction works, and sequencing of construction activities (see **S6.1.4** to **S6.1.6** above) have been investigated and exhaustively used in order to alleviate the construction noise impacts. Assessment results indicate that with the incorporation of all recommended mitigation measures, there are still minor exceedance over the daytime construction noise criteria at one residential building and two schools. The residual impacts and durations of noise exceedance due to construction of KSL are summarised in **Table 6-9**.

Table 6-9 : Residual construction noise impacts

NSR	Description	Noise Impacts, dB(A)			Duration in different noise band (Month)[1]		
		Criterion	Max Impacts	Exceedance	71 – 75 dB(A)[2]	76 – 79 dB(A)	80 – 84 dB(A)
N11	Canton Road Government School	70	**74**	4	2	0	0
N12	Lai Chack Middle School	70	**74**	4	2	0	0
N19	Man King Building	75	**77**	2	N/A	4	0

Note:
[1] Total duration of noise exceedance (i.e. the sum of individual exceedance duration for all activities) is given.
[2] The noise level band between 71 dB(A) and 75 dB(A) applies to schools only.

Since all the practicable direct noise mitigation measures (including quieter plant, temporary noise barriers, large full enclosures, scheduling of construction activities and sequencing of construction activities, as elaborated in **S6.1.4** to **S6.1.6**) have been implemented, Indirect Technical Remedies (ITR) have been considered by the Project Proponent as the last resort for mitigating residual construction noise impacts.

ITR would generally require the consideration to upgrade the glazing (if necessary) for the facades that would be subject to excessive residual noise. In addition, the provision of air-conditioning would also be considered for those units subject to residual noise impacts. Erecting scaffolding to the exterior of the receivers may be required to upgrade the glazing. If necessary, the construction workers would need to get access to the units to replace the glazing and the air-conditioning equipment. After all the replacement works are completed, the scaffolding would need to be dismantled. The whole process would take 1-2 months, depending on the site conditions.

With reference to the East Rail Extension Hung Hum to Tsim Sha Tsui EIA Final Report (ERE EIA) [6-12] which is also prepared by the Project Proponent, the eligibility criteria proposed for qualifying the receivers for ITR are dependent on the severity of the residual noise impact and duration of exceedance after implementing all practicable direct mitigation measures. The eligibility criteria are given as follow:

- A residual impact of 5dB(A) or more (During the upgrading of glazing and provision of air-conditioning, the use of powered tools (eg electric drills) and general activities by the workers would generate high noise levels within the premises. The Project Proponent considers that the requirements of having the 5dB(A) above the criterion for consideration of ITR is appropriate) ; and
- A duration of noise exceedance of equal or more than 1 month (As explained above, ITR work would take about 1-2 months for implementation. Hence, it is not considered appropriate by the Project Proponent to consider ITR for any residual noise impacts shorter than 1 month).

Results indicate that none of the remaining affected NSRs would be qualified for ITR. Nonetheless, preliminary site inspection suggests that most of the classrooms of these schools have been provided with upgraded glazing and air-conditioning.

6.1.8 *Cumulative Construction Noise Impacts from Concurrent Projects During Daytime*

6.1.8.1 *FMPHQ*

The redevelopment of FMPHQ will be undertaken concurrently with KSL works (**Figure 1-2-1**). According to the latest information provided by the FMPHQ developer, the construction is planned for 30 months and will commence in early 2004 and hence will overlap with KSL. Cumulative construction noise impact is considered.

Hankow Centre is the only residential premise that would be potentially affected by concurrent constructions of both KSL and FMPHQ redevelopment. As mentioned in **Chapter 5**, the construction of FMPHQ is tentatively divided into six stages of works, including:

1) Tree retaining wall installation, retaining wall installation for main building, open cut excavation;

2) Retaining wall installation for main building, open cut excavation;

3) Retaining wall installation for main building;

4) Remaining excavation;

5) Foundation work; and

6) Superstructure work.

The cumulative noise levels at different construction phases for the mitigated scenario at Hankow Centre are summarised in Table 6-10 below. Results show that the predicted cumulative noise levels at Hankow Centre will be within the relevant criteria at all stages and residual impact is therefore not anticipated.

Table 6-10 : Cumulative Construction Noise Levels at N3 Hankow Centre

Period	Construction Activities		Predicted Noise Level dB(A)		
	KSL	FMPHQ	KSL	FMPHQ[1]	Cumulative
Mar 05 – May 05	Utilities diversion along Salisbury Road	Remaining excavation	58	70	70
Jun 05 – Mar 06	Temp wall & decking	Remaining excavation + superstructure work	61	69	70
Apr 06 – Oct 06	Excavation	Superstructure work	59	68	69

Note:
[1] Results have been made reference to the approved Project Profile of FMPHQ.
[2] Results are only presented for overlapping construction period.

6.1.8.2 *WKCD*

The latest information for WKCD at the time of preparing this EIA is available from the government website. It is noted that the proposal for WKCD has been submitted in mid June 2004. According to Addendum No. 3 to the Invitation for Proposal for the WKCD [1-7] issued on 30 March 2004, the construction of the WKCD is anticipated to commence in April 2007. There is no available information on the construction programme / method / phasing at this stage.

The Canton Road Government School (N11), Lai Chack Middle School (N12), Victoria Tower (N13) and No.1-3A Austin Road, Wai On Building (N14) are the NSRs that would be potentially affected by the cumulative impacts from both WKCD and KSL projects. An assessment has been

conducted to evaluate the potential cumulative noise impacts caused by the construction of WKCD. It is anticipated that the construction of WKCD would involve mainly piling and superstructure. Information from other approved EIA report [6-13] for large site formation work and building construction suggests that the typical sound power levels of the groups of PME for piling and superstructure, or drainage / utility would be 113dB(A). On this basis, the potential cumulative noise contributions from the WKCD have been predicted (see **Appendix 6-8**) and are summarised below:

Table 6-11 : Cumulative construction noise impacts from WKCD

NSR	Description	Noise Levels, dB(A)			Criterion, dB(A)	Exceedance, dB(A)
		KSL	WKCD	Total		
N11	Canton Road Government School	**74**	69	**75**	70	5
N12	Lai Chack Middle School	**74**	69	**75**	70	5
N13	Victoria Tower	72	66	73	75	0
N14	No.1-3A Austin Road, Wai On Building	75	64	75	75	0

Note: According to the Invitation for Proposal for WKCD, N10 (FSD Kowloon South Divisional HQ) will be relocated as part of the WKCD development project. Hence, as far as the cumulative construction noise impacts from WKCD are concerned, it is not considered as a NSR.

The exceedance at the two schools is caused by the construction of KSL only and all practicable direct mitigation measures have been considered exhaustively including good site practices, use of temporary barrier for particular plant items, quiet plants, typical movable barriers and enclosures, and scheduling of construction works (see **S6.1.4** and **S6.1.6.1** above). No other mitigation measures is considered to be practicable and effective to reduce the residual impact and the duration of the impacts after exhausting the use of direct mitigation measures is 2 months, as laid down in **Table 6-9** above.

It should be noted that WKCD is a Designated Project under the EIAO. Hence, the project proponent of WKCD would need to conduct a separate EIA study for separate approval to address all the impacts during its construction and operational phase. The results for the above table should therefore be considered as for information only and be subject to detailed assessment by the project proponent of WKCD.

6.1.8.3 *Post Secondary College*

The proposed post-secondary college (**Figure 1-2-2**) is located at the junction of Hoi Ting Road and Hoi Wang Road and will be constructed in 2005/2006. Yau Ma Tei Catholic Primary School is identified as the only NSRs that would be potentially affected. Similar to the WKCD, a notional sound power level of 113dB(A) has been assumed for assessment of the cumulative construction noise impact for this school. Results are given in **Appendix 6-8** and summarised below. Cumulative noise impacts on Yau Ma Tei Catholic Primary School would not exceed the 70dB(A) criterion.

Table 6-12 : Cumulative construction noise impacts from post secondary school

NSR	Description	Noise Levels, dB(A)			Criterion, dB(A)	Exceedance, dB(A)
		KSL	School	Total		
N24	Yau Ma Tei Catholic Primary School	69	64	70	70	0

Nonetheless, it is recommended that the Contractor shall liaise with the school representative(s) of the college if it would receive student intake during the construction of the KSL to obtain the examination schedule and avoid noisy construction activities during school examination periods.

6.1.8.4 *Roads D12 (Eastern Section), D1/ D1A*

Subject to the confirmation on potential entrustment of the Roads D12, D1 and D1A to KCRC (**Figure 1-2-2**), the Project Proponent could schedule the construction works and allow programme phasing to avoid the concurrent activities to be undertaken in the vicinity. The construction of roadworks is likely to be commenced in late 2007 when all civil works of KSL are completed. Hence, there will be no cumulative noise impacts at the potentially sensitive receivers including Lai Chack Middle School, Victoria Tower and Wai On Building (ref. FSD Kowloon South Divisional Headquarter will be relocated at that time due to the construction of WKCD). Nonetheless, a separate Environmental Permit (EP) will be applied from EPD for construction and operation of the roadworks.

6.1.8.5 *Cultural Square Development & Pedestrian Piazza*

The proposed Cultural Square Development is located at Salisbury Road (**Figure 1-2-1).** It is anticipated that the construction works will be undertaken concurrently with KSL from 2005 to 2007. The proposed pedestrian piazza is located at the existing Star Ferry Public Transport Interchange (PTI) (**Figure 1-2-1)** and the works would commence in 2007 for completion in 2008. However, there are only hotels and performance art centres in the vicinity of the area and all of these developments are provided with central air conditioning and do not rely on open window for ventilation. Cumulative noise impacts are therefore not anticipated.

6.1.8.6 *Hong Kong Girl Guides Association Headquarter*

The proposed Hong Kong Girl Guides Association Headquarter is located at the junction of Jordon Road and Ferry street (**Figure 1-2-2).** It is anticipated that the construction works will be undertaken concurrently with KSL from 2005 to 2007. Assuming a notional sound power level of 113dB(A) for assessment of the cumulative construction noise impact for this development, results are given in **Appendix 6-8** and summarised below.

Table 6-13 : Cumulative construction noise impacts from Hong Kong Girl Guides Association Headquarter

NSR	Description	Noise Levels, dB(A)			Criterion, dB(A)	Exceedance, dB(A)
		KSL	Headquarter	Total		
N19	Man King Building	**77**	67	**77**	75	2
N23	Man Wah Building	73	**76**	**78**	75	3

The exceedance at Man King Building is caused by the construction of KSL only and all practicable direct mitigation measures have been considered exhaustively including good site practices, use of temporary barrier for particular plant items, quiet plants, typical movable barriers and enclosures, and sequencing of construction activities (see **S6.1.4** and **S6.1.6.2** above). No other mitigation measures is considered to be practicable and effective to reduce the residual impact and the duration of the impacts after exhausting the use of direct mitigation measures is 4 months, as laid down in **Table 6-9** in **S.6.1.7**.

On the other hand, the noise exceedance at Man Wah Building is mainly contributed by the construction of the Hong Kong Girl Guides Association Headquarter. It is recommended that the mitigation measures shall be reviewed by the Design & Build Contractor, subject to the detailed construction programme of the Headquarter. The duration would also be subject to the details of the construction programme, and would be for the worst case up to a maximum of 2 years from Year 2005 to 2007 for the entire construction period of the Headquarter.

6.1.8.7 *Secondary School*

The proposed secondary school (**Figure 1-2-2**) is located at the junction of Hoi Wang Road and Yau Cheung Road. The construction is scheduled to commence in 2007/08 and for completion by 2009/10. There is no other information available on construction programme / method / phasing at this stage. In accordance with the construction programme of KSL, all excavation works for this section of the WKN northern tunnel will be completed by 2007, and the remaining superstructure, backfilling and road reinstatement work will be taken from December 2006 to May 2007. Taking into account 2 months of mobilisation period of the school project, the constructions are very unlikely to be undertaken concurrently.

Assuming a notional sound power level of 113dB(A) for assessment of the cumulative construction noise impact, it is identified that the predicted cumulative noise level on the most likely affected NSR, i.e. Man Cheong Building (N22), caused by the construction of the secondary school will still comply with the noise criterion. Results are given in **Appendix 6-8** and summarised below.

Table 6-14 : Cumulative construction noise impacts from secondary school

NSR	Description	Noise Levels, dB(A)			Criterion, dB(A)	Exceedance, dB(A)
		KSL	School	Total		
N22	Man Cheong Building	72 [1]	66	73	75	0

Note:
[1] The figure is the maximum predicted construction noise level caused by KSL at N22 during Year 2007 (i.e. the possible concurrent period)

6.1.8.8 *China Light Power Electricity Substation*

The proposed CLP electricity substation (**Figure 1-2-2**) is planned at Hoi Wang Road (**Figure 1-2-2**) and is scheduled to be construction in late 2004 for completion in 2007. The NSR that would most likely be affected by the cumulative noise impact is Yau Ma Tei Catholic Primary School which is about 150m at the north of the electricity substation. Similarly, by assuming a notional sound power level of 113dB(A) for the project, it is identified that the cumulative noise level on Yau Ma Tei Catholic Primary School (N24) will not exceed the 70dB(A) criterion. Results are given in **Appendix 6-8** and summarised below.

Table 6-15 : Cumulative construction noise impacts from CLP electricity substation

NSR	Description	Noise Levels, dB(A)			Criterion, dB(A)	Exceedance, dB(A)
		KSL	Substation	Total		
N24	Yau Ma Tei Catholic Primary School	69	65	70	70	0

6.1.9 *Operation of Launching Shaft during Restricted Hours*

The TBM will operate 24 hours and the TBM launching shaft will be provided with a noise insulating cover. This cover will be closed during restricted hours to shelter most of the PMEs inside. The Contractor would be required to apply for a CNP from EPD for its works during the restricted hours. There will not be any plant operating above ground during restricted hours when the noise insulating cover is shut. The gantry above the cover will also not be operating during restricted hour.

6.1.9.1 *Noise Sensitive Receivers & Noise Criteria*

The nearest NSRs that would be affected during restricted hours and the night time noise criterion are summarised in Table 6-16 below. The locations of these NSRs are illustrated in **Appendix 6-9**.

Table 6-16 : NSRs and criteria for restricted hours

Ref	NSRs	Area Sensitivity Rating	Night-time Criterion, dB(A)
N10	FSD Kowloon South Divisional HQ	B	50
N13	Victoria Tower	B	50

The Area Sensitivity Ratings are determined based on the best available information at the EIA study stage. The Area Sensitivity Ratings determined in this EIA Report are unlikely to be different at the time of project implementation unless there are substantial changes such as building redevelopment or land use change in the near vicinity of the NSRs. The Noise Control Authority would process any CNP application taking into consideration the construction method and condition prevailing at the time in accordance with the procedures laid down in the relevant technical memoranda issued under the NCO.

In any event, the Area Sensitivity Ratings assumed in this EIA Report is for indicative assessment only given that there would be changes to the developments (as well as their timing) in the vicinity of the proposed railway alignment. It should be noted that fixed noise sources are controlled under section 13 of the NCO. At the time of investigation, the Noise Control Authority shall determine noise impact from concerned fixed noise sources on the basis of prevailing legislation and practices being in force, and taking account of contemporary conditions/situations of adjoining land uses. Nothing in this EIA Report shall bind the Noise Control Authority in the context of law enforcement against all the fixed noise sources being assessed."

6.1.9.2 *Assessment Results*

There are two key stages for the night-time works as far as construction noise is concerned. The first stage is when the TBM has just started the boring process. During this stage, the diesel train and mortar car do not need to operate. The noise assessment has taken into consideration a number of assumptions for unmitigated scenario as described in **S6.1.2.7**. In particular, the cover for the launching shaft will be closed during night-time and it can achieve an overall noise reduction of 22dB(A).

Assessment indicates that, for the unmitigated scenario, the night-time noise impacts on the receiver would be 53dB(A), exceeding the noise criterion by 3dB(A). It is therefore proposed to use quieter plant to alleviate the noise impacts. The quiet construction methods during night-time are described in **S6.1.2.7** and **S6.1.4.7**. The resultant noise impacts after using quieter plant are 49dB(A) which are within the noise criterion and there are no residual noise impacts during night-time. Further noise mitigation measures are therefore not required. **Appendix 6-9** also presents the calculations for both the unmitigated and mitigated scenarios.

6.1.9.3 *Summary of Recommended Mitigation Measures During Restricted Hours*

A summary of the noise mitigation measures for the TBM launching shaft during restricted hours is given below:

Table 6-17 : Mitigation measures for PME working in the launching shaft during restricted hours

Construction Plant/Worksite	Mitigation Measures
Launching shaft	Noise insulating cover to be shut

Construction Plant/Worksite	Mitigation Measures
Ventilation fan	Silencer + Quieter plant
Compressor	Quieter plant
Conveyor belt	Acoustic enclosure
Water pump	Acoustic enclosure

6.1.10 *Other Recommendations*

6.1.10.1 *Continuous Noise Monitoring*

A continuous noise monitoring mechanism will also be implemented and operated by the Contractors throughout the entire construction period. This mechanism will include a system for reporting the real time monitoring results on the Project Proponent's website within a period of time, to be agreed by EPD, after the relevant noise monitoring data are collected. In cases where exceedance is found, the Contractor and Environmental Team (ET) should take immediate actions to implement remediation measures. The EM&A Manual has specified the roles of ET / Independent Environmental Checker (IEC) / Contractor, Engineer etc on the continuous noise monitoring system. The general system requirements are also be outlined.

6.1.10.2 *Blasting*

Blasting is administrated by the Mines Division of CEDD. According to the Dangerous Goods Ordinance, the Contractor shall obtain a valid Blasting Permit from the Mines Division before carrying out any blasting in HK. When submitting the application for the blasting Permit, the Contractor shall enclose a method statement including manner of working and protective measures to protect adjacent land and property when blasting is carried out at different parts of the site and at different stages of blasting. Proposal to ensure compliance with the limits on ground vibration should be included. The application shall also include relevant plans approved by Building Ordinance Office showing any restrictions and conditions regarding blasting proposal, adjacent properties and structures (within plan radius of 300m), power lines, water main and services [6-14]. The blasting shall also be conducted by a qualified blasting specialist processing a valid Blasting Certificate issued by the authority [6-15].

In order to minimize the risk of loss in human life and damage to properties, the number of blasts per day and the maximum charge to be detonated will be limited. According to current design information, there will be up to 2 times of detonations per day for the drill-&-blast tunnels underneath the FMPHQ. The construction period of the drill-&-blast tunnels would be about 11 months. All the detonation will be conducted underground within the tunnels.

The nearest sensitive receiver is the HKCC. The distance from the drill-&-blast tunnel to the HKCC is between 40m and 160m. The YMCA and the Omni HK Hotels are located at a similar distance as HKCC. The other more critical sensitive receiver is the HKSM located at about 160m to 280m away. The most critical sensitive receiver for the noise generated by the blasting is therefore the HKCC.

It should be noted that each blast will only last for a fraction of second. Depending on the charge weights, impulsive noise of very short duration may be audible at some of the receivers. In order to minimise the nuisance of the short duration of the blasting noise, the Contractor shall implement the following mitigation measures:

- The Contractor shall establish a communication channel with HKCC and HKSM to liaise on the blasting schedule.

- The Contractor shall inform the HKCC and HKSM any scheduled blasting in advance.
- Sufficient time shall be allowed for alerting all the potential sensitive receivers including HKSM, HKCC, etc through established channel of communication prior to each and every blasting activity.
- In case the HKCC and HKSM have any special rehearsals / events that would not allow short impulsive noise even for a certain period in a day, the Contractor shall re-schedule the blasting to suit.
- Proper procedures shall be put in place to alert and minimise any startling effect on the vehicle drivers and pedestrians.
- Subject to detailed design to be conducted by the Contractor (i.e. a Design and Built Contractor), trial tests could be conducted to evaluate the optimal amount of charge to be used for each blasting.

Since blasting will be conducted during periods when there are no special rehearsal / events in the HKCC and HKSM, construction noise monitoring for underground blasting of the drill-&-blast tunnel is not necessary.

6.2 Operational Phase

6.2.1 *Legislation and Standards*

Noise from railway, station plant items and ventilation shafts is controlled under the NCO and the associated Technical Memorandum on Noise from Places Other Than Domestic Premises, Public Places or Construction Sites (TM-Places) [6-16], and the relevant noise criteria are listed in Table 1A, Annex 5 of TM-EIA. Table 6-18 below summarises the noise standards for railway noise.

Table 6-18: Noise criteria for railway noise

Area Sensitivity Rating	Time Period [1]	Acceptable Noise Levels (ANL), $L_{Aeq, 30\ mins, dB(A)}$ dB(A)	Maximum A-weighted sound pressure level, $L_{max\ (2300\text{-}0700hrs)}$ dB(A)
A	Day & evening	60	85
	Night	50	
B	Day & evening	65	
	Night	55	
C	Day & evening	70	
	Night	60	

Note:
[1] Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours

According to TM-EIA, fixed plant noise levels should be 5dB(A) below the appropriate ANLs stipulated in TM-Places, or the prevailing noise levels, whichever is lower. The ANLs for different Area Sensitivity Ratings are summarised Table 6-19.

Table 6-19: Operational noise criteria for fixed noise sources

Area Sensitivity Rating	Time Period [1]	Acceptable Noise Levels (ANL), $L_{Aeq, 30\ mins, dB(A)}$	ANL for Fixed Plant Noise (ANL-5), $L_{eq, 30\ mins, dB(A)}$
A	Day & evening	60	55
	Night	50	45
B	Day & evening	65	60
	Night	55	50
C	Day & evening	70	65
	Night	60	55

Note:
[1] Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours

6.2.2 *Determination of Assessment Area*

The study area for the operational noise impact assessment includes all NSRs within 300m from the boundary of the alignment. The first row of buildings having direct line of sight to the alignment will be most affected. The second row of NSRs will generally be protected from the shielding effect of the first row of buildings. The assessment therefore focuses on the first row of NSRs that have direct line of sight to the alignment.

6.2.3 *Noise Sensitive Receivers & Area Sensitivity Ratings*

6.2.3.1 *Noise Sensitive Receivers*

The existing NSRs to be assessed for operational noise would be the same as those for construction noise. In addition, any future NSRs are also included in the assessment to minimise any constraints on future developments. These future NSRs include planned residential developments in Tsim Sha Tsui and West Kowloon as shown in **Figures 6-1 and 6-2-1 to 6-2-3**.

6.2.3.2 *Area Sensitive Ratings*

The Area Sensitivity Ratings are defined in accordance with the relevant TMs. Determination of the Area Sensitivity Ratings for the NSRs in this study has been made reference to other approved EIA reports including WR EIA [6-18] and ERE EIA[6-12]. The study area is classified as "urban". An Area Sensitivity Rating of "B" is assigned for the NSRs not influenced by road traffic noise from major roads, and an Area Sensitivity Rating of "C" for NSRs indirectly influenced by road traffic noise from main roads.

In accordance with The Annual Traffic Census 2002 [6-19], the Area Sensitivity Rating for NSRs located at Canton Road (from Salisbury Road to Kowloon Park Drive) and Haiphong Road should be "B". For NSRs close to northern part of Canton Road (from Austin Road to Jordan Road), Ferry Street, and West Kowloon Highway (between Austin Road West and Jordan Road (station no. 3502), the Area Sensitivity Rating should be "B". The West Kowloon Highway is not considered as an influencing factor given the setback distance. For other receivers further north, the Area Sensitivity Rating should be "C".

The Area Sensitivity Ratings are determined based on the best available information at the EIA study stage and are unlikely to be different at the time of project implementation unless there are substantial changes such as building redevelopment or land use changes in the near vicinity of the NSRs. Nothing in this EIA report shall bind the Noise Control Authority in the context of law enforcement against any fixed noise sources being assessed.

6.2.3.3 *Prevailing Noise Levels*

Noise measurements have been conducted to establish the prevailing noise levels along the proposed alignment. A summary is given in Table 6-20.

Table 6-20: Prevailing noise levels along the proposed alignment

Area	Time Period [1]	Prevailing Noise Levels, dB(A) $L_{eq, 30\ min, dB(A)}$
Along Canton Road	Day & evening	66 - 73
	Night	63 - 66
West Kowloon	Day & evening	62 - 70
	Night	63 –71

Area	Time Period [1]	Prevailing Noise Levels, dB(A) $L_{eq, 30\ min, dB(A)}$
Charming Garden	Day & evening	68 - 73
	Night	67 - 70

Note:
[1] Day: 0700 to 1900 hours, Evening: 1900 to 2300 hours, Night: 2300 to 0700 hours

6.2.3.4 *Noise Criteria*

A summary of the noise criteria at NSRs caused by fixed plant noise is given in the following **Table 6-21**.

Table 6-21: Summary of noise criteria

Area	Time Period [1]	Prevailing Noise Levels, dB(A) [1]	Area Sensitivity Rating	ANL-5 dB(A) [2]	Criteria dB(A) min of [1] & [2]
Along Canton Road	Day & evening	66 - 73	B	60	60
	Night	63 - 66	B	50	50
West Kowloon	Day & evening	62 - 70	B	60	60
	Night	63 –71	B	50	50
Charming Garden	Day & evening	68 - 73	C	65	65
	Night	67 - 70	C	55	55

6.2.4 *Emission Inventory of Noise Sources*

6.2.4.1 *Trains*

All the tracks for KSL will be underground. The 150m tunnel section at Nam Cheong Park interfacing with WR is enclosed in a concrete box and will be covered with top soil (see **S4.1**). Hence, adverse operational train noise impacts are not anticipated.

6.2.4.2 *Fixed Noise Sources*

Operational noise will emanate from other fixed noise sources including:

- YMT Ventilation Building;
- CRPB; and
- WKN

The YMT Ventilation Building and CRPB will accommodate various plant items such as tunnel ventilation fans, transformers, pumps etc. For the WKN, there will be ventilation shafts to both the north and south ends of the station. Other major plant items to be accommodated in the WKN include fresh-water cooling facilities, ventilation fans, transformers, pumps etc.

Although there is no implementation plan for the topside properties, the ventilation shafts in WKN will be designed to be well above any podium level.

Figures 4-1 to 4-5 show the locations of YMT ventilation building, CRPB and WKN (ventilation shafts and E&M plants etc).

6.2.5 *Assessment Methodology*

Maximum allowable Sound Power Level (SWL) for above-grade louvres and ventilation plants have been established by considering the following:

- Separation distances and orientation from the nearest NSR(s);
- Cumulative noise impacts from other noise sources (e.g. other vent shafts) on the NSR; and
- Tonality, impulsiveness and intermittency based on TM-Places, where appropriate.

The above methodology has been adopted in the East Rail Extension Project [6-12] which is currently being implemented.

6.2.6 *Assessment Results*

Analysis has been conducted to quantify the preliminary near-field SWL criteria (**Appendix 6-10**). A summary of the SWL criteria is given in **Table 6-22**.

Table 6-22 : Summary of SWLs criteria for major fixed noise sources

Station	Plant Item	Distance to nearest NSRs, m	Maximum allowable Sound Power Level, dB(A)	
			Daytime	Night-time
West Kowloon Station (South Block)	East Elevation	5	69	59
	South Elevation	5	76	66
	West Elevation	5	76	66
	North Elevation	5	69	59
West Kowloon Station	Fresh Water Cooling Towers	5	73	63
	Air Cooled Chillers	5	73	63
	Water Cooled Chillers	5	73	63
West Kowloon Station (North Block)	East Elevation	5	72	62
	South Elevation	5	72	62
	West Elevation	5	78	68
	North Elevation	5	78	68
Yau Ma Tei Ventilation Building	East Elevation	40	98	88
	South Elevation	50	98	88
	West Elevation	60	103	93
	North Elevation	60	101	91
Canton Road Plant Building	East Elevation	170	105	95
	South Elevation	170	110	100
	West Elevation	170	105	95
	North Elevation	170	104	96
Ventilation shaft of Emergency Egress Point	East Elevation	60	99	89
	South Elevation	60	98	88
	West Elevation	60	93	83
	North Elevation	60	94	84

Note: The above criteria are based on the assumption that the louvers are facing away from NSRs as a good design practice.

The above SWL criteria should be implemented and refined during the design development by the Contractor. Any new NSRs should also be identified and incorporated into the design as necessary. The Contractor shall install sound attenuators to ensure that the specified maximum SWLs in the above table are achieved. The performance of the sound attenuators shall be obtained by comparing the total SWL of noise emanating from the facade and the specified maximum SWL specified in the above **Table 6-22**.

6.2.7 *Recommendation of Mitigation Measures*

The detailed design should incorporate the following good practice in order to minimise the nuisance on the neighbouring NSRs.

- Louvres should be orientated away from adjacent NSRs, preferably onto main roads (e.g. Kowloon Park Drive, West Kowloon Expressway) which are less sensitive.
- Direct noise mitigation measures including silencers, acoustic louvers and acoustic enclosures should be allowed for in the design for various ECS plant.
- The facade for these plant areas / ventilation shafts should have adequate sound insulation properties to minimise the noise emanating through the building fabric.

6.2.8 *Residual Impacts and Constraints on Future Receivers*

The operational noise generated by the proposed railway can be properly mitigated by implementing the proposed mitigation measures. Residual noise impacts are not anticipated and there are no constraints on the future sensitive receivers that could be identified at this stage. In order to ensure compliance of the operational airborne noise impacts with the TM's stipulated noise standard, the requirement for carrying out a noise commissioning test for all major fixed noise sources should be included in the Contract Document.

6.3 Conclusion

Potential noise sources and representative NSRs for the construction and operational phases have been identified. Noise prediction has been conducted based on established methodologies.

6.3.1 *Construction Phase*

Most of the construction activities will be conducted during daytime period except for the TBM launching shaft located to the south of WKN and the tunnel under Canton Road. The construction noise predictions have also included the potential noise contributions from concurrent projects.

Daytime

Noise assessment for daytime period reveals that mitigation measures including good site practice, use of quiet plant and site hoarding, installation of movable barriers for generally static plants would be required to alleviate the noise impacts at most of the sensitive receivers to within the statutory requirements.

However, the noise impacts at Canton Road Government School, Lai Chack Middle School, Man King Building, Man Fai Building and Olympian City Phase 3 would still be exposed to noise impacts exceeding the criteria. Further noise mitigation measures have therefore been investigated. Specific measures including the use of temporary noise barriers for some particular PMEs and sequential operation of construction activities at specific locations have been recommended to further reduce the noise impacts. However, there is still a minor noise exceedance (due to KSL only) of 4dB(A) for 2 months at the two schools and 2dB(A) for 4 months for Man King Building.

These residual noise impacts could be possibly mitigated by installing large full noise enclosure to accommodate all the noisy plant items. However, such a large-scale full enclosure in an urban setting like Canton Road or so near Man King Building would impose adverse visual impacts to the neighbouring receivers. The foundation works of the enclosure / large cantilevered noise

barrier would require the use of piling rigs and the associated noise impacts on the Building would also be significant. In addition, the time required to construct such a large full noise enclosure would be comparable to the duration of noise exceedance. The net environmental benefits (in terms of construction noise impacts) of implementing this large full noise enclosure would not be significant. As such, it is not practicable to implement large noise enclosure for both the schools and Man King Building. The residual impacts on these receivers would be minor and temporary.

The noise exceedance at the two school, on the other hand, could possibly be avoided if the ground treatment work is scheduled to be carried out during the insensitive period, e.g. summer vacation. However, this mitigation measures will pose a constraint on the construction programme to the Contractor and thus prolonging the overall construction duration as well as nuisance to the schools. It is also considered that there may be supplementary classes or extra-curriculum activities during the school vacation and hence scheduling of the works may not be practicable. However, it is still recommended the Contractor to consult with the school representatives to confirm the practicality of scheduling such works to tie in with long school vacations and the arrangement of summer courses during this period.

Restricted Hours

The launching shaft will be provided with a noise insulating cover which will be closed during restricted hours to shelter the plant items and protect the residential premises in the vicinity. With the implementation of additional mitigation measures including quiet plant and enclosures etc, the predicted noise impacts during restricted hours would comply with the noise criteria. However, the Contractor shall take into account their specific construction methodology and apply separately for a Construction Noise Permit from the Noise Control Authority before commencement of works during restricted hours.

6.3.2 *Operational Phase*

Operational noise impacts can be effectively mitigated by implementing noise control treatment at source during the design stage and residual operational airborne noise impacts are not anticipated. The need for noise commissioning on fixed noise sources should be included in the Contract Document.

7. GROUNDBORNE NOISE IMPACT ASSESSMENT

7.1 Construction Groundborne Noise

7.1.1 *Legislation and Standards*

Control over construction noise is governed by the Noise Control Ordinance (NCO), the EIAO, and their subsidiary requirements. Noise arising from general construction works during normal working hours is governed by the TM-EIAO under the EIAO as shown in Table 6-1. TM for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places) under the NCO stipulates that noise transmitted primarily through the structural elements of building, or buildings, shall be 10 dB(A) less than the relevant ANLs. This approach to deriving groundborne noise limit is pragmatic given the temporary nature of the construction works and the practical difficulty to abate the inherently noise construction activities (e.g. rock drilling / breaking). Such approach is also being adopted in the Project Profile for Development of the Former Marine Police Headquarter (FMPHQ)[7-4] for direct application of Environmental Permit.

Noise sensitivity of the HKCC (a performing arts centre) and the HKSM (a museum) is regarded as similar to schools where a completely immersed attention is often needed. Daytime groundborne construction noise criterion of 60dB(A) therefore applies with reference to TM-EIAO 70dB(A) criterion for schools and taking account of the minus 10dB(A) requirement under the NCO TM-Places. Following the same principle for groundborne noise criteria, groundborne construction noise levels inside hotel and domestic premises relying on open window for ventilation will be limited to 65dB(A), with reference to the daytime airborne noise criterion of 75dB(A) in accordance with TM-EIAO.

In the evening (1900 – 2300hrs) and during nighttime (2300 – 0700hrs), the TM on Noise from Construction Work other than Percussive Piling (TM-GW) applies. Again following the principle of deriving groundborne noise criteria, groundborne noise level will be limited to 10dB(A) below the respective ANLs for the Area Sensitivity Rating category of "B" at the NSRs along Salisbury Road and Canton Road. A summary of these criteria is given in Table 7-1 below.

Table 7-1 : Groundborne noise criteria for HKCC, HKSM, Schools, hotel guestrooms and domestic premises

NSR Description	Groundborne Noise Criteria, dB(A) [2]		
	Daytime (except General Holidays & Sunday)	Daytime during general holidays and Sundays and all days during Evening (1900 to 2300 hrs)	Night-time (2300 to 0700 hrs)
HKCC - Grand Theatre, Studio Theatre, Concert Hall	60	55	[1]
HKSM - Planetarium, Recording Room	60	55	[1]
School - Classrooms	60/55 [4]	55	[1]
Hotel guestrooms along Canton Road & Salisbury Road	65	55	40
Domestic premises along Canton Road	65	55	40

[1] No sensitive uses during these periods
[2] Parameter for daytime noise is $L_{eq, 30mins}$
[3] **Appendix 7-1** presents the ambient noise measurements in HKCC & HKSM
[4] A 5dB(A) reduction to the groundborne noise criterion is recommended for school during examination period.

The granting a CNP is subject to the relevant TMs issued under the NCO. A CNP may be revoked at any time for failure to comply with the permit conditions.

7.1.2 *Noise Sensitive Receivers*

NSRs that would be potentially affected by construction groundborne noise include the HKCC and HKSM, guestrooms of hotels along Salisbury Road and Canton Road, residential units along Canton Roads and schools to the north of Canton Road. The locations of these NSRs are illustrated in **Figure 7-1**.

The HKCC is a performance venue comprising Concert Hall, Grand Theatre, Studio Theatre, Exhibition Gallery and Foyer Exhibition Area, Rehearsal Rooms, Practice Rooms, Function Rooms, VIP Lounges. If needed, recording will be carried out during or after the performance in the recording facilities near the auditorium on 1/F. There will not be any operation during night-time and hence it is only a NSR during daytime and evening periods.

The HKSM is a museum comprising Activity Room and Maintenance office on basement, Lecture Hall, control room and Exhibition Hall on G/F, and Space Theatre, recording room and Office on 1/F. Sound recording is occasionally carried out in both the Lecture Hall (during live music performance) on G/F and the recording room on 1/F. There will not be any operation during night-time and hence it is only a NSR during daytime and evening periods.

Other sensitive receivers along Canton Road include hotel guestrooms and domestic premises. These NSRs would need to be taken into account during both the daytime and night-time periods. School classrooms are also noise sensitive during daytime period, and evening period if there are any evening classes. However, it is unlikely that there will be any class during the night-time period from 2300 to 0700 hours.

7.1.3 *Groundborne Noise Sources from Construction Activities*

Details of the construction methodologies, plant inventory and construction programme are given in **Chapter 4** of this EIA report. Potential groundborne noise impacts on NSRs during the construction phase will arise mainly from hydraulic breakers, hand-held breakers, pipe pile rigs, rock drills and TBM. Other construction activities such as lorry movement, concreting, road paving etc are unlikely to generate significant groundborne noise. Airborne construction noise of these activities is addressed in **Chapter 6** of this EIA Report.

It is anticipated that the rock breaking activities by large hydraulic breakers would represent the worst case for groundborne noise impact. Pipe pile rigs are required for the construction of pipe pile wall along Salisbury Road. These rigs will be operating in soil for most of the time until the last 0.5-1m during toe-in.

7.1.4 *Groundborne Noise Prediction Methodology*

The method used to predict construction groundborne noise is based on the U.S. Department of Transportation "High-Speed Ground Transportation Noise and Vibration Impact Assessment", 1998[7-1]. The vibration level $L_{v,rms}$ at a distance R from the source is related to the vibration source level at a reference distance R_o. The conversion from vibration levels to groundborne noise levels is determined by the following factors:

C_{dist}:	Distance attenuation
$C_{damping}$:	Soil damping loss across the geological media
$C_{building}$:	Coupling loss into building foundation
C_{floor}:	Coupling loss per floor

C_{noise}: Conversion factor from floor vibration levels to noise levels
C_{multi}: Noise level increase due to multiple sources
C_{cum}: Cumulative effect due to neighbouring sites

The predicted groundborne noise level L_p inside the noise sensitive rooms is given by the following equation.

$$L_p = L_{v,rms} + C_{dist} + C_{damping} + C_{building} + C_{floor} + C_{noise} + C_{multi} + C_{cum}$$

7.1.4.1 *Reference Vibration Sources*

The reference source level was determined by on-site measurement of the rock breaking activities of a large hydraulic breaker operating in the basement level of the ERE station. The average vibration velocity measured at 5.5m from the hydraulic breaker was 0.298mm/s (rms). Similarly, the vibration velocities of handheld breakers, pipe pile rigs, rock drills and TBM were determined by measurements and some of these in Peak Particle Velocity (PPV). In such cases, a crest factor of four was applied to establish the rms level in accordance with the FTA Guidance Manual [7-1]. **Appendix 7-1** presents the measurement records of these vibration sources.

The vibration measurements for the TBM were extracted from the in-situ measurements during the bored tunnelling of Kwai Tsing Tunnel of the West Rail project. The geology consists of mainly granite, which is considered similar to the geology along Canton Road. The measurements records are considered the most appropriate available information for the purpose of assessing TBM groundborne noise.

7.1.4.2 *Soil Damping Loss*

Internal losses of soil would cause the vibration amplitude to decay against the propagation distance and the decay relationship is based on the equation set out in the Transportation Noise Reference Book[7-3]:

$$V(R) = V(R_o) \times e^{-2\pi f \eta R/2c}.$$

The velocity amplitude V is dependent on the frequency f in Hz, the soil or rock loss factor η, the wave speed c in m/s, the distance R from the source to the NSR. The properties of soil materials are based on Ungar and Bender[7-3] and reproduced in Table 7-2. The geological profiles along Salisbury Road are shown in **Figure 7-2**. No soil damping loss is applied when the NSR distance is less than the reference source level measurement distance.

Table 7-2 : Wave propagation properties of soils

Soil Type	Longitudinal Wave Speed c, m/s	Loss Factor, η	Density, g/cm^3
Rock	3500	0.01	2.65
Clay, clayey soil	1500	0.5	1.7

7.1.4.3 *Coupling Loss into Building Structures*

This represents the change in the incident ground-surface vibration due to the presence of the piled building foundation. The empirical values based on the guidance set out in the Transportation Noise Reference Book[7-3] are given in Table 7-3.

Table 7-3 : Loss factor for coupling into building foundation

Frequency	Octave Band Frequencies, Hz					
	16	31.5	63	125	250	500
Loss factor for coupling into building foundation, dB	-7	-7	-10	-13	-14	-14

7.1.4.4 *Coupling Loss Per Floor*

This represents the floor-to-floor vibration transmission attenuation. In multi-storey buildings, a common value for the attenuation of vibration from floor-to-floor is approximately 1dB attenuation in the upper floor regions at low frequencies and greater than 3dB attenuation at lower floors at high frequencies. Coupling loss of –1 dB reduction per floor is assumed for a conservative assessment.

7.1.4.5 *Conversion from Floor Vibration to Noise Levels*

Conversion from floor vibration levels to indoor reverberant noise levels is based on standard acoustic principles. The conversion factor is dependent on the surface area S of the room in m^2, the radiation efficiency σ, the volume of the room V in m^3 and the room reverberation time RT in seconds. Analyses were carried out for concert hall, theatres, lecture hall and recording studios. Results are summarised in Table 7-4.

Table 7-4 : Conversion factors from floor vibration levels to indoor reverberant noise levels

NSR Description	Conversion C_{noise} (dB re $1x10^{-6}$ mm/s)
HKCC & HKSM	–26 to –27
Hotel guestrooms and residential units	–26 to –27
School classrooms	-23

Note : Calculations of the above correction factors are given in Appendix 7-1

7.1.4.6 *Multiple Vibration Sources*

This represents the increase in noise level due to multiple noise sources. The groundborne noise levels from construction plant are summed logarithmically in accordance with standard acoustic principles to obtain the total groundborne noise level at the area of interest.

7.1.5 *Assessment Results & Residual Impacts*

Details of the construction methodologies, plant inventory and construction programme are given in **Chapter 4** of this EIA report. Cut-&-cover tunnelling and mined tunnelling will be conducted under Salisbury Road and FMPHQ respectively. This tunnelling work will only be conducted during daytime. However, the bored tunnelling along Canton Road will be conducted 24 hours.

7.1.5.1 *Cumulative Impacts*

Discussions with the FMPHQ developer indicate that the key groundborne noise sources (e.g. foundation works) for the FMPHQ development would be completed in October 2004 and could even be completed by 2 to 3 months earlier. On the other hand, the construction of KSL will commence by early 2005. Most of the rock breaking activities along Salisbury Road would be started in April 2006 (see construction programme in **Appendix 4-3**). Hence, there will not be any overlapping of the rock breaking activities for KSL and FMPHQ redevelopment, and there will not be any cumulative groundborne noise impacts on HKCC and HKSM, and other sensitive receivers along Canton Road.

7.1.5.2 *Tunnelling Work Under Salisbury Road and FMPHQ*

The tunnel construction along Salisbury Road will be mostly above the rockhead until it approaches the YMCA. Tunnel sections close to the HKSM would therefore be on soft ground. At the tunnel sections between YMCA and Old Fire Station Building (OFSB), hydraulic breakers and pipe pile rigs would be operating on rock from below –5mPD. For the cut-&-cover

tunnelling to be carried out for the section along Salisbury Road, pipe pile walls will be used as temporary walls for excavation. For each section of work, pipe pile walls will be first installed down to the bottom of the tunnel levels. After the installation of the pipe pile walls, excavation will then be conducted layer by layer with temporary props installed accordingly, until the entire excavation process is completed. Hence, the toeing in of the pipe piles (ie one of the dominant groundborne noise sources) will not overlap with the use of hydraulic breakers during the excavation process.

The predicted maximum groundborne noise levels at the HKCC, HKSM and YMCA are given in Table 7-5. Sample calculations are given in **Appendix 7-2**. All the predicted noise impacts due to rock breaking are below the statutory criteria given in Section 7.1 and there are no residual construction groundborne noise impacts.

Table 7-5 : Predicted maximum construction groundborne noise levels at HKCC HKSM and YMCA

NSR Description	Soil Materials [2]	Area	Max Predicted Noise Level, dB(A)	Exceedance above ground-borne noise criteria of 60 dB(A)
FMPHQ – Construction plant in simultaneous operation				
Hong Kong Space Museum [1]	Marine deposit/alluvium/fill	1/F Recording Studio 1/F Space Theatre	<15 <15	0 0
Hong Kong Cultural Centre	Granite	Grand Theatre Concert Hall Studio Theatre	20 25 33	0 0 0
YMCA	Granite	Guestrooms	33	0
Salisbury Road between KPD to Hankow Road – Construction plant in simultaneous operation				
Hong Kong Space Museum [1]	Marine deposit/alluvium/fill	1/F Recording Studio 1/F Space Theatre	<15 <15	0 0
Hong Kong Cultural Centre	Granite	Grand Theatre Concert Hall Studio Theatre	16 19 30	0 0 0
YMCA	Granite	Guestrooms	37	0
Both FMPHQ and Salisbury Road between KPD to Hankow Road – Construction plant in simultaneous operation				
Hong Kong Space Museum [1]	Marine deposit/alluvium/fill	1/F Recording Studio 1/F Space Theatre	<15 <15	0 0
Hong Kong Cultural Centre	Granite	Grand Theatre Concert Hall Studio Theatre	21 26 35	0 0 0
YMCA	Granite	Guestrooms	38	0

Notes:
[1] Tunnel section along HKSM is above the inferred rockhead level.
[2] Soil materials refer to materials being impacted by construction plant on site.

7.1.5.3 *Pipe Piling Along Salisbury Road*

Pipe pile rigs are required for the construction of pipe pile walls along Salisbury Road. These rigs will be operating in soil for most of the time until the last 0.5-1m during toe-in.

The predicted groundborne noise with pipe pile rigs working in fill materials would be less than 19dB(A) for HKCC. During toe-in, the predicted noise level for the Studio Theatre in HKCC would be 31dB(A). For YMCA, which is the nearest hotel along Salisbury Road, the predicted groundborne noise is 38dB(A) when pipe pile rigs are operating at rock (see **Appendix 7-2** for calculations). These impacts would comply with the statutory noise criteria as described in Section 7.1.

7.1.5.4 *Bored Tunnelling Along Canton Road*

The tunnel boring machine will be at least 150m away from HKCC and 270m away from HKSM. The predicted groundborne noise levels are less than 15dB(A) and are well below the adopted groundborne noise criteria. Adverse groundborne noise impact due to bored tunnelling on HKCC and HKSM is not anticipated.

Along Canton Road, the predicted groundborne noise levels for the hotels and domestic premises are not greater than 33dB(A) and for the school is 43dB(A). They are below their respective groundborne noise criteria. There are no residual impacts and hence mitigation measures are not required.

The detailed analyses are given in **Appendix 7-2**.

7.1.6 *Recommendations*

Prediction of construction groundborne noise indicates the criteria will be achieved and mitigation measures are not required. In order to ensure proper control of groundborne noise is executed by the contractor, a monitoring requirement is recommended at the worksites in front of the HKCC and HKSM for assurance checking. Rock breaking activities will be subject to an assurance groundborne noise measurement at one selected location each inside HKCC and HKSM to be agreed with their respective operators. If groundborne noise criterion is exceeded, the monitoring shall continue daily until acceptance has been restored against the criterion. Otherwise the monitoring can be discontinued.

7.2 Operational Groundborne Noise

7.2.1 *Legislation and Standards*

With reference to the Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites (TM-Places) under the Noise Control Ordinance (NCO), the criteria for noise transmitted primarily through the structural elements of the building or buildings should be 10dB(A) less than the relevant acceptable noise level (ANL). These criteria apply to all kinds of use from domestic premises to performing arts centres. According to the TM-Places, the groundborne noise standard for HKCC and HKSM is $L_{eq\ 30mins}$ 55dB(A) during general operational periods. Given the nature of activities held at HKCC and HKSM, it is desirable that a more stringent design goal be adopted for these facilities.

Under Annex 13 of the TM-EIA performing arts centres are defined as potential Noise Sensitive Receivers (NSRs). However, the TM-EIA does not have any specific criteria for groundborne noise at performing arts centres. As such the criteria for evaluating noise impacts on these facilities shall be determined on a case by case basis in accordance with the TM-EIA Annex 5. A groundborne noise limit of Lmax 25dB(A) is proposed by the project proponent and subsequently agreed by the EIAO Authority for special buildings, such as concert halls and recording studios following a recognised international standard - the latest guidance manual "Transit Noise and Vibration Impact Assessment" 1995 issued by the Federal Transit Administration (FTA), US Department of Transportation.

The operational groundborne noise criteria for the representative NSRs along KSL alignment are tabulated in Table 7-6 below.

Table 7-6 : Operational groundborne noise criteria for HKCC, HKSM, Schools, hotel guestrooms and domestic premises

NSR Description	Groundborne Noise Criteria, dB(A)	
	Day & Evening (0700 to 2300 hrs)	Night (2300 to 0700 hrs)
HKCC - Grand Theatre, Studio Theatre, Concert Hall	25 (Lmax)	-
HKSM - Planetarium, Recording Room	25 (Lmax)	-
School – Classrooms	55 (Leq 30 mins)	-
Hotel guestrooms along Canton Road & Salisbury Road	55 (Leq 30 mins)	45 (Leq 30 mins)
Domestic premises along Canton Road	55 (Leq 30 mins)	45 (Leq 30 mins)

Note: For HKSM and HKCC, the 25dB(A) criterion is based on FTA guidance manual. It is maximum rms average over a 1 second period.

7.2.2 *Noise Sensitive Receivers*

The most sensitive receivers along the KSL alignment are primarily the HKCC, with three performing venues (the Grand Theatre, the Concert Hall and the Studio Theatre) and the HKSM, with the planetarium and the recording room. The HKCC has frequent performances that are held in its three venues and sometimes these facilities are used for digital sound recording. The HKSM Planetarium is also used for public performances and the facility routinely undertakes digital sound recording and editing of its presentation materials in the recording room.

Other sensitive receivers along the KSL alignment include schools, hotel guestrooms and domestic premises. Hotels and domestic premises are taken into account during both the daytime and night-time periods. HKCC, HKSM & school classrooms are considered to be noise sensitive during daytime and evening only.

Some of these structures have large underground foundation walls facing the alignment, with occupied levels at the same depth as or deeper than the KSL tunnels. The information pertaining to the sensitive receivers and the proposed ambient noise criteria are shown in **Appendix 7-3**. The locations of these representative groundborne noise sensitive receivers are shown in **Figures 7-3-1 to 7-3-4.**

7.2.3 *Groundborne Noise Sources from Operation*

When trains operate in tunnels that are located in close proximity to occupied structures, there is a possibility that vibrations associated with train passbys will be transmitted through the ground and structure, and be radiated as noise in the occupied spaces within the structure. The noise and vibration levels within the structure may be high enough to cause annoyance to the NSRs.

7.2.4 *Groundborne Noise Prediction Methodology*

The most current and evolved projection methodology recommended by the FTA Manual [7-5] is used in this EIA study. This manual is issued by the US Department of Transportation in 1995 and is intended to provide guidance in preparing and reviewing the noise and vibrations sections of environmental submittals to the US Government for grant applications. The methodology has been applied on a number of transit systems over the years, including West Rail, East Rail Tsim Sha Tsui Extension, and MTR Tseung Kwan O Line.

The basic equation describing the model, in decibels, is

L = FDL + LSR + TIL + TCF + CCF + BCF + BVR + CTN + SAF,

Where the prediction components are:

L: Ground borne vibration or noise level within the structure, re: 1 μ-in/sec or 20 μ-Pascal
FDL: Force density level for the KCR SP1900 EMU, re: 1 $lb/in^{0.5}$
LSR: Unit force incoherent line source response for the ground, re: 1 μ-in/sec
TIL: Trackform attenuation or insertion loss, relative level
TCF: Vibration coupling between the tunnel and the ground for soil based tunnels, relative level
CCF: Points and crossing correction factor, relative level
BCF: Vibration coupling loss factor between the soil and the foundation, relative level
BVR: Building vibration reduction or amplification within a structure from the foundation to the occupied areas, relative level
CTN: Conversion from floor and wall vibration to noise, 1 μ-in/sec to 20 μ-Pascal
SAF: Safety margin to account for wheel/rail condition and projection uncertainties

The units selected for the vibration analysis (re: 10^{-6} in/sec) allow direct numerical comparison of vibration levels and noise levels (re: $20*10^{-6}$ Pa) for structure borne noise, which is considered very advantageous. Units for the FDL are consistent with the English units system and thus simplify the analysis and debugging processes and hence minimise the calculation errors. These are also the units used in the FTA Manual.

Predictions are in most cases based on assuming the closest distance from the track centreline to the building foundation of the receiver; however, if a particular facility within a structure is the sensitive receiver, the setback distance is assumed to be from the track centreline to the closest part of the affected receivers. Where curved track occurs the track is considered to be straight and perpendicular to the closest setback point of the venue or receiver. For receivers located outside the curve such as HKCC, this assumption is clearly conservative.

Projections of groundborne noise levels are compared to relevant noise criteria for different trackform options. Using these comparisons, trackform specification is assessed and design recommendations made, as necessary, so that there will be no adverse impact caused by groundborne noise. The key components of the model are described below and the correction factors adopted in this study are summarised in **Appendix 7-3**.

7.2.4.1 *Force Density Level (FDL)*

The vibration source strength level (Force Density Level) for train operations on the KSL was derived from wayside vibration measurements taken during SP1900 seven car EMU passbys on ballast and sleeper track up track main line at Pat Heung Depot. This is the same type of EMU that will be in operation on KSL. The duration of one passby is the period between the passage of the front and rear ends of the train pasts the closest point on the alignment to the building foundation. Measurement results of the FDL are shown in **Appendix 7-3**.

7.2.4.2 *Line Source Response (LSR)*

The basic quantity required for the determination of LSR is the vibration response caused by a unit point source impact, which is defined as the Point Source Response (PSR). Given the PSR along the alignment over the length of the train, the LSR follows directly by incoherent integration of the PSR over the length of the train. Vibration propagation characteristic, in terms of PSR & LSR, is established by vibration measurements conducted from December 2002 to March 2003 at locations along the Salisbury Road and lower Canton Road. The vibration measurement results are shown in **Appendix 7-3**.

7.2.4.3 *Trackform Insertion Loss (TIL)*

The attenuation performance of existing trackforms on West Rail was measured in 2002 and 2003 with attenuation curves given in **Appendix 7-3**. Low vibration trackform (LVT) or resilient baseplates installed atop concrete embedded sleepers (referred to as trackform Type 1 herein) and the tunnel variant of the floating slab trackform (FST2, referred to as trackform Type 2 herein) are already installed on West Rail (WR) and the Ma On Shan (MOS) Extension. Both trackforms have demonstrated attenuation performance for groundborne noise impacts adjacent NSRs. These attenuations are assumed in this study.

In addition, two variants of the KCRC tunnel FST are being developed for KSL. The first FST variant, referred to as trackform Type 3, has altered support bearings to provide greater attenuation at higher frequencies. The existing KCRC tunnel FST has support bearings that are manufactured as solid rubber. However, the thickness of the bearings allows short wavelength vibration to pass through the bearing more easily at high frequencies, above 160 Hz, as shown in **Appendix 7-3**, thus reducing attenuation at higher frequencies. High frequency attenuation can thus be improved by reduction of the bearing thickness, which moves the passing phenomenon to a higher frequency range. New bearings are proposed which reduce the effective thickness of the bearing by introduction of steel of internal flat plates, thus creating a layered bearing, whilst preserving the civil performance of the bearing, namely sufficient resistance to static and low frequency dynamic train loading.

The second FST variant, referred to as trackform Type 4, has both altered support bearings as in trackform Type 3, and increased mass of the FST slab to lower the resonance frequency of the FST from 12.5 Hz, the resonance frequency of the KCRC tunnel FST, to 10 Hz, providing greater attenuation in the lower frequency range. The projected attenuations for these FST variants are given in **Appendix 7-3.** Despite the use of a combination of trackforms, there will be no jointed track used in KSL.

7.2.4.4 *Conservatism in the Model Prediction*

An attempt has been made to estimate the other components of the prediction as accurately as possible, neither underestimating nor overestimating their effect. Thus, the prediction conservatism is primarily determined by the 10 dB safety factor and the use of an FDL determined on rail whose rough condition is not representative of expected operational conditions. The conservatism built into the predictions is thus on the order of 15 dB.

Force Density Level

The FDL determined for the SP1900 EMU was obtained from passby measurements on the up track through Pat Heung Depot on rough rail, which during normal operations will be maintained to a much smoother level. Comparisons of the FDL obtained for the SP1900 EMU to other Hong Kong transit trains, including the old East Rail EMU, as well as several other heavy rail EMUs in operation in the United States, indicate that the SP1900 FDL is 5 dB to 10 dB higher than the maximum FDL levels for the other trains considered above 20 Hz, the low frequency threshold of hearing. A comparison of FDLs is shown in **Appendix 7-3**.

Ground Vibration Transmission

In most ground borne noise assessments, and usually on account of a lack of measurement data, only the most rudimentary aspects of the propagation of vibration through the ground from the tunnel to the structure are taken into account. In this study, considerable care was taken in quantifying the six possible paths through the soil, the rock and along the rock interface that

vibration can take from the tunnel to the structure, as shown in **Appendix 7-3**. It is then assumed that vibration propagates to the structure along all relevant paths and the vibration impact on the structure is determined as the energetic sum of vibration following all relevant paths, thus necessarily resulting in predictions that are conservative in nature.

Safety Factor

Even though it is not required by the FTA Manual, a safety factor of 10 dB is also added to the predictions. This factor accounts for variability in prediction and unforeseen factors related to wheel and rail maintenance. The projection with a safety factor of 10 dB added provides, essentially, an upper bound on selected measured vibration data taken on other systems under similar circumstances.

Train Passbys

Simultaneous passbys are assumed to occur adjacent to every sensitive receiver. This clearly will not occur at every receiver, nor will it necessarily always occur at any one particular receiver. Thus, where one single train passbys occur, groundborne noise impacts are overestimated on the order of 2 dB.

Independent review and verification

A measurement study of the groundborne noise impact on the Kwai Tsing Theatre by the operation of the West Rail (SP1900 EMU and FST Type 2 installed) was conducted. The measurement results were compared with the prediction made using the same groundborne noise assessment methodology for the KSL to allow verification of the prediction accuracy. The measurement results indicated that structural borne noise level during train passbys was roughly 2dB(A) and that there was close agreement between the measured vibration levels and the projection.

The KSL groundborne noise predictions and the measurement results at Kwai Tsing Theatre have been reviewed by the original author of the FTA Manual. The reviewer confirmed that the assessment was based on a very thorough analysis using internationally recognised, state-of-the art methods, and that the conservatism built into the predictions was in the order of 15-20dB. The independent review report and the Kwai Tsing Theatre measurements results are shown in **Appendix 7-3**.

7.2.5 *Prediction Results*

The predicted operational groundborne noise results are summarised in Table 7-7 and sample detailed calculations are shown in **Appendix 7-3**.

Table 7-7: Predicted operational groundborne noise levels

NSR	Description	Location	Track Type		Criteria	Prediction dB(A)		
			Up	Down	dB(A)	Lmax	Leq (30min)	Leq (24h)
GN1	Sheraton Hotel	4/F Guestroom	2	2	45	<35	<35	<35
GN2	Peninsula Hotel	2/F Guestroom	4	4	45	<35	<35	<35
GN3	HKSM	Planetarium	4	4	25	<15	<15	<15
GN4		Recording Room	4	4	25	<15	<15	<15
GN5	YMCA Hotel	4/F Guestroom	4	4	45	<35	<35	<35
GN6	HKCC	Grand Theatre	4	4	25	<15	<15	<15

NSR	Description	Location	Track Type		Criteria	Prediction dB(A)		
			Up	Down	dB(A)	Lmax	Leq (30min)	Leq (24h)
GN7		Concert Hall	4	4	25	<15	<15	<15
GN8		Studio Theatre	4	4	25	<15	<15	<15
GN9	Redeveloped FMPHQ	G/F Guestroom	2	2	45	37	<35	<35
GN10	Marco Polo Hong Kong Hotel	2/F Guestroom	2	2	45	<35	<35	<35
GN11	No. 2-16 Canton Road	1/F Residential	2	2	45	<35	<35	<35
GN12	Imperial Building	1/F Residential	2	2	45	<35	<35	<35
GN13	Marco Polo Prince Hotel & Gateway Hotel	2/F Guestroom	2	2	45	41	37	36
GN14	Canton Road Government School	1/F Classroom	2	2	55	<45	<45	<45
GN15	FSD Kowloon South Divisional HQ	3/F Residential	2	2	45	<35	<35	<35
GN16	R(A) Future development	1/F Residential	2	2	45	<35	<35	<35
GN17	West Kowloon Station Potential Topside Development	1/F Residential	2	2	45	<35	<35	<35
GN18	Man King Building	1/F Residential	1	1	45	36	<35	<35
GN19	Charming Garden	2/F Residential	1	1	45	<35	<35	<35
GN20	Park Avenue	5/F Residential	1	1	45	<35	<35	<35
GN21	Olympian City – Phase 3	2/F Residential	2	2	45	<35	<35	<35

Note:

1. Track Type 1 = Resilient baseplate, Type 2 = 12.5Hz FST (Plain Bearing), Type 3 = 12.5 Hz Modified FST, Type 4 = 10 Hz Modified FST
2. Prediction is based on Leq(double passbys) i.e. simultaneous passbys of up and down trains.
3. Calculations are based on 9-car train scenario.
4. Leq(30mins) and Leq(24hrs) are based on maximum target frequency of 34 trains per hour in each direction running for 19 hours daily. The predictions represent the worst case of the day i.e. constant levels during the day and at night, and extended operation hours. It should be noted that with the reduced patronage forecast, the maximum number of trains per hour will unlikely exceed 25 within the next 30 years.
5. Noise levels of 10 dB(A) below the criteria (i.e. 15, 35 or 45 dB(A)) are considered to be physically insignificant as compared to the relevant criteria.
6. For HKSM and HKCC (GN 3,4,6,7,8), the 25dB(A) criterion is based on FTA guidance manual. It is maximum rms average over a 1 second period. Other criteria are in Leq 30min for worst case scenario as shown in Table 7-6.

7.2.6 *Cumulative Impacts from the Existing MTR Tsuen Wan Line and Other Worst Case Scenarios*

The MTR Tseun Wan Line tunnel at the juncture of Nathan and Salisbury road is situated in rock and significantly deeper than the KCRC KSL extension, which is in soil just above the rock head near where it crosses over the MTR tunnels at this road intersection. Vibration waves radiating from the KSL tunnel are thus trapped in the soil layer above the rock and propagate with two-dimensional geometric attenuation, as against three-dimensional geometric attenuation for the MTR tunnel in bedrock. Furthermore, MTR trains passing by the Space Museum planetarium during two separate noise measurements were not audible. Thus, groundborne vibration and noise from the MTR tunnels is not expected to add significantly to the levels resulting from KSL train operation.

There will be no freight traffic, only EMU, running on KSL. Because of the slow speed of work trains, and the fact that work trains have primary suspensions installed with low resonance frequencies and have a short length, it is not expected that the resulting groundborne noise and vibration would exceed that of a revenue EMU under the anticipated operational conditions. In addition, work trains will only be operated after revenue operation at night. There will be no impact to the critical sensitive receivers such as HKCC, HKSM and school classrooms as these are not considered to be noise sensitive during nighttime.

7.2.7 *Recommendations*

The four types of trackforms should be installed in accordance with the locations described in **Table 7-8** and in **Figure 7-4**.

Table 7-8: Summary of Recommended Track Type

From	To	Approximate Extent (m)	Track Type
ETS Overrun Tunnel	New World Subway No.1	130	2
New World Subway No.1	Nathan Road	40	3
Nathan Road	Kowloon Park Drive Subway	180	4
Kowloon Park Drive Subway	FMPHQ	50	3
FMPHQ	Jordan Road	1350	2
Jordan Road	Olympian City Phase 3	1630	1
Olympian City Phase 3	Hoi Fai Road	240	2
Hoi Fai Road	NAC Overrun Tunnel	180	1

In order to ensure compliance of the operational groundborne noise criteria, a commissioning test will be included in the Contract document. More frequent rail and train maintenance, and adjustment of speed profile at critical locations such as Salisbury Road in front of HKCC and HKSM will be able to further reduce the groundborne noise impacts as contingency measures.

7.3 Conclusion

7.3.1 *Construction Phase*

Potential groundborne noise sources during the construction phase have been identified. The noise impacts on neighbouring sensitive receivers have been quantified. Results indicate that the predicted impacts are within the statutory requirements and hence mitigation measures are not required. There are no residual construction groundborne noise impacts.

7.3.2 *Operational Phase*

Projections of ground borne noise at identified representative sensitive receivers have been performed, based on a methodology recommended by the US Department of Transportation and assuming an additional 10 dB safety factor, using train source vibration levels measured on the KCRC SP1900 EMU, ground vibration propagation measurements performed along lower Canton and Salisbury Roads and trackform attenuation data taken on West Rail.

In addition to the two trackforms already in use in WR and MOS Extension, two variant FST trackforms are proposed to provide extra attenuation required at the LCSD facilities. These variants are incrementally altered version of the existing KCRC tunnel FST: they both have modified support bearings and one has increased slab mass in order to lower the resonance frequency from 12.5 Hz to 10 Hz. With the installation of the recommended trackforms, no exceedance has been identified at any NSRs along KSL.

8. WATER QUALITY IMPACT ASSESSMENT

8.1 Legislation and Standards

The relevant legislation and associated guidance applicable to the present study for the assessment of water quality impacts include:

- Water Pollution Control Ordinance (WPCO) CAP 358, Water Quality Objectives (WQOs) for the Victoria Harbour Water Control Zone (VHWCZ) [8-1];
- Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems Inland and Coastal Waters (TM-Water), Effluents discharge limits for the Victoria Harbour Water Control Zone[8-2];
- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499), Technical Memorandum on Environmental Impact Assessment Process (TM-EIA) [8-3];
- ProPECC PN 5/93 "Drainage Plan subject to Comment by the Environmental Protection Department" [8-4];
- ProPECC PN 1/94 "Construction Site Drainage" [8-5];
- ProPECC PN 3/94 "Contaminated Land Assessment And Remediation" [8-6]; and
- "Recommended Pollution Control Clauses for Construction Contracts" issued by EPD[8-7].

8.2 Baseline Conditions

8.2.1 *Victoria Harbour*

Victoria Harbour is a major tidal channel with considerable assimilative capacity. According to Marine Water Quality 2002[8-8], with the implementation of the Harbour Area Treatment Scheme (HATS) Stage 1, the water quality in eastern end and middle portion of the Victoria Harbour has been improved. Although the discharge volume from the Stonecutter Island Sewage Treatment Works is high, the overall water quality in western harbour is still maintained.

8.2.2 *Monitoring Stations Near to Project Site*

The representative marine water quality monitoring stations in the vicinity of the project site are VT10 in YMT Typhoon Shelter, and VM5, VM6, and VM7 in the Victoria Harbour. A summary of the monitoring data at these stations as shown in Marine Water Quality Year 2002 is given in Table 8-1:

Table 8-1 : Marine water quality in Year 2002

	Monitoring Station			
	VM5	**VM6**	**VM7**	**VT10 (Yau Ma Tei Typhoon Shelter)**
Temperature (°C)	23.1 (16.3 – 27.4)	23.1 (16.3 –27.4)	23.2 (16.4 – 27.5)	24.0 (18.2 – 27.6)
Salinity (ppt)	31.8 (29.1 –33.3)	31.8 (28.7 – 33.2)	31.7 (28.7 – 33.2)	30.5 (27.3 – 32.1)
Dissolved Oxygen (mg/L)	5.7 (4.6 –6.9)	5.5 (4.7 – 6.3)	5.6 (4.6 – 7.0)	**3.1** (1.9 – 3.9)
BOD_5 (mg/L)	1.2 (0.5 – 2.4)	1.2 (0.7 –2.3)	1.5 (0.5 – 3.1)	1.1 (0.8 – 1.7)
SS (mg/L)	6.0 (3.2 – 13.3)	7.0 (3.4 – 17.0)	6.0 (3.9 – 10.1)	14.8 (4.8 – 26.3)
TIN (mg/L)	0.31 (0.13 – 0.64)	0.33 (0.20 – 0.65)	0.34 (0.20- 0.66)	**0.54** (0.38 – 0.71)

	Monitoring Station			
	VM5	VM6	VM7	VT10 (Yau Ma Tei Typhoon Shelter)
NH_3-N (mg/L)	0.006 (0.003 – 0.010)	0.006 (0.003 – 0.010)	0.007 (0.003 – 0.011)	0.009 (0.004 – 0.013)
Chlorophyll-a (mg/L)	4.8 (0.6 – 18.9)	4.2 (0.4 – 16.2)	4.2 (0.7 –19.8)	1.5 (0.7 – 4.5)
E. Coli (cfu 100m/L)	**4500 (630 – 42000)**	**5000 (600 – 19000)**	**4600 (1500 – 60000)**	**3700 (330 –37000)**

Note: [1] Data presented are depth averaged, except as specified.
[2] Data presented are annual arithmetic mean except for *E. Coli*, which are geometric mean values
[3] Data enclosed in brackets indicate the ranges
[4] Bolded cells indicate non-compliance with the WQOs for a parameter

According to Marine Water Quality 2002, most monitoring stations showed a reduction of *E. Coli* and NH_4 – N on comparing with past few years. The DO in Victoria Harbour has reached a high value in 2002. Widespread increases in DO at most monitoring stations in Victoria Harbour were observed. According to EPD's past marine water quality monitoring data, there was an overall rise of about 1°C in the surface and depth-averaged temperature over the past ten years. It is probably related to the extensive uses of seawater as coolant in the harbour area.

It can be seen from the above table that the water quality in YMT Typhoon Shelter (VT10) was not satisfactory. It is signified by low DO, high TIN and high faecal bacteria. Non-compliance of DO and Total Inorganic Nitrogen (TIN) were also recorded in Year 2002.

8.3 Water Sensitive Receivers

The closest water receiving body in the vicinity of the project site is the western region of the VHWCZ. Part of the alignment will also be adjacent to the YMT Typhoon Shelter. Due to the highly urbanised nature of Kowloon Peninsula, there are no natural streams located within 300m from the alignment.

There is neither marine biological sensitive receiver such as fish culture zone, shellfish culture ground, marine park/reserve nor commercial fishing ground in the VHWCZ. However, a number of seawater abstraction points for flushing and cooling are identified in the vicinity.

The representative Water Sensitive Receivers (WSRs) in the vicinity of the project site are summarized in Table 8-2 and shown in **Figure 8-1**.

Table 8-2 : Water sensitive receivers

WSR no.	WSRs Description	Operator
1	Yau Ma Tei Typhoon Shelter	-
2	Seawater abstraction point (Flushing)	WSD
3	Seawater abstraction point (Cooling)	MTRC Kowloon Station
4	Seawater abstraction point (Cooling)	China H.K City
5	Seawater abstraction point (Cooling)	Harbour City
6	Seawater abstraction point (Cooling)	Ocean Centre
7	Seawater abstraction points (Cooling)	Ocean Terminal
8	Seawater abstraction points (Cooling)	Government premises
9	Seawater abstraction points (Cooling)	New World Centre
10	Planned Seawater abstraction points (Cooling)	East Rail Extension
11	Storm water outfall	DSD
12	Storm water outfall	DSD

8.4 Construction Water Quality Impact

The site will be maintained by good site practices and there will be no direct discharge of wastewater into the Victoria Harbour during the construction phase. Hence, quantitative water quality dispersion modelling is considered not necessary. Other water quality issues relevant to the construction phase are described in the following sections.

8.4.1 *Pollution Sources from Construction Activities*

According to the latest design information, there will be no dredging activities, marine work platform construction and reclamation work for the proposed barging facility. Potential water pollution sources during construction phase will include sources mainly from land-based activities, including:

- Construction runoff;
- Runoff from tunnelling activities and underground works;
- Sewage effluent due to workforce on site;
- Drainage diversion;
- Groundwater seepage; and
- Groundwater from potential decontamination activities

8.4.1.1 *Construction Runoff*

Construction site runoff comprises:

- Runoff and erosion from site surfaces, drainage channels, earth working areas and stockpiles;
- Runoff from the proposed barging facility;
- Wash water from dust suppression sprays and wheel washing facilities; and
- Fuel, oil, solvents and lubricants from maintenance of construction machinery and equipment.

Construction runoff may cause physical, biological and chemical effects. The physical effects include potential blockage of drainage channels and increase of Suspended Solid (SS) levels in the VHWCZ.

Local flooding may also occur in heavy rainfall situations. The chemical and biological effects caused by the construction runoff are highly dependent upon its chemical and nutrient content.

Runoff containing significant amounts of concrete and cement-derived material may cause primary chemical effects such as increasing turbidity and discoloration, elevation in pH, and accretion of solids. A number of secondary effects may also result in toxic effects to water biota due to elevated pH values, and reduced decay rates of faecal micro-organisms and photosynthetic rate due to the decreased light penetration.

8.4.1.2 *Tunnelling and Underground Works*

During tunnelling work, rainfall, surface runoff and groundwater seepage pumped out from the tunnel would have high SS content. The situation would be worse during wet seasons.

Surface runoff may also be contaminated by bentonite and grouting chemicals that would be required for the construction of bored tunnels (for tunnel boring and ground treatment) and diaphragm walls for cut-and-cover tunnel sections. In addition, wastewater from tunnelling works will also contain a high concentration of SS.

8.4.1.3 *Sewage Effluent*

Sewage effluents will arise from the sanitary facilities provided for the on-site construction workforce. The characteristics of sewage would include high levels of BOD_5, Ammonia and *E. Coli* counts.

8.4.1.4 *Drainage Diversion*

Drainage infrastructure is available along the proposed alignment from TST to NAC. A separate Drainage Impact Assessment will be prepared and submitted by the Design Team. The assessment will identify the diversion or upgrading of the existing drainage infrastructure. The potential water quality impact associated with the drainage diversion or upgrading will be from the run-off and erosion from site surfaces and earth working areas. Small amount of wastewater may be released during the disconnection of various drainage systems.

8.4.1.5 *Groundwater Seepage*

The WKN and the tunnels from WKN to NAC will be constructed by cut and cover using D-wall technique (see **Chapter 4**). This construction methodology can minimise the intrusion of groundwater during excavation. D-wall technique involves excavation of a narrow trench that is kept full of slurry, which exerts hydraulic pressure against the trench walls and acts as a shoring to prevent collapse. Slurry trench excavations can be performed in all types of soil, even below the ground water table.

The construction usually begins with the excavation of discontinuous primary panels of typically up to 6m long and down to the rockhead. In order to provide an effective cut-off to ground water flow, the walls will need to be toe grouted. Once the excavation of a panel is completed, a steel reinforcement cage will be placed in the centre of the panel. Concrete is then poured in one continuous operation. Once the primary panels are set, secondary panels will be constructed between the primary panels and the process then repeats to create a continuous wall. It should be noted that this slurry trench method will reduce the gap between the panels to the practicable minimum. After this, soil excavation will be commenced. The intrusion of groundwater through D-wall panels during soil excavation is therefore considered insignificant.

For the tunnels to the south of WKN, bored tunnelling will be adopted along Canton Road, except for some locations (e.g. TBM launching / construction access shaft, CRPB, tunnel section along Salisbury Road, etc as described in **Chapter 4**) which will be constructed by cut-&-cover. Ground treatment (e.g. grouting) will be carried out along Canton Road prior to bored tunnelling. The intrusion of groundwater during bored tunnelling would therefore be insignificant.

8.4.1.6 *Groundwater from Contaminated Area*

Potential land contamination areas are identified in the vicinity of the study area including the TST Fire Station, the former shipyard sites within the West Kowloon Reclamation, Canton Road

Government Office, Tai Kok Tsui petrol filling station at Skyway House and the factory building at Shum Mong Road.

Site investigations were conducted between Oct 2002 and Feb 2003. Ground water table was found at about 1-2m below the ground level. The locations of the collected groundwater samples are shown in **Figure 8-2.** Some of the water samples show certain degree of contamination as described in the following sections.

(a) Groundwater Analytical Results

Table 8-3 shows the measurement results for the groundwater samples taken from 5 drillholes. Heavy metals (including Cd, Cr, Cu, Ni, Pb, Zn, Hg, As, Ba, Co, Mo and Sn), BTEX, cyanide, PAH, Total Petroleum Hydrocarbon (TPH) and dioxin were tested.

Estimation indicates that the amount of groundwater generated during dewatering will be around 580m^3 per day, which is corresponding to the flow band of 400 – 600m^3 / day listed in the TM-Water.

Table 8-3 : Comparison between contaminants and TM-Water effluent discharge criteria

Parameters	Maximum Concentration[1] (mg/L) (unless specified)					TM-Water Effluent limit for inshore waters of VHWCZ (mg/L)	Reporting Limit (μg/L)[5]
	KSD100/ DHE063	KSD100/D HEPZ052	KSD100/D HEPZ113	KSD100/D HE053	KSD100/ DHE120[3]	400 – 600 m^3 / day	
PH	7.89	8	7.4	7.2	7.7	6-9	
Temperature °C	22.4	20.4	19.1	19.8	26.9	< 40°C	20 –25
TPH C6 – C9	<0.020	<0.020	<0.020	<0.020	<0.020	---	
TPH C10–C14	<0.050	<0.050	<0.050	<0.050	<0.050	---	
TPH C15 – C28	0.115	<0.1	0.13	<0.1	0.11	---	
TPH C29 – C36	<0.050	<0.050	<0.050	<0.050	0.321	---	
Dioxin (pg/L)	0.04	---	---	---	0.019	---	10 pgL
Cd	< 0.0002	**0.0013**	0.0005	<0.0002	0.0005	0.001	
Cr	0.006	0.043	0.051	0.0071	0.0043	0.7	
Cu	0.4	0.230	0.330	0.340	0.055	0.7	
Ni	0.0035	0.023	0.027	0.0057	0.0081	0.7	
Pb	0.013	0.210	0.210	0.0051	0.061	0.7	
Zn	0.130	0.270	0.29	0.053	0.037	0.7	
Hg	< 0.0005	0.0016	**0.0029**	**0.0025**	<0.0005	0.001	
As	<0.010	0.021	0.015	<0.010	<0.010	0.7	
Ba	0.130	0.35	0.35	0.110	0.120	2.7	
Co	0.0045	0.016	0.017	0.0048	<0.001	---	
Mo	0.015	0.019	0.017	0.026	0.0079	---	
Sn	0.0053	0.124	0.074	0.0074	0.011	---	
Total Cyanide (μg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	---	
PAH[8] (μg/L)	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	0.1 – 1 (Low molecular weight) 0.02 – 0.1 (High molecular weight)

Parameters	Maximum Concentration[1] (mg/L) (unless specified)					TM-Water Effluent limit for inshore waters of VHWCZ (mg/L)	Reporting Limit (μg/L)[5]
	KSD100/ DHE063	KSD100/D HEPZ052	KSD100/D HEPZ113	KSD100/D HE053	KSD100/ DHE120[3]	400 – 600 m³ / day	
Benzene (μg/L)	< 2	< 2	< 2	< 2	< 2	---	1
Ethylbenzene (μg/L)	< 2	< 2	< 2	< 2	< 2	---	
Toluene (μg/L)	< 2	< 2	< 2	< 2	< 2	---	
Meta- & Para Xylene (μg/L)	< 4	< 4	< 4	< 4	< 4	---	
Ortho Xylene (μg/L)	< 2	< 2	< 2	< 2	< 2	---	

Note [1]: Bolded letters indicate exceedance in discharge limits at flow band of 400 –600m³ /day.
[2]: KSD100/DHEPZ052: Fire Station in Canton Road;
KSD100/DHE053: West Kowloon Reclamation (replaced adjacent drillhole KSD100/DHE056);
KSD100/DHEPZ113: Petrol station in Skyway House;
KSD100/DHE120: Former shipyard site in West Kowloon Reclamation Area;
KSD100/DHE063: industrial activities west Canton Road
[3]: There will be no groundwater discharge from DHE120 as there will only be at-grade rail works
[4]: ProPECC Note 3/94: Contaminated Land Assessment and Remediation
[5]: According to TM-Water, the chemicals concentration for TPH, dioxin, BTEX and PAH should be below the Reporting limit. Discharges of PCB, PAHs, petroleum oil, pesticide and toxicant into foul sewers, inland waters and coastal waters are prohibited. As the presence of these chemicals is not known at this stage, the groundwater cannot be discharged to the stormwater or foul sewer directly.

It can be seen from the above table that the maximum temperature of the samples are less than 40°C and the pH of the samples are in the range of 6-9, which comply with the standards stipulated in TM-Water. In addition, the concentration of Cr, Ni, As, Cu, Pb, Zn, and Ba are well below the TM-Water limits. However, exceedances in heavy metals (Cd and Hg) contents are observed at locations KSD100 / DHEPZ052 (Fire Station in Canton Road), KSD100 / DHE053 (West Kowloon Reclamation), and KSD100/DHEPZ113 (Petrol station in Skyhouse).

(b) Impact on health of construction workers

The Dutch ABC Values for groundwater are based on the use of groundwater for potable supply. As this is rarely the case in Hong Kong, the Dutch B Values are not necessarily appropriate for assessing the requirement of groundwater remediation, particularly within urban areas where there may be numerous diffuse sources of historical contamination within the vicinity. Hence, the Dutch C values are used for assessment.

When comparing the groundwater with the Dutch levels, 4 groundwater samples exceed the Dutch C Levels. The analytical results exceeding the Dutch C Levels are given in Table 8-4.

Table 8-4 : Summary of groundwater samples exceeding Dutch C Level

Drillhole reference	Depth (mbgl)	Contaminant	Concentration (μg/L)	Dutch C Limit (μg/L)
KSD100/DHEPZ052	8.0m	Copper Lead	230 210	200 200
KSD100/DHE053[1]	6.5m	Copper Mercury	340 2.5	200 2
KSD100/DHE063	3.0m	Copper	400	200

Drillhole reference	Depth (mbgl)	Contaminant	Concentration (μg/L)	Dutch C Limit (μg/L)
KSD100/DHEPZ113	6.5m	Copper	330	200
		Lead	210	200
		Mercury	2.9	2

Notes:

[1] According to the record for Drillhole KSD100/DHE056 (see **Figure 2** of **Appendix 10-2**), there is distributed marine deposit starting from approximately 5.8m deep. The on-site Contamination Specialist decided to take soil samples at 0.5, 1 and 3m deep. This drillhole was backfilled after sampling. However, the amount of groundwater collected before backfilling of the borehole was found to be insufficient for the required analytical testing. As such, groundwater was collected at an adjacent Drillhole KSD100/DHE053 (835327m easting and 818111m northing) as determined by the on-site Contamination Specialist.

The groundwater analytical results indicate occasionally elevated concentrations over the Dutch C level of metals including copper, lead and mercury. Such results are not considered unusual for groundwater in urban areas, where there are numerous potential diffuse sources of contamination. Free product was not observed in any of the samples or drillholes.

The impact of groundwater on the health of construction workers is based on the Dutch C Value as a screening tool, followed by a risk assessment approach where elevated concentrations of contaminants are present. The assessment methodology is given in the Contamination Assessment Report in **Appendix 10-2**. Table 8-5 below summarizes the Risk Based Screening Levels (RBSL) for each contaminant. Specific values for the sources of reference for individual factors are given in **Appendix 10-2**.

Table 8-5 : Risk Based Screening Levels for selected contaminants in groundwater

Contaminants	THQ	Risk	RfD_o	SF_o	BW	AT_n	AT_c	IR	ED	EF	RBSL (μg/L)
Copper	1	--	0.005	--	60	5	--	0.02	5	312	17500
Lead	--	0.0004	--	0.28	60	--	70	0.02	5	312	70200
Mercury	1	--	0.0001	--	60	5	--	0.02	5	312	351

Note [1]: THQ-Taget Hazard Quotient for chemical
Risk- Taget excess individual lifetime cancer risk
RfD_o-Chronic Oral Reference dose
SF_o- Carcinogenic slope factor
BW-Body Weight
AT_n-Averaging time for non-carcinogens
AT_c-Averaging time for carcinogens
IR-Water Ingestion Rate
ED-Exposure Duration
EF-Exposure Frequency
RBSL-Risk-Based Screening Level for Groundwater

Although the contamination of groundwater exceeds Dutch C level, none of the samples exceed the calculated RBSL for construction workers. Hence, remedial action of groundwater is not considered necessary.

8.4.2 *Recommended Mitigation Measures*

In accordance with the Practice Note for Professional Persons on Construction Site Drainage, Environmental Protection Department, 1994 (ProPECC PN 1/94), construction phase mitigation measures shall include the following:

8.4.2.1 *Construction Runoff and Site Drainage*

- At the start of site establishment (including the barging facilities), perimeter cut-off drains to direct off-site water around the site should be constructed with internal drainage works

and erosion and sedimentation control facilities implemented. Channels (both temporary and permanent drainage pipes and culverts), earth bunds or sand bag barriers should be provided on site to direct stormwater to silt removal facilities. The design of the temporary on-site drainage system will be undertaken by the contractor prior to the commencement of construction.

- The dikes or embankments for flood protection should be implemented around the boundaries of earthwork areas. Temporary ditches should be provided to facilitate the runoff discharge into an appropriate watercourse, through a site/sediment trap. The sediment/silt traps should be incorporated in the permanent drainage channels to enhance deposition rates.
- The design of efficient silt removal facilities should be based on the guidelines in Appendix A1 of ProPECC PN 1/94, which states that the retention time for silt/sand traps should be 5 minutes under maximum flow conditions. Sizes may vary depending upon the flow rate, but for a flow rate of 0.1 m^3/s a sedimentation basin of 30m^3 would be required and for a flow rate of 0.5 m^3/s the basin would be 150 m^3. The detailed design of the sand/silt traps shall be undertaken by the contractor prior to the commencement of construction.
- Construction works should be programmed to minimize surface excavation works during the rainy seasons (April to September). All exposed earth areas should be completed and vegetated as soon as possible after earthworks have been completed, or alternatively, within 14 days of the cessation of earthworks where practicable. If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by tarpaulin or other means.
- The overall slope of the site should be kept to a minimum to reduce the erosive potential of surface water flows, and all trafficked areas and access roads protected by coarse stone ballast. An additional advantage accruing from the use of crushed stone is the positive traction gained during prolonged periods of inclement weather and the reduction of surface sheet flows.
- All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms. Deposited silt and grit should be removed regularly and disposed of by spreading evenly over stable, vegetated areas.
- Measures should be taken to minimise the ingress of site drainage into excavations. If the excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.
- Open stockpiles of construction materials (for example, aggregates, sand and fill material) of more than 50m^3 should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.
- Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system and storm runoff being directed into foul sewers.
- Precautions be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecasted, and actions to be taken during or after

rainstorms are summarised in Appendix A2 of ProPECC PN 1/94. Particular attention should be paid to the control of silty surface runoff during storm events, especially for areas located near steep slopes.

- All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facilities should be provided at every construction site exit where practicable. Wash-water should have sand and silt settled out and removed at least on a weekly basis to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains.
- Oil interceptors should be provided in the drainage system downstream of any oil/fuel pollution sources. The oil interceptors should be emptied and cleaned regularly to prevent the release of oil and grease into the storm water drainage system after accidental spillage. A bypass should be provided for the oil interceptors to prevent flushing during heavy rain.
- Construction solid waste, debris and rubbish on site should be collected, handled and disposed of properly to avoid water quality impacts. Requirements for solid waste management are detailed in Section 9 of this Report.
- All fuel tanks and storage areas should be provided with locks and sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank to prevent spilled fuel oils from reaching water sensitive receivers nearby.
- By adopting the above mitigation measures with Best Management Practices (BMPs) it is anticipated that the impacts of construction site runoff from the construction site will be reduced to an acceptable levels before discharges.

8.4.2.2 *Tunnelling Works*

- Cut-&-cover tunnelling work should be conducted sequentially to limit the amount of construction runoff generated from exposed areas during the wet season (April to September).
- Uncontaminated discharge should pass through settlement tanks prior to off-site discharge
- The wastewater with a high concentration of SS should be treated (e.g. by settlement in tanks with sufficient retention time) before discharge. Oil interceptors would also be required to remove the oil, lubricants and grease from the wastewater.
- Direct discharge of the bentonite slurry (as a result of D-wall and bored tunnelling construction) is not allowed. It should be reconditioned and reused wherever practicable. Temporary storage locations (typically a properly closed warehouse) should be provided on site for any unused bentonite that needs to be transported away after all the related construction activities are completed. The requirements in ProPECC PN 1/94 should be adhered to in the handling and disposal of bentonite slurries.

8.4.2.3 *Sewage Effluent*

- Portable chemical toilets and sewage holding tanks are recommended for handling the construction sewage generated by the workforce. A licensed contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.

8.4.2.4 *Groundwater from Contaminated Areas*

Direct discharge of groundwater is not adopted. Contaminated groundwater from dewatering process should be recharged back into the ground at the discharged wells in the stockpile areas or temporary work areas as shown in **Figure 8-3**. The groundwater recharging wells will be selected at places where the groundwater quality will not be affected by the recharge operation as indicated in Section 2.3 of the TM-Water.

The Contractor shall perform ambient measurements on the groundwater quality at the WKN and the cut-&-cover tunnel to the north of WKN with reference to ProPECC PN3/94 "Contaminated Land Assessment and Remediation", prior to the selection of the recharge wells; and submit a working plan to EPD for agreement. The measurement data of the groundwater will serve as the baseline and the pollutant levels of the groundwater to be recharged shall be measured and not be higher than the baseline measurement at the recharge well.

Apart from the mitigation measures mentioned in **S8.4.2.1** and **S8.4.2.2**, the following additional mitigation measures are proposed to minimize the release of contaminants:

- Free products shall be removed by installing the petrol interceptor prior to recharge;
- Groundwater monitoring wells will be installed to monitor the effectiveness of the recharge wells. The locations of the monitoring wells will be near to the recharge points. During the recharge period, the groundwater level at the monitoring well shall be monitored to ensure that there is no likelihood of locally risen groundwater level and transfer of pollutants beyond the site boundary. Details of groundwater monitoring are given in the EM&A Maunal.

In addition, before excavation, the Contractor shall update the extent of potential groundwater contamination by collecting more groundwater samples along the alignment. The effluent limits and reporting limits are shown in Table 8-3. The Contractor should apply for a discharge licence under the WPCO through the Local Control Office of EPD for groundwater recharge operation.

8.4.3 *Residual Impacts*

Residual impacts during the construction phase are not anticipated provided that the above mitigation measures are implemented.

8.5 Operational Water Quality Impact

There will be no direct discharge of wastewater into the Victoria Harbour during the operational stage. Hence, quantitative water quality dispersion modelling is considered not necessary. Other water quality issues relevant to the operational phase are described in the following sections.

8.5.1 *Pollution Sources & Prediction of Impacts*

Potential water pollution sources during the operational phase are summarised below:

- Runoff from rail track and operational tunnel drainage;
- Station runoff;
- Discharge from fresh water cooled facilities; and
- Sewage from station operation.

8.5.1.1 *Run off from Rail Track*

Since all tracks are contained in concrete tunnel box, there will be no rainwater runoff. The tunnel wall will be equipped with water-tight liner and design for no seepage. The amount of groundwater seepage into the tunnel will be insignificant. Any tunnel run-off could be contaminated with limited amount of grease from passing trains or from maintenance activities. Standard designed silt trap and oil interceptor will be provided to remove the oil, lubricants, grease, silt, grit and debris from the wastewater before discharging into stormwater drainage. The waste will then be disposed of as general refuse and industrial wastes as described in **S9.3**. No adverse impact on marine environment is anticipated.

8.5.1.2 *Station Runoff*

Rainwater runoff from station structure (e.g. ventilation building, entrance etc) is not contaminated and hence has no adverse water quality impact.

8.5.1.3 *Discharge from Fresh Water Cooling Facility*

The discharge water from the fresh water-cooling facility (located in WKN) will contain small amount of dust/chemical. The discharge will be small in quantity and will be connected to main sewer system of the station.

According to the information from Design Team, three types of chemicals including, Drew 2215, Biosperse 280 and Hanmol P-50, will be added into the condenser water to control corrosion and micro-organism growth. These chemicals have been widely adopted in Hong Kong. They are described below:

Drew 2215 An ortho-phosphate based liquid cooling water treatment chemical which is an inherently biodegradable compound. It is dosed occasionally to compensate the chemical loss due to regular water loss in the condenser water system during blowdown or winddrift. The dosage volume is about 32L each time, resulting in the final concentration of around 100ppm.

Hanmol P-50 An oxidizing biocide and is used as a disinfectant to the cooling water. It is dosed twice per week with dosage volume of around 75L. The chemical content of Hanmol P-50 is sodium hypochlorite, which containing 12% w/w available chlorine. 1 ppm of the Hanmol P-50 will be used in the proposed condenser water system.

BIOSPERSE 280 A broad-spectrum biocide and will be shot dosed twice per week into the condenser water system to control the growth of microorganism. The dosage volume is about 5L each time, resulting in concentration of 200ppm inside the condenser water system. In a typical cooling system, 35% of the BIOSPERSE 280 will decompose in 1 hr, 75% is lost in 24 hours and 92% is lost in 48 hrs.

(a) <u>Impact on Sewerage System</u>

Potential water quality impact of the proposed fresh water cooling facility will be the daily bleed-off (~ $5m^3$ per day) from the condenser water. The bleed off will be used as flushing water and stored in flushing tanks. After flushing, the bleed-off, together with the raw sewage will be pumped to the Stonecutters Island Sewage Treatment Works (SCSTW) for chemical enhanced

primary treatment before discharging into the harbour. As there is no biological treatment involved inside the sewage treatment plant, it is considered that there is no significant impact on the sewage treatment works from ecotoxicology perspective.

(b) Impact on Environment

The amount of DREW 2215 in the breed-off (~5m^3 per day) from the condenser water system is 100 ppm. The concentration of the DREW 2215 will be further reduced after mixed with other wastewater generated inside the station. In addition, due to the high dilution capacity of the SCSTW and the inherently biodegradable property of DREW 2215, it is considered that there is no significant impact of Drew 2215 on the marine water quality after discharging from the SCSTW in the ecotoxicology standpoint.

Based on the dosage rate of Hanmol mentioned earlier, the maximum residual chlorine amount will be 0.12 ppm, which is lower than the residual chlorine content in drinking water (~1ppm). Hence, it is considered that Hanmol P-50 in the condenser water will have no impact on the environment.

For BIOSPERSE 280, due to the intermittent nature of the biocide dosing and bleeding off, the fast degradation rate of Biosperse 280 and the high dilution effect from the SCSTW, it is considered that the impact on marine environment is insignificant.

Although the chemicals used in fresh water cooling facilities have no adverse impact on the sewerage system and the environment, the Project Proponent is required to apply for the discharge licence under WPCO before the operation of the station.

8.5.1.4 *Sewage from Station*

A Design & Build Contractor will be appointed by the Project Proponent to conduct the detailed design and the construction and he will be responsible for carrying out the Sewerage Impact Assessment and submit to the relevant government departments for approval. Review of information from MOS Railway suggests that the typical Average Dry Weather Flow (ADWF) for a train station (without top-side properties) would be about 0.8l/s, which would be equivalent to about 55m^3/day, assuming 19 hours of operation. It is therefore anticipated that the ADWF for the WKN would be of similar order and probably in the order of 50-100m^3 /day. Given the small quantity of the ADWF for WKN, the capacity of the foul sewer is adequate for the proposed sewage discharge. Hence, no water quality impact is anticipated. The sewage discharge location is shown in **Appendix 8-1**.

8.5.2 *Recommended Mitigation Measures*

Mitigation measures are only required to mitigate runoff from track during the operational phase. With the implementation of the following mitigation measures, no residual impact during operational phase is anticipated.

- Track drainage channels discharge should pass through oil/grit interceptors/chambers to remove oil, grease and sediment before being pumped to the public stormwater drainage system;
- The silt traps and oil interceptors should be cleaned and maintained regularly; and
- Oily contents of the oil interceptors should be transferred to an appropriate disposal facility, or to be collected for reuse, if possible.

8.6 Conclusion

8.6.1 *Construction Phase*

Potential water pollution sources have been identified as construction runoff, sewage from site workforce, drainage diversion and groundwater contamination. Mitigation measures including covering excavated materials, carrying out excavation during dry seasons as far as possible and providing sedimentation tanks etc are recommended to mitigate any adverse water quality impacts.

Chemical tests have been conducted for ground water samples collected during the site investigation. Results indicate that some of the samples near the WKN and along the northern tunnels would be contaminated and exceed the discharge limit stipulated in TM-Water. Direct discharge of groundwater is thus not recommended. However, none of the samples exceed the calculated RBSL and therefore remedial action is not considered necessary for groundwater. To proper handle the groundwater, the groundwater during dewatering process should be re-charged on-site with careful monitoring to minimize environmental impact.

8.6.2 *Operational Phase*

The operational water quality impact for track run-off and tunnel seepage will have no adverse water quality impact provided that mitigation measures are incorporated in the design. The fresh water cooling system for station and tunnels will not cause adverse water quality impacts.

All proposed mitigation measures are clearly defined in the Environmental Mitigation Implementation Schedule.

9. WASTE MANAGEMENT IMPLICATIONS

9.1 Legislation and Standards

The following legislations relate to the handling, treatment and disposal of waste in HKSAR, and will be considered in assessing potential impacts and their avoidance or mitigation:

- Waste Disposal Ordinance (Cap 354) [9-1];
- Waste Disposal (Chemical Waste) (General) Regulation (Cap 354) [9-2];
- Land (Miscellaneous Provisions) Ordinance (Cap 28) [9-3]; and
- Public Health and Municipal Service Ordinance (Cap 132) – Public Cleansing and Prevention of Nuisances By-laws [9-4].

9.1.1 *Waste Disposal Ordinance*

The Waste Disposal Ordinance (WDO) prohibits unauthorised disposal of wastes. Construction and Demolition (C&D) waste is not directly defined in the WDO but is considered as "trade waste" which is defined as waste from any trade, manufacturer or business, or any wasted building, or civil engineering materials, but does not include animal waste.

Under the WDO, wastes can only be disposed of at sites licensed by EPD. Breach of these regulations can lead to a fine and/or imprisonment. The WDO also stipulates the requirements for issuing licenses for the collection and transportation of wastes. Licenses are however not required for the collection and transportation of C&D waste or trade waste.

9.1.2 *Waste Disposal (Chemical Waste) (General) Regulation*

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

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

This regulation also prescribes the storage facilities to be provided on site including labelling and warning sign. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written emergency procedures for spillage, leakage or accidents arising from storage of chemical wastes. The waste producer must also provide employees with training for such procedures.

9.1.3 *Land (Miscellaneous Provisions) Ordinance*

The inert portion of C&D materials may be taken to public filling facilities including public filling area, public filling barging points and stockpiling areas. These facilities usually form part of land reclamation schemes and are operated by CEDD. This ordinance requires Dumping

Licenses (to be issued by CEDD) to be obtained by individuals or companies, who deliver inert C&D materials to the public filling facilities.

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

9.1.4 *Public Cleansing and Prevention of Nuisances by-Laws*

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

9.1.5 *Other Relevant Guidelines*

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

Table 9-1 : Other relevant documents and information

Bureau / Department	Documents / Guidelines / Technical Circulars
Planning, Environmental and Lands Branch	• Waste Disposal Plan for Hong Kong (December 1989) [9-5] • Waste Reduction Framework Plan, 1998 to 2007 [9-6]
Environment, Transport and Works Bureau	• Works Branch Technical Circular (WBTC) No. 32/92, The Use of Tropical Hard Wood on Construction Site [9-7] • WBTC No. 2/93, Public Dumps [9-8] • Works Bureau TC No 2/93B, Public Filling Facilities [9-9] • WBTC No. 16/96, Wet Soil in Public Dumps [9-10] • Works Bureau TC Nos. 4/98 and 4/98A, Use of Public Fill in Reclamation and Earth Filling Project [9-11] • Works Bureau TC Nos. 25/99, 25/99A and 25/99C, Incorporation of Information on Construction and Demolition Material Management in Public Works Sub-committee Papers [9-12] • Works Bureau TC No. 12/2000, Fill Management [9-13] • Works Bureau TC No. 19/2001, Metallic Site Hoardings and Signboards [9-14] • Works Bureau TC No. 06/2002, Enhanced Specification for Site Cleanliness and Tidiness [9-15] • Works Bureau TC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates [9-16] • Works Bureau TC No. 21/2002, Trip-ticket System for Disposal of Construction and Demolition Material [9-17] • Environment, Transport and Works Bureau Technical Circular (ETWBTC) (Works) No. 33/2002, Management of Construction and Demolition Material Including Rock [9-18] • ETWBTC (Works) No. 34/2002, Management of Dredged / Excavated Sediment [9-19] • ETWBTC (Works) No. 15/2003, Waste Management on Construction Sites [9-20]
EPD / CEDD	• New Disposal Arrangements for Construction Waste (1992) [9-21]
EPD	• Code of Practice on the Packaging, Labeling and Storage of Chemical Wastes (1992) [9-22]
PlanD	• Environmental Guidelines for Planning In Hong Kong (1990), Hong Kong Planning and Standards Guidelines [9-23]

According to ETWBTC No. 33/2002[9-18], for Designated Projects, a C&D Material Management Plan has to be submitted to the Public Fill Committee in case of C&D materials exceed 50,000m^3.

ETWBTC No. 15/2003[9-20], which supersedes "WBTC No. 5/98, On-site Sorting of Construction Waste on Demolition Sites" and "WBTC No. 29/2000, Waste Management Plan", sets out the

policy and procedures requiring contractors to prepare and implement an enhanced Waste Management Plan to encourage on-site sorting of C&D materials and to reduce C&D waste generation during construction.

9.1.6 *Landfill Disposal Criteria for Contaminated Soil*

Excavated contaminated soil has to meet certain criteria before disposal to landfill is allowed. The criteria are set out in the *Guidance Notes for Investigation and Remediation of Contaminated Sites of: Petrol Filling Stations; Boatyards and Car Repair/Dismantling Workshops* [9-24]. These criteria relate primarily to Toxicity Characteristic Leaching Procedure (TCLP) limits. In case these limits are exceeded, in-situ treatments would be required before final disposal to landfill.

9.1.7 *Disposal Criteria for Dredged / Excavated Sediment*

ETWBTC No. 34/2002[9-19] stipulates the procedures for seeking approval to dredged / excavated sediment and the management framework for marine disposal of such sediment. Applications for approval of dredging / excavation proposal and allocation of marine disposal shall be made to the Secretary of Marine Fill Committee. Marine Dumping Permits are required from EPD for the disposal of dredged/ excavated sediment.

9.2 Construction Phase

9.2.1 *Potential Sources of Wastes*

During the construction phase, the main activities (land based) that will potentially generate waste include excavation, tunnelling, demolition and construction of station and associated structures. Typical waste types associated with these activities include:

- C&D materials;
- Excavated contaminated materials, marine deposit and alluvium;
- Chemical waste;
- Sewage; and
- General refuse.

9.2.2 *Assessment Methodology*

The potential environmental impacts associated with the handling and disposal of waste arising from the construction works will be assessed in accordance with the following:

- Estimation of the types, timing and quantities of the wastes to be generated; and
- Assessment of the potential impact on the capacity of waste collection, transfer and disposal facilities.

Secondary environmental impacts due to the management of waste, including potential air emission and noise arising from the temporary spoil stockpiling, barging facility and disposal route have been assessed and evaluated in the previous sections.

9.2.3 *C&D Materials*

9.2.3.1 *C&D Materials Generated*

The proposed alignment, station will run through various layers of materials including rock at the bottom, marine deposits and alluvium (as residual material from previous reclamation works) at some of the locations, and fill material on the top. These materials will need to be excavated for cut-&-cover activity. For bored and mined tunnelling, only the spoil within the tunnel will be excavated.

Table 9-2 gives the estimated quantity of C&D materials to be excavated in accordance with the C&D Material Management Plans for KSL[9-25] [9-26] prepared by the Design Team. The corresponding Fill and Surplus Materials Data Forms, as extracted from the C&DMMPs are given in **Appendix 9-1**.

Table 9-2 : Summary of annual generated quantities of C&D materials

		Annual Quantity of C&D Materials Generated, m^3				
C&D Materials		**2004**	**2005**	**2006**	**2007**	**Total**
Soil Material	Fill	-	276,900	305,800	-	582,700
	Grade IV & V	-	149,600	73,000	-	222,600
	Others	-	-	800	-	800
	From D-wall installation	-	73,700	96,600	-	170,300
Rock	Grade III or above - MDG/SDG	-	104,600	75,000	700	180,300
Artificial Hard material	bituminous / concrete pavement	-	29,200	15,400	-	44,600
C&D Waste		-	4,300	10,300	2,900	17,500
	Sub Total	**-**	**638,300**	**576,900**	**3,600**	**1,218,800**

The total volume of C&D materials is estimated to be 1,218,800m^3 and the maximum annual generation of excavated material would be about 638,300m^3 at Year 2005.

9.2.3.2 *Mitigation Measures Adopted to Minimise C&D Material*

The combination of the urban setting and the nature of the physical constraints have limited the availability of alternative schemes for the station and tunnel construction (see **Chapter 4**). The current design is to use bored tunnelling along Canton Road, cut-&-cover techniques for both the WKN and other tunnel sections, and mined tunnelling underneath FMPHQ and at Cherry Street.

Measures have been adopted to minimise the generation of C&D materials at the outset during the design stage. As excavation cannot be avoided, only limited measures can be taken to minimise the quantity of C&D materials, including:

- Adoption of tunnelling construction techniques (e.g. bored tunnelling along Canton Road) that would minimise the amount of excavation as far as possible;
- Reduction of the size and the number of offline plant rooms;
- Minimisation of the overall size of the plant buildings and tunnel box sections through effective structural scheming for plant building and tunnel layout; and

- Efficient use of the space for station layout to minimise the overall width of the station and tunnel box sections.

9.2.3.3 *Reuse of C&D Materials*

The opportunity of reusing excavated fill material for backfilling and reinstatement works has been maximised by identified temporary stockpiles near to the work site. Several temporary stockpile locations have been identified as shown in **Figures 4-1-1 to 4-1-3**.

The tunnel to the north of the WKN will be constructed in segments of about 100m. Depending on site constraints, a portion of the excavated C&D material of the tunnel segment will be temporarily stored in the work front. When the tunnel segment is constructed, the excavated C&D will be backfilled for reinstatement. The process will then be repeated for other segments. This method will maximise the reuse of C&D materials, and hence reduce the storage of C&D materials and the transporting time from the excavation site to the stockpiles.

It is estimated that approximately 331,100m^3 of the inert C&D materials could be reused and the rest 887,700m^3 would need to be disposed. A summary of the reused materials is given below.

Table 9-3 : Summary of C&D material generated, reused and disposed

C&D Materials		Quantity of C&D Materials, m^3		
		Generated	**Reused**	**Disposed**
Soil Material	Fill	582,700	308,500	274,200
	Grade IV & V	222,600	20,800	201,800
	Others	800	-	800
	From D-wall installation	170,300	-	170,300
Rock	Grade III or above - MDG/SDG	180,300	1,800	178,500
Artificial material	bituminous / concrete pavement	44,600	-	44,600
C&D Waste		17,500	-	17,500
	Sub Total	**1,218,800**	**331,100**	**887,700**

The reused C&D materials would consist of fill grade IV and V decomposed granite materials. It is anticipated that the excavated grade IV and V decomposed granite materials consists of mainly grade V, which is suitable for backfilling. Concrete debris will not be used as an on-site backfill material due to its relatively large size, except for those less than 150mm in diameter which can be used as fill when mixed with general fill materials. It is also difficult to control the quality of compaction using concrete debris as fill. The actual amount of reused C&D material will depend on the content and quality of the excavated materials.

9.2.3.4 *On-site sorting of C&D material*

All C&D materials arising from the construction of KSL from WKN to NAC Station will be sorted on-site to recover the inert C&D materials and reusable and recyclable materials prior to disposal off-site. All inert C&D materials will be broken down by handheld breakers according to the Dumping Licence conditions before disposal to public filling outlets by barges.

All surplus C&D materials will become the property of the Contractor once they are removed from the site. The Contractor will be responsible for devising a system to work for on-site sorting of C&D materials and promptly remove all sorted and processed material arising from the

construction activities to minimise temporary stockpiling on-site. It is recommended that the system should include the identification of the source of generation, estimated quantity, arrangement for on-site sorting and / or collection, temporary storage areas, and frequency of collection by recycling Contractors or frequency of removal off-site.

It has been assumed that inert C&D materials (e.g. soil, building debris, concrete) will be sorted out from C&D materials at source to avoid double handling. Silty / clayey materials from alluvium and marine deposits will be identified at source. Non-contaminated alluvial and marine deposits will be transported by leak proof trucks to eliminate water leakage during transportation to the barging facility for open sea disposal. The trucks should also be covered with impervious sheeting to prevent any dust emissions.

9.2.3.5 *Disposal Programme for C&D Material*

The estimated disposal programme of surplus C&D material is shown below:

Table 9-4 : Summary of annual disposal quantities of C&D materials

Disposal Method	Annual Disposal Quantity, m^3				Total
	2004	2005	2006	2007	
Public Fill	---	568,800	300,700	700	870,200
Landfill	---	4,300	10,300	2,900	17,500

There will be approximately 870,200m^3 of C&D materials that need to be disposed off-site as public fill. A number of potential public fills has been identified from CEDD's Fill Management database (Table 9-5.).

Table 9-5: Potential public fill sites and the annual inert C&D waste generated between Yr 2005 and Yr 2008

Project	Volume by Years (million m^3)			
	2005	2006	2007	2008
Penny's Bay Reclamation Stage 2	3.226	3.267	1.455	---
Yam O Further Reclamation	---	3.360	4.440	3.960
Sub-Total	3.226	6.627	5.895	3.960
Present Project (Public Fill required)	0.57	0.3	0.007	---

Source: CEDD Fill Management database from http://www.ced.gov.hk/eng/index.htm

The Project Proponent shall notify CEDD of the estimated spoil volumes to be generated, and liaise and agree with the Public Fill Committee for the disposal of surplus inert C&D materials including good quality rock during the detailed design phase of the project.

The C&D waste materials include those from the construction of the cut-&-cover tunnels and bored tunnel. The spoil from the TBM launching shaft will be transported by a conveyor belt system to the nearest ground level, and then be transported by dump trucks to the barging facility for final disposal (e.g. approved Public Filling Area, where the C&D materials will be designated to various development projects that require public fill for reclamation and earth filling purposes). This will ensure that the distance travelled by the transportation vehicles is optimised. The location of barging facilities is shown in **Figure 4-1-2**, and the transportation routings of the trucks to and from barging point are indicated in **Appendix 9-2**.

The peak hourly flow of lorries carrying C&D materials to the barging facilities for the entire KSL (from TST to Nam Cheong) would be approximately 43 veh/hr.

9.2.4 *Imported Fill Material*

It is anticipated that any fill materials required will be sourced from the excavated materials stockpiled at the temporary stockpiling areas, whenever it is suitable. Hence, no imported fill will be required.

9.2.5 *Excavated Contamination Materials and Marine Deposit*

9.2.5.1 *Contamination Soil*

A Contamination Assessment Plan (CAP) has been prepared and agreed-in-principle by EPD (**Appendix 10-1 of Chapter 10**). It collected historical information and existing site conditions as the basis for land contamination assessment. The assessment has been conducted at selected sampling hotspots and approximately 39m^3 of soil is confirmed to be contaminated at the ex-government dockyard at Canton Road Government Office (see **Chapter 10**). Details of the findings are reported in the Contamination Assessment Report. "Excavation and Landfill Disposal" is considered as the most suitable and cost effective remediation method as none of the contaminants exceed the TCLP limits. A Remediation Action Plan (RAP), which has been submitted together with the Contamination Assessment Report for EPD endorsement, has detailed the site clean up method. Details of land contamination assessment and RAP are given in **Appendix 10-2 of Chapter 10**.

9.2.5.2 *Marine Deposits*

A summary of the generation of marine deposits and alluvium is given in Table 9-6.

Table 9-6 : Summary of annual generation of marine deposits and alluvium

	Year				
Waste	**2004**	**2005**	**2006**	**2007**	**Total, m^3**
Marine deposits and alluvium	-	38,400	56,500	-	94,900

A Sediment Quality Report was prepared as per the requirements given in the WBTC 34/2002 "Management of Dredged / Excavated Sediment" [9-19]. The Final Sediment Quality Report has been approved by EPD in 2003.

Based on the Final Sediment Quality Report, field sampling work involving 31 drill holes was carried out during the fourth quarter of 2002. A total of 92 samples had been collected and tested. Results indicate that 14 samples contained Heavy Metal compounds registered in Categories M (Material > Lower & ≤ Upper Chemical Exceedance Level) and H (Material > Upper Chemical Exceedance Level) and 2 samples containing PAH registering Category M. However, none of the samples were within Category H and exceeding 10 times of LCEL (Lower Chemical Exceedance Level).

These samples were also considered for biological screening as per the requirements given in WBTC 34/2002. Four of these samples had been proposed for biological screening while the rest of the 14 samples either do not require biological screening (since < 10 times of LCEL) or the sample volume was not large enough. Biological screening results indicate that all of the four samples failed the biological screening. The locations of these samples are given in **Figure 9-1.**

Since the samples (Category M) failed the biological screening, these marine deposits should be disposed at Type 2 confined marine disposal site according to the requirements given in the WBTC 34/2002. The rest of the marine deposit along the proposed alignment should be assigned for Type 1 open sea disposal.

Given that the whole length of the KSL is around 3.7km, the volume of sediment for disposal will be 26m^3/m. According to the approved Sediment Quality Report, the total extent of the sediment requiring Type 2 Disposal is 1,080m, equivalent to 28,080m^3 (mainly including WKN and northern tunnel). The location of marine sediment subject to Type II disposal is illustrated in **Figures 9-2-1 to 9-2-3**. The remaining 66,820m^3 of marine deposits will be subject to Type 1 open sea disposal.

9.2.6 *C&D Waste*

About 17,500m^3 of C&D waste will be generated throughout the construction works from general site clearance works, tree felling, piling works and earthworks for construction of various structures. This C&D material has to be disposed of at landfills.

9.2.7 *Chemical Waste*

Chemical wastes likely to be generated from the construction activities for the proposed tunnels, station and associated structures will include:

- Scrap batteries or spent acid/alkali from their maintenance;
- Used paint, engine oils, hydraulic fluids and waste fuel;
- Spent mineral oils/cleansing fluids from mechanical machinery; and
- Spent solvents/solutions, some of which may be halogenated, from equipment cleansing activities.

Chemical waste may pose serious environmental, health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the Waste Disposal (Chemical Waste) (General) Regulation and the Code of Practice on the Packing, Labelling and Storage of Chemical Waste [9-22]. These hazards may include:

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

It is difficult to quantify the amount of chemical waste as it will be highly dependent on the Contractor's on-site maintenance practice and the quantities of plant and vehicles utilized. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance will be small and in the order of few hundred litres per month.

9.2.8 *Sewage*

Sewage will arise from amenity facilities used by the construction workforce and site office's sanitary facilities. Night soil from chemical toilets will also be generated. The sludge needs to be properly managed to minimise odour and potential health risks to the workforce by attracting pests and other disease vectors.

The number of construction workers to be employed on site is not available at this stage, but is anticipated to be about 1,000 staff. As the workers will be scattered along the proposed alignment, station and work sites, the most cost-effective solution will be to provide adequate number of portable toilets along the alignment to ensure that sewage from site staff is properly

collected. Depending on site conditions, land availability and site activities, the locations and number of portable toilets will be determined in the Waste Management Plan (WMP) to be submitted by the Contractor and agreed by EPD. No adverse waste impact is envisaged provided that maintenance by licensed contractors is conducted regularly.

9.2.9 *General Refuse*

The presence of a construction site with workers and site office will result in the generation of a variety of general refuse requiring disposal. General refuse will mainly consist of food waste, aluminium cans and waste paper.

The storage of general refuse has the potential to give rise to adverse environmental impacts. These include odour if the waste is not collected frequently (for example, daily), windblown litter, water quality impacts if waste enters waster bodies, and visual impact. The sites may also attract pests, vermin, and other disease vectors if the waste storage areas are not well maintained and cleared regularly. In addition, disposal of wastes at sites other than approved landfills, can also lead to similar adverse impacts at those sites.

The number of staff (clerical and workers) to be employed for the project is not available at this stage, but is anticipated to be about 1,000 staff. On this basis, the total refuse generated per day would be about 650kg/day, assuming the refuse generated rate is 0.65kg/head/day. Provided that the mitigation measures recommended in **S9.2.10** are adopted, the potential environmental impacts caused by the storage, handling, transport and disposal of general refuse is expected to be minimal. It is recommended that general refuse should be collected on a daily basis for disposal. Given the small quantity of general refuse, adverse impacts to the operation of the landfills are not expected.

9.2.10 *Recommended Mitigation Measures*

The requirements as recommended in ETWB TC 15/2003 Waste Management on Construction Sites and its latest version, and other relevant guidelines, should be included in the Particular Specification for the Contractor as appropriate.

Each tenderer should be requested to submit an outline WMP for tender assessment. Prior to the commencement of construction work, the Contractor should prepare a WMP to provide an overall framework for waste management and reduction. It should contain the following key elements:

- Waste management policy;
- Record of generated waste;
- Waste reduction target;
- Waste reduction programme;
- Role and responsibility of waste management team;
- Benefit of waste management;
- Analysis of waste materials;
- Reuse, recycling and disposal plans;
- Transportation process of waste products; and
- Monitoring and action plan.

Waste management options with less environmental impacts are preferred. The waste management hierarchy should be as follows:

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

This hierarchy should be used to evaluate the waste management options to allow maximum waste reduction and often reducing costs. For example, by reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing raw materials and disposing of wastes. Records of quantities of wastes generated, recycled and disposal (locations) should be properly kept.

A trip-ticket system should be established in accordance with ETWBTC No. 21/2002 [9-20] to monitor the disposal of public fill and solid wastes at public filling facilities and landfills, and to control fly-tipping. A trip-ticket system will be included as one of the contractual requirements and implemented by the Contractor. The Engineer shall audit the result of the system.

A recording system for the amount of waste generated, recycled and disposed of (including the disposal sites) should be established during the construction phase. The Contractor should provide training to workers on the concepts of site cleanliness and on appropriate waste management procedures, including waste reduction, reuse and recycling at the beginning of the Contract.

The recommended mitigation measures for other waste types are described as follows.

9.2.10.1 *Excavated Contamination Materials and Marine Deposit*

Contamination Soil

About 39m^3 of contaminated soil is identified (refer to **Chapter 10** for details). Given the small amount of volume, disposal in landfill site is recommended. Potential landfill sites include SENT and NENT. Details of the mitigation measures on handling of the contaminated soil shall be referred to **Appendix 10 –2.**

Marine Deposit

- The total amount of marine deposits and alluvium is 94,900m^3. Normally, the contaminated marine deposit will require to be disposed of at confined contaminated mud pits such as East Sha Chau, while the uncontaminated marine and alluvial deposit will require open sea disposal, e.g. in South Cheung Chau, Nine Pin, etc

Possible mitigation measures to handle the contaminated / uncontaminated alluvial / marine sediment are summarized as follows:

- All construction plant and equipment shall be designed and maintained to minimise the risk of silt, sediments, contaminants or other pollutants being released into the water column or deposited in the locations other than designated location.

- All vessels shall be sized such that adequate draft is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash.
- Before moving the vessels which are used for transporting dredged material, excess material shall be cleaned from the decks and exposed fittings of vessels and the excess materials shall never be dumped into the sea except at the approved locations.
- Adequate freeboard shall be maintained on barges to ensure that decks are not washed by wave action.
- The Contractors shall monitor all vessels transporting material to ensure that no dumping outside the approved location takes place. The Contractor shall keep and produce logs and other records to demonstrate compliance and that journeys are consistent with designated locations and copies of such records shall be submitted to the Engineers.
- The Contractors shall comply with the conditions in the dumping licence.
- All bottom dumping vessels (hopper barges) shall be fitted with tight fittings seals to their bottom openings to prevent leakage of material.
- The material shall be placed into the disposal pit by bottom dumping.
- Contaminated marine mud shall be transported by split barge of not less than 750m^3 capacity and capable of rapid opening and discharge at the disposal site.
- Discharge shall be undertaken rapidly and the hoppers shall be closed immediately. Material adhering to the sides of the hopper shall not be washed out of the hopper and the hopper shall remain closed until the barge returns to the disposal site.

9.2.10.2 *C&D Materials*

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

- Maintain temporary stockpiles and reuse excavated fill material for backfilling and reinstatement;
- For the tunnel section to the north of WKN, stockpile excavated C&D material adjacent to its source for immediate backfill once the tunnel section is completed;
- Carry out on-site sorting;
- Surplus artificial hard materials should be delivered to Tuen Mun Area 38 recycling plant or its successor for recycling into subsequent useful products;
- Due to the relatively small quantities and poor condition of the existing bituminous pavement, it is not recommended that the pavement be recycled for subsequent reinstatement. Instead, the material may be used for paving of construction access and temporary holding / parking areas;

- Make provisions in the Contract documents to allow and promote the use of recycled aggregates where appropriate;
- Adopt 'Selective Demolition' technique to demolish the existing structures and facilities with a view to recovering broken concrete effectively for recycling purpose, where possible;
- Implement a trip-ticket system for each works contract to ensure that the disposal of C&D materials are properly documented and verified; and
- Implement an enhanced Waste Management Plan similar to ETWB TC(W) No. 15/2003 – "Waste Management on Construction Sites" to encourage on-site sorting of C&D materials and to minimize their generation during the course of construction.

In addition, disposal of the C&D materials onto any sensitive locations such as agricultural lands, etc. should be avoided. The Contractor shall propose the final disposal sites to the Project Proponent and get its approval before implementation.

9.2.10.3 *C&D Waste*

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

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

HKSAR has developed a charging policy for the disposal of waste to landfill. When it is implemented, this will provide additional incentive to reduce the volume of waste generated and to ensure proper segregation to allow disposal of inert material to public filling areas.

9.2.10.4 *Chemical Waste*

Chemical waste producers should be registered with EPD. For those processes which generate chemical waste, the Contractor shall identify any alternatives that generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.

Chemical waste should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes as follows. Containers used for storage of chemical wastes should:

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

The storage area for chemical wastes should:

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

Disposal of chemical waste should:

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

9.2.10.5 *Sewage*

Adequate numbers of portable toilets should be provided for the workers. The portable toilets should be maintained in a state, which will not deter the workers from utilizing these portable toilets. Night soil should be collected by licensed collectors regularly.

9.2.10.6 *General Refuse*

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

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

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

9.3 Operational Phase

9.3.1 *Types of Wastes*

During the operational phase, the station and the associated facilities will generate the following wastes:

- General refuse;
- Industrial waste; and
- Chemical waste.

9.3.2 *General Refuse and Industrial Waste*

General refuse will arise from the public, station employees and commercial operators within the WKN. Waste would include food, paper, wood, plastic, office waste, metal containers etc. The storage and handling of these wastes may give rise to environmental impacts.

Maintenance activities of the station and tracks will generate industrial waste including scrap materials from rail and carriage maintenance, used fluorescent tubes, used welding rods, cleansing materials and discarded electronic equipment.

It is anticipated that waste generated by each of the WKN would be approximately 500kg/day. A reputable waste collector should be employed to remove general refuse and industrial waste from the stations, separately from chemical wastes, on a daily basis to minimise odour, pest and litter impacts.

9.3.3 *Chemical Waste*

Similar to industrial waste, lubricants, paints, used batteries, mineral oil, coolants, and solvents will be generated during the operational phase within the stations and alignment areas. These wastes may pose significant environmental, health and safety hazard if they are not properly managed.

The requirements given in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes [9-22] should be followed in handling of these chemical wastes. A trip-ticket system should be operated in accordance with the Waste Disposal (Chemical Waste) (General) Regulation to monitor all movements of chemical wastes which will be collected by a licensed collector to a licensed facility for final treatment and disposal.

9.4 Residual Environmental Impacts

With the implementation of recommended mitigation measures, residual impacts are not anticipated for both the construction and operational phases.

9.5 Conclusion

9.5.1 *Construction Phase*

The quantity and timing for the generation of waste during the construction phase have been estimated. Measures, including the opportunity for on-site sorting, reusing excavated fill materials (stored in stockpiles) etc, are devised in the construction methodology to minimise the

surplus materials to be disposed off-site via the barging facilities in West Kowloon. The annual disposal quantities for C&D materials and their disposal methods have also been assessed.

Recommendations have been made for the Contractor for implementation during the construction period to minimise the waste generation and any off-site disposal.

9.5.2 *Operational Phase*

The types and quantities of waste that would be generated during the operational phase have been assessed. Recommendations have been made to ensure proper treatment and disposal of these wastes.

10. LAND CONTAMINATION ASSESSMENT

10.1 Legislation

Legislation and non-statutory guidance for carrying out the land contamination assessment is provided in the following:

- Technical Memorandum on Environmental Impact Assessment Process (TM-EIA) [10-1];
- ProPECC PN 3/94 – Contaminated Land Assessment and Remediation [10-2]; and
- Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops [10-3].

10.2 Background Information

The assessment is carried out by reviewing the relevant historical information such as site geological information, ground conditions, aerial photos and site inspection.

Relevant information has been obtained for the underground oil storage tanks in the existing TST Fire Station at the north of Canton Road and the petrol filling station at the intersection of Kok Cheung Street and Pok Man Street (under Skyway House).

All collected information and inspection findings have been reviewed and sampling locations have been selected for evaluating the potential of contamination that might be encountered during the construction period.

10.2.1 *Geology Information*

The regional geology of the study area is shown on the 1:20,000 Geological Map, Sheet 11, Hong Kong and Kowloon, from the Hong Kong Geological Survey.

The main rock type within the Kowloon peninsula comprises an equigranular medium grained biotite monzogranite of the Kowloon Granite. The superficial deposits in the TST area have an embayment of marine sand beach deposits stretching from the shoreline at Salisbury Road up Nathan Road to just north of Mody Road. The marine sand and beach deposit is also shown to run along and lie below Canton Road with the deposit extending to the west into the area of reclamation.

An alluvial deposit is shown to extend from Austin Road into the project area to below the former typhoon shelter and will underlie the marine deposits in this area.

To the north of the former Jordan Ferry piers the route runs across reclamation areas comprising the former Yau Ma Tei typhoon shelter. The geological map indicates that marine deposits should exist in this area and some marine sands may lie below the old reclaimed areas to the north of the shelter.

10.2.2 *Ground Conditions*

Geological sections for the whole alignment are shown in Contamination Assessment Plan (CAP) in **Appendix 10-1**. Along Salisbury Road, the upper 2 to 4m of soil (approximately) is fill material. Below this is a 5m thick marine deposits made up of beach sand deposits. These deposits comprise typically loose to medium dense sands, which occasionally have silt and clay mixed into the material. The next 5m is made up of alluvium which comprises a sequence of

mixed brown silty and clayey fine to medium sands and gravels. The lowest stratum recorded (down to a depth of 15m) is predominantly completely decomposed granite (CDG) and moderately to slightly decomposed granite (M/SDG). M/SDG can be described as a strong to very strong pink mottled grey and black speckled medium grained granite with medium to widely spaced joints. The average groundwater level recorded at Salisbury Road is about 3m below the surface.

At Canton Road, the CDG layer is approximately 15 to 30m thick lying underneath a thin layer of fill material (1 to 5m). The CDG layer has its thickest accumulations near Haiphong Road and in the reclamation area. The average groundwater level recorded is about 1-2m below the surface. The thickness of top fill layer gradually increases to 20m at the West Kowloon Reclamation Area where the majority of the alignment will be located within this area. The average groundwater levels recorded are about 6-7m and 3m below ground in West Kowloon Reclamation Area and Tai Kok Tsui respectively.

10.2.3 *Historical Information*

10.2.3.1 *Reclamation*

Review of historical maps and aerial photography indicates that there were several phases of reclamation over the whole alignment. Across the southern and western Kowloon Peninsula the majority of reclamation was carried out before 1904. Reclamation in several other small areas along the main TST waterfront was completed by 1982. The West Kowloon Reclamation was formed as part of the Airport Core Programme and except for the area known as YM6 was completed by 1995. The remaining area of YM6 reclamation is currently under construction.

10.2.3.2 *Industrial Uses*

Aerial photographs of 1964, 1974, 1985 and 1995 have been reviewed. There were industrial facilities (e.g. shipyards, warehouse) along the waterfront of Canton Road in 1964 and 1974. Most of the shipyards during that period did not have specific precautionary measures to prevent spillage of oil onto the ground. Aerial photographs reveal that the TST Fire Station and the commercial buildings were constructed during early 1970's and early 1980's and the area next to the TST fire station was open storage/car parking area between 1985 and 1995. The remaining area of YM6 reclamation, the waterfront of the Canton Road Government Office, was the typhoon shelter and the dockyard of the Marine Department.

Further up north was the YMT typhoon shelter and Tai Kok Tsui. These areas had not been reclaimed in 1985. In Tai Kok Tsui, the landuses were identified in accordance with street maps from 1996 to 2002 [10-4]. Most buildings were residential uses except two factory buildings located at Sham Mong Road.

The factory building, Tai Kok Tsui Centre (existing Skyway House), located at the intersection of Kok Cheung Street and Pok Man Street was constructed in 1982 and was reconstructed into a commercial building in 2000. A petrol filling station had been at the ground floor of the building since the factory building was occupied. Another factory building located immediately north of the Tai Kok Tsui Centre had been occupied since early 1974.

Review of the 1980 survey map revealed that there was ex-shipyard operation located at the south of Chui Yu Road opposite to the Tung Chow Street Park. It is located at more than 200m to the northeast of the KSL alignment and has been redeveloped into residential premises.

10.2.3.3 *Others*

The available historical information also indicates that the potential of land contamination caused from accidental spillage or change of land use is unlikely. There is no record indicating the presence of incineration facilities, burn pits or facilities that utilizes high temperature along the proposed alignment.

10.3 Site Inspection

A site inspection was conducted on 24 June 2002 to obtain more information regarding the current industrial activities, and to confirm potentially contaminated sampling locations for the intrusive site investigation. All land lots/ sites within a distance of 300m from the boundary of the alignment have been inspected.

The landuses along Canton Road are mainly commercial buildings and hotels. The TST Fire Station comprises of four wings in a Z shape with a 14 storey residential block. Petrol and diesel filling facilities are provided in the Fire Station. The area between the TST Fire Station and the Canton Road Government Office is an open space currently occupied by HyD and car/coach parking facilities.

The West Kowloon Reclamation Area is mainly an unoccupied land with newly constructed residential and commercial developments.

In Tai Kok Tsui, most buildings are residential in the vicinity of the alignment. The petrol filling station still exists at the ground level of Skyway House. The factory building next to the petrol filling station has been converted to commercial and trading uses with only general mechanical repairs at the ground level, which is paved with concrete.

10.4 Potential Impacts

The potential land contamination areas are described below.

10.4.1 *Along Canton Road*

Canton Road has been developed from past industrial activities to commercial use (e.g. hotel and office etc.) for more than 20 years. The extensive amount of utilities works (e.g. cabling, gas work, road maintenance, etc.) carried out along Canton Road over the years has diminished the possibility of having contaminated soil in the top fill material which is only about 5m thick.

10.4.2 *TST Fire Station to Canton Road Government Office*

Information of the underground oil storage tanks inside TST Fire Station has been provided by the Fire Services Department (FSD). There are two underground tanks located near the shower room block at approximately 60m to the west of the alignment, one for storage of diesel and the other for petrol. The volume of each tank is approximately 4.55m^3. The tanks have been used for more than 30 years and there is no record on previous spillage or leakage of fuel into the soils and groundwater. Since bored tunnelling will be adopted along this section for the tunnels, potential impacts on workers during the construction phase is possible, if contaminated soil is present.

The ex-dockyard site at West Kowloon Reclamation, between the Canton Road Government Offices and TST Fire Station, has been an open space since the 1980s. Potential impacts on workers are possible if contaminated soil is present.

The ex-government maintenance workshop located at the waterfront of the Canton Road Government Office had been operated for more than 20 years before reclamation. It may have possible residual marine deposits that could be contaminated.

10.4.3 *West Kowloon Reclamation Area*

Latest geological information suggests that there are still marine deposits in this area. Depending on the quality of the marine deposit, different disposal methods would be required. A sediment Quality Report has been prepared to summarise the chemical test results for marine deposits at various drillhole locations [10-5]. A detailed description on the quantity and quality of the marine sediment that need to be disposed of is given in **Chapter 9**. Locations of the marine sediment that require confined marine disposal is given in **Figure 9-2-1** for information.

10.4.4 *Tai Kok Tsui*

The petrol filling station located at Skyway House is approximately 50m from the KSL alignment. According to the information provided by the filling station operator, the filling station had been operated since 1982. There are two underground tanks located at the basement level, one for storage of unleaded gasoline and the other for diesel. The volume of each tank is approximately 22.75m^3. The tanks are supported on a concrete base with no direct contact between the tanks and the tanks' storage rooms. Information on previous spillage or leakage of diesel fuel is not available.

Although the factory building next to Skyway House is now a commercial and trading premise, it has been an industrial building since 1974. Information on the industrial activities at that period of time is not available. However, typical industrial activities would include garment, machinery manufacturing, printing and publishing. These activities may pose potential contamination issues.

The ex-shipyard operation, at approximately 200m from the alignment, opposite to Tung Chow Street Park has been changed to a residential development. It may have possible residual marine deposits contamination.

10.5 Contamination Assessment Plan

The CAPs have specified the requirements on the following aspects:

- Sampling locations
- Depth of sampling points
- Sampling methodology for soil and groundwater
- Sample size and handling criteria
- Analytical parameters & methodology
- Quality control

The draft CAP was submitted to February 2003 and has been agreed-in-principle by EPD. The updated CAP based on the current design is shown in **Appendix 10-1**.

10.6 Site Investigation

Site investigation works were carried out between 29 October 2002 and 28 February 2003 by the GI Contractor. Five drillholes proposed in the CAP were excavated and drilled for soil and groundwater sampling. The exact locations and depths for sampling are determined by the on-site Contamination Specialist to suit condition and constraints during the investigation. All soil and groundwater samples were analysed by a HOKLAS accredited laboratory for all parameters listed in the CAP. A Contamination Assessment Report has been prepared to summarise the entire contamination assessment programme, investigation procedures and methodologies, the analytical results of soil and groundwater samples, the scope of any remedial work required, and the particular health and safety requirement that may be required during the works. The Contamination Assessment Report and Remediation Action Plan have been prepared and attached in **Appendix 10-2**.

10.7 Assessment Criteria

The results of soil analysis were compared to the Dutch "B" Values as given in ProPECC Note PN3/94"[10-2] which have been adopted as the remediation target in most cases in HKSAR. However, there is no criterion for dioxins and furans (i.e. Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF)). The USPEA criterion of 1ppb TEQ (1ng/g, Toxicity Equivalent Unit) is therefore adopted as the assessment criterion. This criterion has been used as the remediation target for residential sites in USA and in another approved EIA study [10-6].

10.8 Interpretation of Results

A total of 33 soil samples have been collected from 5 drillholes. All the soil samples collected are within the vertical excavation extent for KSL construction. Results indicate that all soil samples are below the Dutch B levels except 1 soil sample collected from KSD100/DHE063 (see **Figure 10-1**), of which the lead concentration exceeded the Dutch B level but within the Dutch C level (Table 10-1). The analytical results for all soil samples are detailed in **Appendix 10-2**.

Table 10-1 : Summary of soil samples exceeding Dutch B Level

Drillhole reference	Depth	Contaminant	Concentration (mg/kg dry soil)	Dutch B Limit (mg/kg dry soil)	Dutch C Limit (mg/kg dry soil)	Exceedance
KSD100/DHE063	1.5m	Lead	220	150	600	> B and < C

The nature and distribution of the contaminated soil samples indicate that contamination is present at discrete hotspot. The finding is supported by the pattern of landuse on this site, which involved ex-dockyard of the Marine Department and typhoon shelter. Analytical results suggest that contamination is not spatially continuous, and is generally limited in depth.

However, it is Government policy that soils containing contaminants exceeding the Dutch B Levels should be remediated. Details of the soil remediation method and the disposal criteria of the contaminated soils are described in Section 10.9.

10.9 Soil Remediation and Disposal

Details of the soil remediation options are given in **Appendix 10-2**. A summary is given below.

- Only a small quantity of 39m^3 of soil (1.0 - 2.0m below ground level) has been contaminated by Lead at drillhole KSD100/DHE063 (**Figure 10-1**);

- Remediation options (including excavation and landfill disposal, solidification and stabilisation, soil-washing, and physical separation) have been investigated with respect to their associated advantages and disadvantages;
- Landfill disposal has been recommended, and the contaminated soil has been tested to be acceptable for landfill disposal in accordance with the TCLP testing (Table 10-4); and
- Specifications for the remedial works (including disposal methodology, requirements for compliance testing, and the need for protective and safety measures) are given in **Appendix 10-2**.

Table 10-4 : TCLP testing results for KSD100/DHE063 at 1.5m

Parameters	TCLP testing results (ppm)	TCLP limit (ppm)
Cadmium	<1	10
Chromium	<1	50
Copper	<2	250
Nickel	<1.5	250
Lead	12	50
Zinc	<10	250
Mercury	<1	1
Tin	<2	250
Silver	<2	50
Antimony	<2	150
Arsenic	<2.5	50
Beryllium	<1	10
Thallium	<0.08	50
Vanadium	<4	250
Selenium	<1	1
Barium	<2	1000

10.10 Recommendations

The remediation area for contaminated soil should be clearly marked out on site and excavated to an extent of 3.5m radius from the sample location. Excavation should be undertaken by dedicated earth-moving plant.

The overlaying uncontaminated material should be removed and stockpiled adjacent to the excavation until the specified depth is reached. The excavated contaminated soils should not be stockpiled on site, but should immediately be loaded onto trucks and taken to the chosen landfill site. All trucks carrying contaminated material should be adequately covered by sheets to prevent dispersion of contamination.

The remediation contractor should have a valid discharge licence from EPD where applicable and should carry out the remediation works in accordance with all relevant legislative requirements and EPD's Guidance Note.

The remediation programme should be supervised by the on-site Geotechnical Engineer (to be appointed by the Contractor) with at least 7 years experience in contamination assessment or decontamination. All relevant method statements prepared by the remediation contractor should be reviewed and approved by the Decontamination Specialist before proceeding with the works.

Should the event of the soil contamination following excavation be more extensive than envisaged by the CAP, CAR, RAP, a confirmatory testing will be carried out as follows:

- A confirmatory testing will be carried out following excavation at each location, in order to confirm that all contaminated material has been removed.
- The confirmatory testing will consist of five samples in each location, situated immediately to the north, south, east and west of each location, and at the base of the excavation.
- If the results of analysis are less than the Dutch B Levels, no further excavation will be required.
- If the concentrations exceed the Dutch B Level, the area of excavation should be extended, and further confirmatory testing should be carried out following this excavation. In such case, the area of excavation should be extended by a further 5m radius in the quadrant where the contaminated sample is encountered, or by a further 0.5m depth if the contaminated sample is from the base of the excavation. This procedure should be followed until no further contamination is encountered.

10.11 Conclusions

A land contamination assessment has been conducted for the project. Historical information such as site geological information, ground condition, aerial photos has been reviewed.

Five locations have been selected for soil analysis. Results indicate that only one soil sample (i.e. KSD100/DHE063 at ex-government dockyard at Canton Road Government Office) needs to be remediated. A total volume of $39m^3$ (i.e. 0.5m – 1.5m with a 7m diameter) is required to be disposed of at the landfill as a last resort after consideration of other remediation options. The remediation action plan and specification for remediation works are detailed in the Contamination Assessment Report.

11. LANDSCAPE AND VISUAL IMPACT ASSESSMENT

This section of the report outlines the landscape and visual impacts associated with KSL in accordance with the EIAO. Impacts during both construction and operational phases are assessed. The assessment includes:

- A listing of the relevant environmental legislation and guidelines;
- A definition of the scope and contents of the study, including a description of the assessment methodology;
- A qualitative review of the four alignment options considered for the KSL, together with a review of the findings of the previous study [11-1] & [11-2] and Project Proposal prepared by KCRC.
- A review of the relevant planning and development control framework;
- A review of comments on landscape and visual issues received during previous consultation with the public and/or advisory bodies and how these have been addressed in the design;
- A baseline study providing a comprehensive and accurate description of the baseline landscape and visual character;
- Recommendation of appropriate mitigation measures and associated implementation programmes;
- Identification of the potential landscape and visual impacts and prediction of their magnitude and potential significance, before and after the mitigation measures; and
- An assessment of the acceptability or otherwise of the predicted residual impacts, according to the five criteria set out in Annex 10 of the TM-EIA.
- All potential impacts and proposed mitigation measures are clearly mapped in colour and illustrated with clear annotation and cross-referencing between text, tables and illustrations. Colour photographs showing baseline conditions, and photomontages and illustrative materials supporting conclusions are provided and the locations of all viewpoints are clearly mapped. Photomontages at representative locations provide comparison between existing views; proposals on day 1 after completion without mitigation; on day 1 after mitigation, and in year 10 after mitigation.

11.1 Environmental Legislation and Guidelines

The following legislation, standards and guidelines are applicable to the evaluation of landscape and visual impacts associated with the construction and operation of the project:

- Environmental Impact Assessment Ordinance, Cap.499. S.16 [11-3] (EIAO) and the Technical Memorandum on EIA Process (TM-EIA) [11-4];
- Town Planning Ordinance (Cap. 131) [11-5];
- Kowloon Planning Area No. 1 -Tsim Sha Tsui Draft Outline Zoning Plan (OZP) No. S/K1/18 dated 17th October 2003 [11-6];
- Kowloon Planning Area No. 20 -South West Kowloon Draft Outline Zoning Plan (OZP) No. S/K20/15 dated 26th March 2004 [11-7];

- Shatin Draft Outline Zoning Plan (OZP) No. S/ST/19 dated 16th Jan 2004 [11-25];
- Draft Kowloon Planning Area 20 - South West Kowloon (Central Section) Outline Development Plan No. D/K20B/C [11-8];
- Draft Kowloon Planning Area 20 - South West Kowloon (Southern Section) Outline Development Plan No. D/K20C/B [11-9];
- EIAO Guidance Note 8/2002 [11-10];
- Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187) [11-11];
- Hong Kong Planning Standards and Guidelines [11-12] Chapter 10, 'Conservation';
- Hong Kong Planning Standards and Guidelines [11-12] Chapter 4, 'Open Space';
- Hong Kong Planning Standards and Guidelines [11-12] Chapter 11, 'Urban Design Guidelines';
- WBTC No. 25/92 – Allocation of Space for Urban Street Trees [11-13];
- Works Branch Technical Circular WBTC No. 25/93, Control of Visual Impact of Slopes [11-14];
- WBTC No. 30/2001 – Capital Works or Maintenance Works (including Tree Planting) Within or Adjacent to the Kowloon Canton Railway (Hong Kong) Section [11-16];
- ETWBTC No. 7/2002 – Tree Planting in Public Works [11-17];
- ETWBTC No. 14/2002 - Management and Maintenance of Natural Vegetation and Landscape Works and Tree Preservation [11-18];
- ETWBTC No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features [11-26];
- Lands Administration Office Instruction Section D12 - Tree Preservation [11-19];
- HYDTC 10/2001 – Visibility of Directional Signs [11-20];
- GEO publication (1999) – Use of Vegetation as Surface Protection on Slopes [11-21];
- GEO Publication No.1/2000 – Technical Guidelines on Landscape Treatment and Bio-engineering of Man-made Slopes and Retaining Walls [11-22];
- SILTech Publication (1991) – Tree Planting and Maintenance in Hong Kong (Standing Interdepartmental Landscape Technical Group) [11-23]; and
- Urban Council Publication (Chinese Language Edition 1998) - Champion Trees in Urban Hong Kong [11-24].

11.2 Scope and Content of the Study

11.2.1 *Project Overview*

The rationale for the selection of the Canton Road corridor as the preferred alignment is described and illustrated in **Chapter 3**.

The scope of the work, construction methodologies and works sites and works areas for the selected alignment are described in detail, and illustrated with figures in **Chapter 4**.

In addition to the works described in chapter 4, the proposed airborne noise mitigation measures identified in **Chapter 6** would include temporary noise barriers / enclosures to be erected at selected locations along the cut and cover section. These will typically be 3-4m tall and placed close to the noise sources of individual construction plant items, within the contractors works areas. They will be moved around within the contractors works areas as construction progresses, to suit the locations of particular noise generation activities.

11.2.2 *Limits of the Study Area*

The limit of the landscape impact study is 100m from the works limit of the Project. The limits of the visual impact studies are the Zones of Visual Influence (ZVIs) of KSL during the construction and operational phases.

11.2.3 *Assessment Methodology – Landscape Impacts*

Landscape impacts have been assessed separately for the construction and operational phases of the proposed scheme. The assessment involves the following procedures:

11.2.3.1 *Identification of the baseline landscape resources (physical & cultural) and landscape character within the study area*

This is achieved by site visit and desk-top study of topographical maps, information databases and photographs (including tree survey information). The identification of potential impacts are based upon the review of the engineering scheme design and construction methods, which have been superimposed over the baseine resources, and detailed tree survey plans.

11.2.3.2 *Assessment of the degree of sensitivity to change of the landscape resources / character areas*

This is influenced by a number of factors including whether the resource / character is common or rare, whether it is considered to be of local, regional, national or global importance, whether there are any statutory or regulatory limitations/ requirements relating to the resource / character, the quality of the resource / character, the maturity of the resource, and the ability of the resource / character to accommodate change. The sensitivity of each landscape feature and character unit is classified as follows:

High:	Important landscape or landscape resource of particularly distinctive character or high importance, sensitive to relatively small changes
Medium:	Landscape or landscape resource of moderately valued landscape characteristics reasonably tolerant to change
Low:	Landscape or landscape resource, the nature of which is largely tolerant to change

11.2.3.3 *Identification of potential sources of landscape impacts*

These are the various elements of the construction works and operational procedures that would generate landscape impacts.

11.2.3.4 *Identification of the magnitude of landscape impacts*

The magnitude of the impact depends on a number of factors including the physical extent of the impact, the landscape and visual context of the impact, the compatibility of the project with the surrounding landscape, and the time-scale of the impact - i.e. whether it is temporary (short, medium or long term), permanent but potentially reversible, or permanent and irreversible. Landscape impacts have been quantified wherever possible.

The magnitude of landscape impacts is classified as follows:

Large:	The landscape or landscape resource would suffer a major change
Intermediate:	The landscape or landscape resource would suffer a moderate change
Small:	The landscape or landscape resource would suffer slight or barely perceptible changes
Negligible:	The landscape or landscape resource would suffer no discernible change.

11.2.3.5 *Identification of potential landscape mitigation measures*

These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise adverse impacts; remedial measures such as colour and textural treatment of building features; and compensatory measures such as the implementation of landscape design measures (e.g. tree planting, creation of new open space etc) to compensate for unavoidable adverse impacts and to attempt to generate potentially beneficial long term impacts. A programme for the mitigation measures has been provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures have been identified and their approval-in-principle will be sought.

11.2.3.6 *Prediction of the significance of landscape impacts before and after the implementation of the mitigation measures.*

By synthesising the magnitude of the various impacts and the sensitivity of the various landscape resources, it is possible to categorise impacts in a logical, well-reasoned and consistent fashion. Table 11-1 shows the rationale for dividing the degree of significance into four thresholds, namely insubstantial, slight, moderate, and substantial depending on the combination of a negligible-small-intermediate-large magnitude of impact and a low-medium-high degree of sensitivity of landscape resource or character. The significant thresholds are defined as follows:

Substantial:	Adverse/ beneficial impact where the proposal would cause significant deterioration or improvement in existing landscape quality
Moderate:	Adverse/ beneficial impact where the proposal would cause a noticeable deterioration or improvement in existing landscape quality
Slight:	Adverse/ beneficial impact where the proposal would cause a barely perceptible deterioration or improvement in existing landscape quality
Insubstantial:	No discernible change in the existing landscape quality

Table 11-1 : Relationship between receptor sensitivity and impact magnitude in defining impact significance

Magnitude of Impact	Low	Medium	High
Large	Slight*/ Moderate	Moderate/ Substantial	Substantial
Intermediate	Slight/ Moderate	Moderate	Moderate/ Substantial
Small	Insubstantial/ Slight	Slight/ Moderate	Slight*/ Moderate
Negligible	Insubstantial	Insubstantial	Insubstantial

Receptor Sensitivity
(Landscape Resource, Landscape Character Area or VSR)

*In these instances, "slight" impact significance will only be applied in special situations with justifications, in order to avoid underestimation of the impact.

11.2.3.7 *Prediction of Acceptability of Impacts*

An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the TM-EIAO.

In addition, the following points should be made with regard to the methodology of the assessment:

- It is assumed that funding, implementation, management and maintenance of the mitigation proposals can be satisfactorily resolved according to the principles in WBTC 14/2002 [11-18]. All mitigation proposals in this report are practical and achievable within the known parameters of funding, implementation, management and maintenance. The suggested agents for the funding and implementation (and subsequent management and maintenance, if applicable) are indicated in Tables 11-2, 11-3, 11-5 and 11-6. Approval-in-principle to the implementation, management and maintenance of the proposed mitigation measures has been sought from the appropriate authorities.
- It is assumed that the planned open spaces along the alignment will not be built until after the commissioning of KSL, and thus these open spaces will not be impacted during the construction phase of KSL.

11.2.4 *Assessment Methodology – Visual Impacts*

Visual impacts have been assessed separately for the construction and operational phases the project. The assessment of visual impacts involves the following procedures:

11.2.4.1 *Identification of the Zones of Visual Influence during the construction and operational phases of the project*

This is achieved by site visit and desk-top study of topographic maps and photographs, and preparation of cross-sections to determine visibility of the project from various locations.

11.2.4.2 *Identification of the Visually Sensitive Receivers (VSRs) within the ZVIs at construction and operational phases*

These are the people who would reside within, work within, play within, or travel through, the ZVIs.

11.2.4.3 *Identification of potential sources of visual impacts*

These are the various elements of the construction works and operational procedures that would generate visual impacts.

11.2.4.4 *Assessment of the degree of sensitivity to change of the VSRs*

Factors considered include:

- The type of VSRs, which is classified according to whether the person is at home, at work, at play, or travelling. Those who view the impact from their homes are considered to be highly sensitive as the attractiveness or otherwise of the outlook from their home will have a substantial effect on their perception of the quality and acceptability of their home environment and their general quality of life. Those who view the impact from their workplace are considered to be only moderately sensitive as the attractiveness or otherwise of the outlook will have a less important, although still material, effect on their perception of their quality of life. The degree to which this applies depends on whether the workplace is industrial, retail or commercial. Those who view the impact whilst

taking part in an outdoor leisure activity may display varying sensitivity depending on the type of leisure activity. Those who view the impact whilst travelling on a public thoroughfare will also display varying sensitivity depending on the speed of travel.

- Other factors which may be considered (as required by EIAO GN 8/2002 [11-10]) include the value and quality of existing views, the availability and amenity of alternative views, the duration or frequency of view, and the degree of visibility.

The sensitivity of VSRs is classified as follows:

High:	The VSR is highly sensitive to any change in their viewing experience
Medium:	The VSR is moderately sensitive to any change in their viewing experience
Low:	The VSR is only slightly sensitive to any change in their viewing experience

11.2.4.5 *Identification of the relative numbers of VSRs*

This is expressed in terms of whether there are very few, few, many or very many VSRs in any one category of VSR.

11.2.4.6 *Assessment of the potential magnitude of visual impacts.*

Factors considered include:

- Compatibility with the surrounding landscape;
- Duration of the impact;
- Reversibility of the impact;
- Scale of the impact and distance of the source of impact from the viewer; and
- Degree of visibility of the impact, and the degree to which the impact dominates the field of vision of the viewer.

The magnitude of visual impacts are classified as follows:

Large:	The VSRs would suffer a major change in their viewing experience;
Intermediate	The VSRs would suffer a moderate change in their viewing experience;
Small:	The VSRs would suffer a small change in their viewing experience;
Negligible:	The VSRs would suffer no discernible change in their viewing experience.

11.2.4.7 *Identification of potential visual mitigation measures*

These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise adverse impacts; remedial measures such as colour and textural treatment of building features; and compensatory measures such as the implementation of landscape design measures (e.g. tree planting, creation of new open space etc) to compensate for unavoidable adverse impacts and to attempt to generate potentially beneficial long term impacts. A programme for the mitigation measures is provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are identified and their approval-in-principle has been sought.

11.2.4.8 *Prediction of the significance of visual impacts before and after the implementation of the mitigation measures*

By synthesising the magnitude of the various visual impacts and the sensitivity of the VSRs, and the numbers of VSRs that are affected, it is possible to categorise the degree of significance of the

impacts in a logical, well-reasoned and consistent fashion. Table 11-1 shows the rationale for dividing the degree of significance into four thresholds, namely, insubstantial, slight, moderate and substantial, depending on the combination of a negligible-small-intermediate-large magnitude of impact and a low-medium-high degree of sensitivity of VSRs. Consideration is also given to the relative numbers of affected VSRs in predicting the final impact significance - exceptionally low or high numbers of VSRs may change the result that might otherwise be concluded from Table 11-1. The significance of the visual impacts is categorised as follows:

Substantial:	Adverse / beneficial impact where the proposal would cause significant deterioration or improvement in existing visual quality
Moderate:	Adverse / beneficial impact where the proposal would cause a noticeable deterioration or improvement in existing visual quality
Slight:	Adverse / beneficial impact where the proposal would cause a barely perceptible deterioration or improvement in existing visual quality
Insubstantial:	No discernible change in the existing visual quality

11.2.4.9 *Prediction of Acceptability of Impacts*

An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the TM-EIAO.

In addition, the following points should be made with regard to the methodology of the assessment:

- It is assumed that funding, implementation, management and maintenance of the mitigation proposals can be satisfactorily resolved according to the principles in WBTC 14/2002. All mitigation proposals in this report are practical and achievable within the known parameters of funding, implementation, management and maintenance. The suggested agents for the funding and implementation (and subsequent management and maintenance, if applicable) are indicated in Tables 11-2, 11-3, 11-5 and 11-6. Approval-in-principle to the implementation, management and maintenance of the proposed mitigation measures has been sought from the appropriate authorities.
- It is assumed that the planned open spaces along the alignment will not be built until after the commissioning of KSL, and thus these open spaces will not be impacted during the construction phase of KSL.

11.3 Planning and Development Control Framework and Public Consultation

11.3.1 *Review of Planning and Development Control Framework*

A review has been undertaken of the current planning goals and objectives, statutory land-use and landscape planning designations for the Study Area.

The statutory designations for the Study Area are shown on the Kowloon Planning Area No.1 – TST Outline Zoning Plan (OZP) No. S/K1/18 dated 17th October 2003 [11-6]; the Kowloon Planning Area No.20 - South West Kowloon OZP No. S/K20/15 dated 26th March 2004 [11-7]; and the Shatin Draft Outline Zoning Plan (OZP) No. S/ST/19 dated 16 January 2004 [11-25] (**Figures 11-3-1 to 11-3-3**). (The Shatin OZP is included due to the need to extend KCRC's tenancy of the existing temporary works area at Shek Mun for the duration of the KSL construction period.)

The non-statutory draft Kowloon Planning Area 20 – South West Kowloon (Central Section) Outline Development Plan No. D/K20B/C[11-7] and draft Kowloon Planning Area 20 – South

West Kowloon (Southern Section) Outline Development Plan No. D/K20C/B[11-8] illustrate the latest intentions of the Government.

The proposed West Kowloon Arts and Cultural District is currently zoned as "Other Specified uses" designated for Arts, Cultural, Commercial and Entertainment uses. It is proposed to be an arts, commercial and entertainment district with distinguished identity, capable of achieving a critical mass and supported by a range of mixed use development (including office, retail, residential, hotel and GIC facilities). The Government has invited developers to submit proposals. The selected developer will be invited to develop the entire area, tentatively scheduled for the first phase of development by early 2010.

Whilst it is predicted in this chapter that there will be large temporary impacts to existing open spaces, street trees and amenity areas, the permanent impact will be small and localised. The predicted permanent impact on open space comprises:

- Permanent loss of a small area (approximately 300sq.m.) of public open space at the corner of Canton Road and Kowloon Park Drive.

The permanent loss of this public open space will be partially mitigated by the provision of an attractive public streetscape area in front of the West Kowloon Station building (at least 400sq.m.), with shade tree planting and adequate seating facilities (mitigation measure OM13 in Table 11-3).

There will be no impact on the use of the existing and planned open spaces above the rail reserve. There will be no restriction on the construction of pergolas, pavilions, store rooms and toilet blocks or other structures normally incorporated in open spaces, nor will there be any restriction on tree planting in the open spaces above the rail reserve.

There will also be no impact on existing mature trees in the site of the Former Marine Police Headquarters as a result of the KSL construction or operation.

On this basis, it is considered that KSL railway proposal would be in general accordance with the landscape planning goals and objectives for the study area.

Nevertheless, the KSL must be very carefully designed to minimise any potentially adverse landscape and visual impacts on the environment, particularly during the construction period.

11.3.2 *Public Consultation*

There have been a number of public consultations on KSL since 2002, with the following parties:

- Kowloon City DC (November 2002);
- Shamshuipo DC (June and July 2003);
- Yau Tsim Mong DC (June 2003);
- local hoteliers (August 2003); and
- Tsim Sha Tsui Area Committee (August 2003).

The only specific comment on landscape and visual issues raised during these consultations has been comment by Shamshuipo DC on the impacts on Nam Cheong Park. KCRC have agreed with the Shamshuipo DC that the planting works scheduled to be undertaken by KCRC at the end of the West Rail construction contract will instead be undertaken at the end of the KSL construction contract, so as to minimise abortive planting work and save costs. Furthermore, at Shamshuipo DC request, KCRC have agreed to provide a toilet block to a quality suitable for

long term use as part of the permanent reinstatement works at Nam Cheong Park (this is referenced later in this chapter in mitigation measure OM5 in Table 11-3).

11.4 Baseline Study

A baseline review has been undertaken of the landscape resources, landscape character areas, zones of visual influence, and visually sensitive receivers. The findings of the baseline review are presented in **Appendix 11-1**.

A detailed tree survey has been undertaken within the proposed scheme gazettal boundary. A copy of the survey is provided in **Appendix 11-2**. The findings from the tree survey augment the findings of the review of the landscape resources presented in **Appendix 11-1**. The findings of the Tree Survey also assist in the quantification of impacts on existing trees, as described later in this chapter. The Tree Survey has identified which existing trees are considered to be of high amenity value, according to normally accepted criteria, which are described in the Tree Survey methodology.

11.5 Landscape Impact Assessment

11.5.1 *Potential Sources of Landscape and Visual Impacts*

The nature and extent of the works, works sites, works areas and the construction methodologies are described in detail in **Chapter 4**. For ease of reference, the extent of works at ground level, including all contractors' temporary works areas, are shown on all the plans illustrating landscape and visual impacts in this Section.

Sources of Landscape and Visual Impacts in the Construction Phase will include:-

- site clearance works involving the removal of existing vegetation;
- construction of site accesses;
- excavation works for the cut-&-cover tunnels and station works;
- extensive stockpiling of excavated materials;
- haulage off-site of excavated materials;
- stockpiling of building materials;
- temporary traffic/road diversions;
- importation and storage of construction equipment and plant;
- movable temporary noise barriers / enclosures, 3-4m high, which will be moved around within the contractors' works areas to suit the location of noise generation activities as site work progresses;
- the laying down of utilities, including water, drainage and power;
- barging facilities;
- contractor's temporary works areas, including site accommodation and parking areas;
- use of the existing KCRC temporary works area at Shek Mun for an extended period from the completion of MOS Rail to the completion of the KSL;

- construction of station and entrances at WKN;
- construction of above ground features such as vent shafts, E&M plant a short interface tunnel and principal fire-fighting access points; and
- night lighting.

Sources of Landscape and Visual Impacts during operational phase will include:-

- EEP at Canton Road;
- YMT Vent Building;
- Canton Road Plant Building
- Above ground station, entrances and associated facilities at WKN including the fresh-water cooling facility;
- Footbridge Link between WKN and existing footbridge FB14; and
- Residual impacts from loss of trees during the construction phase.

The minimising of potential landscape and visual impacts has been a very important factor in the development of the project design. During project design development, the physical extent of the works have been reduced as far as possible so as to minimise impacts on existing trees and open spaces, and to minimise the degree of visual impact. There are three areas of public open space that will be affected by the temporary and permanent works. The following explanatory statements are provided to explain the necessity of the works which affect these public open spaces:

- **Nam Cheong Park (LR43)**. The temporary works area that will temporarily alienate part (approximately 12,000 sq.m.) of Nam Cheong Park is required for the cut-&-cover construction of the tunnel which will connect with the WR at NAM Station. The works area proposed for the KSL is currently being used as a works area under the KCRC West Rail Project (Contract CC403), and the proposed works area for KSL will not take any more land than is currently occupied by West Rail. Public consultation has been undertaken with Shamshuipo DC on the temporary works area within Nam Cheong Park, as described above in section 11.3.2.
- Public Landscape Areas of the HKCC / HKSM / Hong Kong Museum of Art Complex (LR6). The temporary works area which will temporarily alienate part (approximately 2,000sq.m) of Salisbury Garden is required for two reasons. Initially to construct a temporary subway to replace the existing subway that must be rebuilt as part of the scheme. Several alternatives to the temporary subway, including a temporary footbridge across Salisbury Road, have been investigated although the temporary subway is considered to be the scheme with least impact to the public during construction. The second reason for the works area is that this section of works is particularly complicated. Working space is severely restricted by traffic lanes, the pedestrian subway through the site, extensive major utilities, and the MTR tunnels beneath. It is particularly important to provide backup space near the site if extensive delays are to be avoided and construction risk is to be minimised. The Salisbury Gardens site is the only available location where such a works area could be established in this area. Without this site there will be

significant risk of prolonged disruption in this area. The size of the works area has now been reduced since the draft EIA to minimise the extent of impact on the waterfront and surrounding facilities.

- Public Open Space at corner of Canton Road and Kowloon Park Drive (LR54). The Canton Road Plant Building that will permanently alienate approximately 300sq.m. of public open space at the corner of Kowloon Park Drive and Canton Road will house an Emergency Evacuation stair and an Emergency Access Stair and Lift. This building is essential to the safety strategy for the KSL south section. The building also houses stair pressurisation and fire suppression facilities which are essential features of such a building. The footprint occupied by the building has been reduced to an absolute minimum. The location of the building is dictated by physical constraints on all sides: the rail tunnels to the west; the foundations of the Kowloon Park Drive flyover to the north and east; and the China HK Centre building to the south. In addition maximum clearance has been provided to the China HK Centre building in order to provide sufficient space for evacuating passengers in the event of a tunnel emergency. Taking into consideration all of these constraints means that the space left around the building is too small to permit reprovision of public open space. However, the appearance of the building will be softened by climbing plants and also there will be sufficient space to plant some compensatory trees and tall shrubs in locations where they will not block traffic sightlines (mitigation measure OM12 in Table 11-3). In addition, the permanent loss of public open space will be partially mitigated by the provision of an attractive public streetscape area in front of the West Kowloon Station building (at least 400sq.m.)with shade planting and adequate seating facilities (mitigation measure OM13 in Table 11-3).

11.5.2 *Nature and Magnitude of Landscape Change Before Mitigation in Construction Phase*

The magnitude of the impacts, before implementation of mitigation measures, on the landscape resources and landscape character areas that would occur in the construction phase are described below and tabulated in Table 11-4. Only those resources and character areas that are impacted are listed. All impacts are adverse unless otherwise stated. There are no impacts on any Champion trees in the Landscape Study Area. The distribution of impacts upon existng trees (including trees with high amenity value) is shown on **Figure 11.5.1.**

LR6: Public Landscape Areas of the HKCC / HKSM / Hong Kong Museum of Art Complex.
There would be a large change to Salisbury Garden due to the temporary contractors / RSS site offices and temporary traffic arrangements that would temporarily alienate approximately 2,000 m^2 of public landscape area.

LR7: Trees within the HKCC / HKSM / Hong Kong Museum of Art complex.
There would be impact on approximately 32 trees, of which 9 have a high amenity value. However, most of the trees are capable of being transplanted.

LR8: Trees/ Planting along Salisbury Road.
There would be impact on approximately 17 street trees (of which approximately 4 have a high amenity value) due to the cut-&-cover construction techniques and temporary traffic arrangements. However, most of the trees are capable of being transplanted.

LR16: Trees along Canton Road (From Salisbury Road to Kowloon Park Drive)
There would be impact on approximately 12 semi-mature street trees (none of which have a high amenity value) along Canton Road, caused by cut-&-cover construction techniques and temporary traffic arrangements. All of these trees are capable of being transplanted.

LR25: Trees along Canton Road (From China Hong Kong City to Austin Road)
There would be impact on approximately 36 trees (of which approximately 7 have a high amenity value) caused by cut-&-cover construction techniques associated with WKN station and temporary traffic arrangements along Canton Road. Some of these trees are capable of being transplanted.

LR26: Trees at WKCD Development Area north of Canton Road Fire Station
There would be impact on approximately 11 trees (of which approximately 1 has a high amenity value) caused by cut-&-cover construction of the tunnel which bisects this site.

LR31: Trees along Wui Cheung Road
There would be impact on approximately 41 young/ semi-mature trees along Wui Cheung Road and approximately 7 young/ semi-mature trees along the southern boundary within the City Golf Club, caused by cut-&-cover construction of the tunnel and works for WKN Station at this section of the route. In addition, the works area A3 occupies a large area to the west of the proposed alignment. This will affect an additional 30 trees. Most of these trees are capable of being transplanted. Approximately 10 of the affected trees are high amenity value.

LR32: Trees/ Planting at Bus Station on Wui Cheung Road
There would be impact on approximately 70 trees (of which approximately 10 have a high amenity value) in this area, caused by cut-&-cover construction of the tunnel and works for WKN Station entrance construction and associated works areas. In addition there would be construction impact on approximately 7 young/ semi-mature trees located within the adjacent golf driving range, adjacent to the bus station, on the eastern boundary. Most of these trees are capable of being transplanted.

LR33: Trees along Jordan Road
There would be impact on approximately 110 trees (of which approximately 15 have a high amenity value) caused by the cut-&-cover construction techniques within the works area for the main tunnel. Further construction impact will affect approximately 20 trees during the construction of modified subways at the j/o Ferry Street and Jordan Road. Most of these trees are capable of being transplanted.

LR35: Existing Trees at the Planned Local Open Space at Man Wui Street
There would be impact on approximately 8 young / semi-mature trees (of which approximately 2 have a high amenity value) caused by cut-&-cover construction techniques within the works area for the main tunnel and the temporary dismantling of the footbridge/ ramp on the northern side of Jordan Road. Most of these trees are capable of being transplanted.

LR40: Trees/ Vegetation at the Planned District Open Space west of Man Cheong Street
There would be impact on approximately 25 trees (of which none have a high amenity value). The tunnel alignment bisects the site with works area occupying the remainder of site unaffected by cut-&-cover construction techniques. Most of these trees are capable of being transplanted.

LR43: Nam Cheong Park Temporary Public Open Space
There will be impact on Nam Cheong Park as an area of approximately 12,000 m^2 of it will be occupied for works area. In addition, an area of the park will be required for the cut-&-cover construction of the tunnel which will connect with the WR at NAM Station. The works area proposed for the KSL is currently being used as a works area under the KCRC West Rail Project (Contract CC403).

LR44: Trees within the Nam Cheong Park Temporary Public Open Space
There would be impact on approximately 7 recently planted trees (of which none have a high amenity value) within the park as a result of cut-&-cover construction of the main tunnel and the location of the works area within the Park. This area is also planned to receive new tree planting as part of the mitigation measures implemented under the KCRC West Rail Project (Contract CC403). However, agreement has been reached between KCRC, LCSD and DLO to postpone the planned tree planting within this area of the park to prevent abortive tree planting and unnecessary tree impacts by the KSL project. The mitigation planting will instead be undertaken as part of the mitigation measures implemented under the KSL project (as part of mitigation measure OM5 in table 11-3).

LR45: Vegetation along West Kowloon Highway corridor
There would be some impact on grassland and approximately 700 young trees (of which approximately 4 have a high amenity value, and approximately 125 are 'undersized') caused by cut-&-cover construction techniques and stockpiling of excavated materials along the section from Cherry Street to NAM Station. Most of these trees are capable of being transplanted.

LR46: Topsoil in all planted areas
There would be impact on all the soil in the above mentioned areas.

LR52: Temporary Landscape at West Kowloon Cultural District
There would be impact on a small portion of the temporary landscape area due to the proposed barging point, however no trees are affected.

LR53: Landscape Forecourt of Olympian City 2 Development
There would be large temporary impact on approximately 3,500 sq.m. of the forecourt due to construction access to Cherry street culvert, utilities and drainage diversions, temporary storage area, and temporary traffic management. There would be impact on approximately 60 trees (of which approximately 25 have a high amenity value). Most of the trees are capable of being transplanted.

LR54: Public Open Space at Corner of Canton Road and Kowloon Park Drive
The whole open space will be affected by the construction of the Canton Road Plant Building which will occupy most of the area currently occupied by the open space. All 12 trees (of which 6 are of high amenity value) will be affected. All are capable of transplanting, although the largest trees will suffer some loss of form and amenity value during the transplanting process.

In addition to the above impacts on landscape Resources, there would be large magnitude of change on landscape character areas LCA2, LCA3, LCA15, LCA19, LCA20, LCA21, LCA24, LCA26, LCA28 and LCA30 due to the excavation works, temporary works areas, extensive stockpiling of excavated materials, temporary traffic diversions and associated impacts on trees as described above.

There would be intermediate magnitude of change on landscape character areas LCA17 due to impacts on street trees, and LCA29 due to utilities diversions in front of Olympian City 2 development.

There would be small magnitude of change on landscape character area LCA8 due to construction activity in the road carriageways.

There would be small magnitude of change on landscape character area LCA31 due to the extended use of the existing KCRC temporary Works Area at Shek Mun, rather than handing the site back to Government at the end of the MOS Rail construction period, as a hydroseeded grass area awaiting future development by others.

There would be negligible magnitude of change on all the remaining landscape character areas.

11.5.3 *Nature and Magnitude of Landscape Change Before Mitigation in Operational Phase*

The magnitude of the change, before implementation of mitigation measures, on the landscape resources that would occur in the operational phase would be the same as the impacts described above for construction phase impacts. The impacts are tabulated in Table 11-4.

The magnitude of the change, before implementation of mitigation measures, on the landscape character areas that would occur in the operational phase are described below and tabulated in Table 11-4.

There would be intermediate magnitude of change, before mitigation, on the following landscape character areas:

- LCA15 due to the Canton Road Plant Building and the residual effect of loss of trees during construction stage;
- LCA17 due to the residual effect of loss of trees during construction stage;
- LCA28 due to residual effect of loss of trees during construction stage;
- LCA30 due to the residual impacts on the landform and trees in Nam Cheong Park.

There would be small magnitude of change on the following landscape character areas:

- LCA2, LCA3, LCA20, and LCA24 due to residual effects of the loss of trees during the construction phase;
- LCA26 due to YMT Vent Building and residual effect of loss of trees during construction stage.

There would be negligible magnitude of impact on all the remaining landscape character areas.

11.5.4 *Recommended Landscape and Mitigation Measures in Construction and Operational Phases*

The proposed landscape mitigation measures in the construction and operational phases are listed in Tables 11-2 and 11-3 below, together with an indication of Funding, Implementation, Management and Maintenance agencies. The mitigation measures are illustrated in **Figures 11-5-11 to 11-5-23.**

Table 11-2 : Proposed construction phase landscape mitigation measures

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency
CM1	The construction area and contractor's temporary works areas shall be minimised to avoid impacts on adjacent landscape. Existing trees within contractor's temporary works areas shall be retained and protected where practical(see also CM5 and CM6).	KCRC	KCRC
CM2	Regular checks shall be carried out to ensure that the work site boundaries are not transgressed, hoardings are properly maintained and that no damage is being caused to the surrounding landscape areas.	KCRC	KCRC

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency
CM3	Topsoil, where identified, shall be stripped and stored for re-use in the construction of the soft landscape works, where practical. The Contract Specifications shall include for identification, storage and reuse of topsoil as appropriate. Under the Specification, the Contractor shall be required to identify at the commencement of the contract any existing topsoil for preservation, storage and re-use, for comment and approval by the Engineer.	KCRC	KCRC
CM4	The potential for soil erosion shall be reduced by minimising the extent of vegetation disturbance on site and by providing a protective cover (e.g. plastic sheeting or a grass cover established by hydroseeding) over newly exposed soil.	KCRC	KCRC
CM5	All works shall be carefully designed to minimise impacts on existing trees. All retained trees shall be recorded photographically at the commencement of the contract, and carefully protected during construction by fencing them off from the rest of the works. A detailed Tree Protection Specification shall be provided in the Contract Specifications. Under this specification, the Contractor shall be required to submit, for approval, a detailed Working Method Statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas. The project proponent shall review the site works in order to maximize the preservation of the trees of high amenity value in situ. A total of no more than 1200 trees shall be affected (i.e. felled or transplanted) by the works, of which no more than 105 shall be of high amenity value.	KCRC	KCRC
CM6	The project proponent shall maximize the transplantation of trees of high amenity value if preservation in situ is not feasible. A detailed Tree Transplanting Specification shall be provided in the Contract Specifications, if applicable. Sufficient time for necessary tree root and crown preparation periods prior to moving the trees shall be allowed in the project programme. Precise numbers of trees to be retained, transplanted and felled shall be determined and agreed separately with Government during the Tree Felling Application process under ETWBTC 14/2002. (See also OM2 and OM3). However, a minimum of 80% of the affected trees of high amenity value shall be transplanted. Destination locations for the transplants and arrangement for transplantation shall be resolved and agreed with relevant department in advance. Potential destination locations include: • Roadside landscape areas in West Kowloon; • Vacant lots in West Kowloon zoned for development as public open space; and • Existing public open spaces. If potential destination locations cannot be found by the time the trees are removed from site, they will be located to a holding nursery until destination locations are found. If no locations outside the project area can be found, they will be stored in the holding nursery for the duration of the contract and transplanted back into the project area at the end of the project.	KCRC	KCRC
CM7	Large temporary stockpiles of excavated material shall be covered with visually unobtrusive sheeting (in subdued 'camouflage' colour tone) to prevent dust and dirt spreading to adjacent landscape areas and vegetation, and to create a neat and tidy visual appearance.	KCRC	KCRC

Table 11-3 : Proposed operational phase landscape mitigation measures

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency	Management Agency*	Maintenance Agency*
OM1	Not used.				

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency	Management Agency*	Maintenance Agency*
OM2	Compensatory tree planting shall be incorporated along all roadside amenity areas affected by the construction works. Required numbers and locations of compensatory trees shall be determined and agreed with Government during the Tree Felling Application process under ETWBTC14/2002.	KCRC	KCRC	HyD	LCSD
OM3	Compensatory tree planting shall be incorporated into any public open spaces affected by the construction works. Required numbers and locations of compensatory trees shall be determined and agreed with Government during the Tree Felling Application process under ETWBTC14/2002.	KCRC	KCRC	LCSD	LCSD
OM4	The total number of compensatory trees planted in the project area, for OM2 and OM3 combined, shall be not less than 130% of the number of affected trees. (Compensatory trees may be either new trees, or existing trees that are transplanted to a holding nursery and then back to the project area). Compensatory trees shall be at least heavy standard size, unless planting is on a slope, in which case tree size will be the largest practical size given technical restrictions due to slope angle. Semi-mature size trees shall be used where appropriate at sensitive and prominent locations (e.g. Salisbury Garden).	KCRC	KCRC	HyD or LCSD	LCSD
OM5	Sensitive design and reprovision of the affected areas of Nam Cheong Park incorporating replacement facilities for those provided at present, using materials of a quality suitable for long term use and acceptable to relevant Government departments, plus provision of a new toilet block.	KCRC	KCRC	LCSD	LCSD/ ArchSD (hard landscape works)
OM6	Reinstatement of levels at planned open spaces allowing adequate structural loading for future flexibility in open space design, particularly for landform, earth mounding, typical park structures (pergolas, pavilions, store rooms, toilet blocks etc.) and tree planting works (requiring a minimum soil depth of 1.5m).	KCRC	KCRC	-	-
OM7	Reinstatement of works areas to former condition, subject to applicable Government standards.	KCRC	KCRC	-	-
OM8	Attractive streetscape design shall be incorporated at all station entrances areas and above ground structures, including the provision of tree planting where space permits. All streetscape areas and hard and soft landscape areas disturbed during construction shall be reinstated to equal or better quality, to the satisfaction of the relevant Government departments.	KCRC	KCRC	HyD	HyD / LCSD

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency	Management Agency*	Maintenance Agency*
OM9	All above ground structures, including Station Entrances, Vent Shafts, Emergency and Firemen's' Accesses etc shall be sensitively designed in a manner that responds to the existing and planned urban context, which may include soft landscape measures, to minimise the potential adverse landscape and visual impacts.	KCRC	KCRC	KCRC within KCRC boundary, elsewhere HyD	KCRC within KCRC boundary, elsewhere LCSD
OM13	Creation of attractive public streetscape area in front of West Kowloon Station (at least 400sq.m.), with shade trees in paving and adequate seating facilities, as partial mitigation for the permanent alienation of public open space at corner of Canton Road and Kowloon Park Drive	KCRC	KCRC	KCRC within KCRC boundary, elsewhere HyD	KCRC within KCRC boundary, elsewhere LCSD

Note:
*Management and Maintenance Agencies are identified as per ETWBTC 2/2004[11-25]
**Agreement and approval, including precise delineation of boundaries, etc., of the implementation, management and maintenance agencies of the project will be sought from all relevant authorities during the detail design stages of the project.

11.5.4.1 *Programme of Implementation of Landscape Mitigation Measures*

The construction phase landscape mitigation measures listed in Table 11-2 above should be adopted from the commencement of construction and should be in place throughout the entire construction period.

The operational phase landscape mitigation measures listed in Table 11-3 above should be adopted during the detailed design and be built as part of the main construction works so that they are in place at the date of commissioning of the railway. However, it should be noted that the full effect of the soft landscape mitigation measures would not be appreciated for another several years.

11.5.5 *Prediction of Significance of Landscape Impacts*

The potential significance of the landscape impacts during the construction and operational phases, before and after mitigation, are provided below in Table 11-4. Only those resources that are impacted are listed in Table 11-4 – resources not impacted are not listed in the Table.

The landscape impacts for the construction and operational phases after mitigation are mapped in **Figures 11-5-1 to 11-5-5**. This assessment follows the stated methodology and assumes that the appropriate mitigation measures identified in Tables 11-2 and 11-3 above would be implemented, and that the full effect of the soft landscape mitigation measures would be realised after ten years. Photomontages of the proposed development are presented in **Figures 11-5-31 to 11-5-44**.

11.5.5.1 *Construction Phase Landscape Impacts*

Residual impacts on landscape resources in the construction phase are mapped in **Figure 11-5-1**. Residual impacts on landscape character areas in the construction phase are mapped in **Figures 11-5-3 and 11-5-4** and listed below.

Residual adverse landscape impacts of substantial significance in the construction phase that will be experienced by the landscape resources and landscape character zones are listed below. These impacts are indicated in the Table 11-4.

- **LR6**: Public Landscape Area at the Cultural Centre/ Space Museum/ Hong Kong Museum of Art complex
- **LR43:** Nam Cheong Park Temporary Public Open Space
- **LR53:** Landscape Forecourt at Olympian City 2 development
- **LCA2**: Salisbury Road Character Area
- **LCA3**: TST Promenade Area
- **LCA15:** Canton Road (Southern section) Character Area
- **LCA30:** Nam Cheong Park Character Area.
- **LR54:** Public Open Space at Corner of Canton Road and Kowloon Park Drive

Residual adverse impacts of moderate significance in the construction phase that will be experienced by the landscape resources and landscape character areas are listed below.

- **LR7**: Trees within Cultural Centre/ Space Museum/ Hong Kong Museum of Art complex
- **LR16:** Trees along Canton Road (From Salisbury Road to Kowloon Park Drive)
- **LR25:** Trees along Canton Road (From China Hong Kong City to Austin Road)
- **LR31**: Trees along Wui Cheung Road.
- **LR40**: Trees/ Vegetation at the Planned District Open Space west of Man Cheong Street
- **LR45**: Vegetation along West Kowloon Highway corridor
- **LCA19**: West Kowloon Reclamation Character Area
- **LCA20:** Wui Cheung Road Character Area.
- **LCA21:** City Golf Club Character Area
- **LCA23:** Wui Cheung/ Austin Road West Character Area.
- **LCA24:** Jordan Road Character Area.
- **LCA28**: West Kowloon Highway Character Area
- **LCA29**: Olympian City High Rise Residential/ Commercial Character Area

All other residual adverse impacts in the construction phase will be of slight or insubstantial significance.

11.5.5.2 *Operational Phase Landscape Impacts*

Residual landscape impacts on landscape resources in the operational phase are mapped in **Figure 11-5-2**. Residual landscape impacts on landscape character areas in the operational phase are mapped in **Figure 11-5-5** and listed below.

All residual adverse landscape impacts in the operational phase will be of insubstantial significance, with the exception of the impacts on the Public Open Space at the corner of Canton Road and Kowloon Park Drive (LR54), where an adverse impact of moderate significance is anticipated due to the permanent alienation of approximately 300sq.m. of public open space and 12 trees (including 6 of high amenity value) due to the proposed Canton Road Plant Building.

Table 11-4 : Significance of landscape impacts in the construction and operational Phases (Note: All impacts adverse unless otherwise noted. Only those resources or character areas that are impacted are listed in the table – resources not impacted are not listed.)

Id. No.	Landscape Resource / Landscape Character	Sensitivity to Change (Low, Medium, High)	Magnitude of Change before Mitigation (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
								Construction	Operation	
			Construction	Operation	Construction	Operation			DAY 1	YEAR 10
Part 1 – Physical Landscape Resources (Topography, Vegetation, Soil, Open Space, Special Features, etc)										
LR6	Public Landscape Area at the Cultural Centre/ Space Museum/ Hong Kong Museum of Art complex	High	Large	Small	Substantial	Moderate	CM2,CM5, OM3,	Substantial	Slight	Insubstantial
LR7	Trees within the Cultural Centre/ Space Museum/ Hong Kong Museum of Art complex	High	Large	Large	Substantial	Substantial	CM2,CM5, OM3	Moderate	Slight	Insubstantial
LR8	Trees/ Planting along Salisbury Road	Medium	Large	Small	Moderate	Moderate	CM2,CM5, OM2	Moderate	Slight	Insubstantial
LR16	Trees along Canton Road (from Salisbury Road to Kowloon Park Drive)	High	Large	Large	Substantial	Substantial	CM1,CM2,CM5, CM6,OM2,OM8	Moderate	Slight	Insubstantial
LR25	Trees along Canton Road (from China Hong Kong City to Austin Road)	High	Large	Large	Substantial	Substantial	CM1, CM2, CM5, CM6, OM2	Moderate	Slight	Insubstantial
LR26	Trees at WKCD Development Area north of Canton Road Fire Station	High	Intermediate	Intermediate	Moderate	Moderate	CM1, CM2, CM5, CM6, OM7	Moderate	Slight	Insubstantial
LR31	Trees along Wui Cheung Road	Medium	Intermediate	Intermediate	Moderate	Moderate	CM1, CM2, CM3, CM5, CM6, OM2, OM7	Moderate	Slight	Insubstantial
LR32	Trees / Planting at Bus Station on Wui Cheung Road	Medium	Large	Large	Moderate	Moderate	CM1, CM2, CM3, CM5, CM6, OM7, OM8	Moderate	Slight	Insubstantial
LR33	Trees along Jordan Road	Medium	Intermediate	Intermediate	Moderate	Moderate	CM1, CM2, CM3, CM5, CM6, OM2, OM8	Moderate	Slight	Insubstantial
LR35	Trees at the Planned Local Open Space at Man Wui Street	Medium	Small	Small	Slight	Slight	CM1, CM2, CM3, CM4, CM6, OM3, OM7, OM8	Slight	Slight	Insubstantial

Id. No.	Landscape Resource / Landscape Character	Sensitivity to Change (Low, Medium, High)	Magnitude of Change before Mitigation (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
								Construction	Operation	
			Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LR40	Trees/ vegetation at the Planned District Open Space west of at Man Cheong Street	Low	Large	Large	Moderate	Moderate	CM1, CM2, CM3, CM4, CM5, CM6, OM7	Moderate	Slight	Insubstantial
LR43	Nam Cheong Park Temporary Open Space	High	Large	Large	Substantial	Substantial	CM1,CM2, OM5	Substantial	Slight	Insubstantial
LR44	Trees in Nam Cheong Park Temporary Open Space	Medium	Small	Small	Slight	Slight	CM1, CM2, CM3, CM4, CM5, CM6, OM3, OM5, OM6	Slight	Insubstantial	Insubstantial
LR45	Vegetation along West Kowloon Highway corridor	Medium	Large	Large	Substantial	Moderate	CM1,CM2,CM3,CM4, CM5,CM6, ,OM2, OM7	Moderate	Slight	Insubstantial
LR46	Topsoil in all planted areas	Low	Intermediate	Intermediate	Slight	Slight	CM3	Slight	Insubstantial	Insubstantial
LR52	Temporary landscape at WKCD	Low	Small	Small	Slight	Slight	CM1, CM2, CM3, CM4, CM5, CM6, OM3, OM5, OM6	Insubstantial	Insubstantial	Insubstantial
LR53	Landscape Forecourt of Olympian City 2 Development	High	Large	Large	Substantial	Substantial	CM1,CM2,CM3, CM5,CM6, OM2, OM3, OM6, OM7, OM8	Substantial	Slight	Insubstantial
LR54	Public Open Space at Corner of Canton Road and Kowloon Park Drive	High	Large	Large	Substantial	Substantial	OM8, OM9	Substantial	Moderate	Moderate
Part 2 – Landscape Character Areas										
LCA2	Salisbury Road Character Area	High	Large	Small	Substantial	Slight	CM1,CM2,CM5, CM6, OM2	Substantial	Slight	Insubstantial
LCA3	TST Waterfront Area	High	Large	Small	Substantial	Slight	CM1,CM2,CM3,CM5, CM6, OM3	Substantial	Slight	Insubstantial
LCA8	Kowloon Park Drive Character Area	Medium	Small	Negligible	Slight	Insubstantial	CM1,CM2,CM5, CM6, OM2	Slight	Insubstantial	Insubstantial
LCA15	Canton Road (Southern section) Character Area	High	Large	Intermediate	Substantial	Moderate	CM1, CM2, CM3, CM4, CM5, CM6, OM2, OM8,	Substantial	Slight	Insubstantial
LCA17	Canton Road (Northern section) Character Area	Medium	Intermediate	Intermediate	Slight	Moderate	CM1, CM2, CM3, CM4, OM5, CM6, CM7, OM2	Moderate	Slight	Insubstantial
LCA19	West Kowloon Reclamation Character Area	Construction – Low Operation – High	Large	Negligible	Moderate	Insubstantial	CM1, CM2, CM3, CM4, CM5, CM6, CM7, OM7	Moderate	Insubstantial	Insubstantial

Id. No.	Landscape Resource / Landscape Character	Sensitivity to Change (Low, Medium, High)	Magnitude of Change before Mitigation (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
								Construction	Operation	
			Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LCA20	Wui Cheung Road Character Area	Medium	Large	Small	Moderate	Slight	CM1, CM2, CM3, CM4, CM5, CM6, CM7, OM2, OM3	Moderate	Slight	Insubstantial
LCA21	City Golf Club Character Area	Low	Large	Negligible	Moderate	Insubstantial	CM1, CM2, CM3, CM4, CM5,CM6, CM7, OM7, OM9	Moderate	Insubstantial	Insubstantial
LCA24	Jordan Road Character Area	Medium	Large	Small	Moderate	Slight	CM1, CM2, CM3, CM4, CM5, CM6, CM7, OM3, OM8, OM9	Moderate	Slight	Insubstantial
LCA26	Lai Cheung / Sham Mong Road Character Area	Medium	Large	Small	Moderate	Slight	CM1, CM2, CM3, CM4, CM5, CM6, CM7, OM3, OM8, OM9	Moderate	Slight	Insubstantial
LCA28	West Kowloon Highway Character Area	Low	Large	Intermediate	Moderate	Slight	CM1, CM2, CM3, CM4, CM5, CM6, CM7, OM7, OM9	Moderate	Slight	Insubstantial
LCA29	Olympian City High Rise Residential/ Commercial Character Area.	High	Intermediate	Small	Moderate	Slight	CM1, CM2, CM3, CM5, CM6, , OM2, OM3, OM6, OM7, OM8	Moderate	Slight	Insubstantial
LCA30	Nam Cheong Park Character Area	High	Large	Intermediate	Substantial	Moderate	CM1, CM2, CM3, CM4, CM5, CM6, CM7, OM3, OM5, OM7	Substantial	Slight	Insubstantial
LCA31	Shek Mun Landscape Character Area	Medium	Small	N/A	Slight	N/A	CM1	Slight	N/A	N/A

.

11.6 Visual Impact Assessment

11.6.1 *Potential Sources of Visual Impacts*

The potential sources of landscape and visual impacts are described above in section 11.5.1.

11.6.2 *Visual Mitigation Measures*

The proposed visual mitigation measures in the construction and operational phases are summarised in Tables 11-5 and 11-6 below, together with an indication of Funding, Implementation, Management and Maintenance agencies. The mitigation measures are illustrated in **Figures 11-5-11 to 11-5-23.**

Table 11-5 : Proposed construction phase visual mitigation measures

ID No.	Visual Mitigation Measure	Funding Agency	Implementation Agency
CM1	The construction area and contractor's temporary works areas shall be minimised to avoid impacts on adjacent landscape. Existing trees within contractor's temporary works areas should be retained and protected where practical (see also CM5 and CM6).	KCRC	KCRC
CM2	Regular checks shall be carried out to ensure that the work site boundaries are not transgressed, hoardings are properly maintained and that no damage is being caused to the surrounding landscape areas.	KCRC	KCRC
CM4	The potential for soil erosion shall be reduced by minimising the extent of vegetation disturbance on site and by providing a protective cover (e.g. plastic sheeting or a grass cover established by hydroseeding) over newly exposed soil.	KCRC	KCRC
CM7	Large temporary stockpiles of excavated material shall be covered with visually unobtrusive sheeting (in subdued 'camouflage' colour tone) to prevent dust and dirt spreading to adjacent landscape areas and vegetation, and to create a neat and tidy visual appearance.	KCRC	KCRC
CM8	Control night lighting and prevent glare to surrounding VSRs by directing all security lighting downward into works sites and works areas.	KCRC	KCRC
CM9	Clean & tidy hoardings shall be provided. Good site practice will be adopted by the contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period.	KCRC	KCRC
CM10	Temporary noise barriers shall be designed to minimise adverse visual impacts on adjacent VSRs	KCRC	KCRC

Table 11-6 : Proposed operational phase visual mitigation measures

ID No.	Visual Mitigation Measure	Funding Agency	Implementation Agency	Management Agency	Maintenance Agency
OM1	Not used				
OM2	Compensatory tree planting shall be incorporated along all roadside amenity areas affected by the construction works. Required numbers and locations of compensatory trees shall be determined and agreed with Government during the Tree Felling Application process under ETWBTC14/2002.	KCRC	KCRC	HyD	LCSD

ID No.	Visual Mitigation Measure	Funding Agency	Implementation Agency	Management Agency	Maintenance Agency
OM3	Compensatory tree planting shall be incorporated into any public open spaces affected by the construction works. Required numbers and locations of compensatory trees shall be determined and agreed with Government during the Tree Felling Application process under ETWBTC14/2002.	KCRC	KCRC	LCSD	LCSD
OM4	The total number of compensatory trees planted in the project area, for OM2 and OM3 combined, shall be not less than 130% of the number of affected trees. (Compensatory trees may be either new trees, or existing trees that are transplanted to a holding nursery and then back to the project area). Compensatory trees shall be at least heavy standard size, unless planting is on a slope, in which case tree size will be the largest practical size given technical restrictions due to slope angle. Semi-mature size trees shall be used where appropriate at sensitive and prominent locations (e.g. Salisbury Garden).	KCRC	KCRC	HyD or LCSD	LCSD
OM5	Sensitive design and reprovision of the affected areas of Nam Cheong Park incorporating replacement facilities for those provided at present, using materials of a quality suitable for long term use and acceptable to relevant Government departments, plus provision of a new toilet block.	KCRC	KCRC	LCSD	LCSD/ ArchSD (hard landscape works)
OM6	Reinstatement of levels at planned open spaces allowing adequate structural loading for future flexibility in open space design, particularly for landform. earth mounding, typical park structures (pergolas, pavilions, store rooms, toilet blocks etc.) and tree planting works (requiring a minimum soil depth of 1.5m).	KCRC	KCRC	Not Applicable (No management required)	Not Applicable (No maintenance required)
OM7	Reinstatement of works areas to former condition, subject to applicable Government standards.	KCRC	KCRC	KCRC within KCRC boundary, elsewhere HyD/LandsD/ LCSD/ allocatee department as per ETWBTC 2/2004	KCRC within KCRC boundary, elsewhere HyD/LandsD/ LCSD/ allocatee department as per ETWBTC 2/2004
OM8	Attractive streetscape design shall be incorporated at all station entrances areas and above ground structures, including the provision of tree planting where space permits. All streetscape areas and hard and soft landscape areas disturbed during construction shall be reinstated to equal or better quality, to the satisfaction of the relevant Government departments.	KCRC	KCRC	HyD	HyD / LCSD

ID No.	Visual Mitigation Measure	Funding Agency	Implementation Agency	Management Agency	Maintenance Agency
OM9	All above ground structures, including Station Entrances, Vent Shafts, Emergency and Firemen's' Accesses etc shall be sensitively designed in a manner that responds to the existing and planned urban context, which may include soft landscape measures, to minimise the potential adverse landscape and visual impacts.	KCRC	KCRC	KCRC within KCRC boundary, elsewhere HyD	KCRC within KCRC boundary, elsewhere LCSD
OM10	The Footbridge Link between WKN Station and existing footbridge FB14 shall be designed to the satisfaction of ACABAS.	KCRC	KCRC	HyD	HyD
OM11	Temporary planting shall be implemented along east side of WKN station structure to provide partial screening and to create a more pleasant pedestrian environment prior to any future property development on the sites.	KCRC	KCRC	KCRC	KCRC
OM12	Tall shrubs and climbing plants shall be planted against the face of the Canton Road Plant Building so as to soften building façade. Trees shall also be planted in locations around the building where traffic sightlines permit.	KCRC	KCRC	KCRC within KCRC boundary, elsewhere HyD	KCRC within KCRC boundary, elsewhere LCSD

Note:
*Management and Maintenance Agencies are identified as per ETWBTC 2/2004[11-25]
**Agreement and approval, including precise delineation of boundaries, etc., of the implementation, management and maintenance agencies of the project will be sought from all relevant authorities during the detail design stages of the project.

11.6.2.1 *Programme of Implementation of Visual Mitigation Measures*

The construction phase measures listed above should be adopted from the commencement of construction and should be in place throughout the entire construction period.

The operational phase measures listed above should be adopted during the detailed design, and be built as part of the construction works so that they are in place at the date of commissioning of KSL. However, it should be noted that the full effect of the soft landscape mitigation measures would not be appreciated for another several years.

11.6.3 *Prediction of Significance of Visual Impacts*

An assessment of the potential significance of the visual impacts during the construction and operational phases, before and after mitigation, is briefly described below, and listed in detail in Table 11-7. This follows the proposed methodology and assumes that the appropriate mitigation measures identified in Tables 11-5 and 11-6 above would be implemented, and that the full effect of the soft landscape mitigation measures would be realised after ten years. Photomontages of the proposed development before and after mitigation are illustrated in **Figures 11-5-31 to 11-5-44**.

11.6.3.1 *Construction Phase*

Residual visual impacts in the construction phase are mapped in **Figures 11-5-6 and 11-5-7**. Adverse impacts of substantial significance during the construction phase would be experienced by the VSRs listed below. This primarily because of the cut & cover excavations, extensive stockpiling of excavated materials; temporary works sites and works areas, temporary noise mitigation measures, temporary traffic diversions, the associated removal of trees, either by felling or transplanting, and the obstruction of views arising from hoardings;

C1: Guests and Workers at Regent Hotel and New World Hotel and Shopping Mall

C2: Guests and Workers at Peninsular and Sheraton Hotels

C3: Existing commercial developments along west side of Canton Road (Hotels, Shopping Malls and Offices)

C4: Existing commercial development along south end of east side of Canton Road (Shopping Malls, offices

C14: Commercial Development at No.1 Peking Road and Former Marine Police Headquarters and Old Fire Station

C/R2: Olympian City Development- Site C

GIC1: Visitors and users at Cultural Centre/ Museum of Art/ Space Museum complex and Gardens.

GIC2: YMCA

O11: Existing amenity area at Man Cheong Street

O14: Visitors and Park users at Nam Cheong Park

R1: Planned residential development at the junction of Canton Road and Austin Road

R4: Man Cheong Street

R6: Charming Garden residential development

T1: Pedestrians (including tourists) on Salisbury Road

T3: Pedestrians (including tourists) on Canton Road

Adverse residual visual impacts of moderate significance would be experienced during the construction phase by :-

C7: Existing commercial development along north end of east side of Canton Road (Shopping Malls, offices.

C9: Olympian City Development- Site A

C11: Commercial developments along Peking Road

O1: Visitors and park users at Signal Hill and Middle Road Children's Playground

GIC5: Canton Road Fire Station

R3: Residential developments at Jordan Road

T2: Pedestrians (including tourists) outside Star Ferry Terminal

All other VSRs would suffer either slight adverse or negligible residual visual impacts as noted in Table 11-7.

11.6.3.2 *Operational Phase*

Residual visual impacts in the operational phase are mapped in **Figure 11-5-8**.

After all visual mitigation measures are implemented and have matured over 10 years, there would be no residual adverse visual impacts of any significance.

Table 11-7 : Significance of visual impacts in the construction and operational phases (Note: All impacts adverse unless otherwise noted. Only those VSRs that are impacted are listed in the table – VSRs not impacted are not listed.)

VSR Type & ID.	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, partial, glimpse)	Minimum Distance Between VSR & Source(s) of Impact	Magnitude of Change in View before Mitigation (Negligible, Small, Intermediate, Large)		Receptor Sensitivity (Low, Medium, High)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
											Construction	Operation	
				Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
VSRs in Kowloon													
C1	Guests and workers at Regent Hotel and New World Hotel and shopping mall	Full	200m	Large	Negligible	High	High	Substantial	Insubstantial	CM2,CM8,CM9, OM2	Substantial	Insubstantial	Insubstantial
C2	Guests and workers at Peninsula and Sheraton Hotels	Full	15m	Large	Negligible	High	High	Substantial	Insubstantial	CM2,CM8,CM9, OM2	Substantial	Insubstantial	Insubstantial
C3	Existing commercial developments along west side of Canton Road (Hotels, shopping malls and offices)	Full	5m	Large	Negligible	High	High	Substantial	Insubstantial	CM1,CM2,CM8, CM9, OM2, OM8, OM9	Substantial	Insubstantial	Insubstantial
C4	Existing commercial development along south end of east side of Canton Road (Shopping malls, offices)	Full	5m	Large	Negligible	High	High	Substantial	Insubstantial	CM1,CM2,CM8, CM9, OM2, OM8, OM9	Substantial	Insubstantial	Insubstantial
C7	Existing commercial development along north end of east side of Canton Road (Shopping malls, offices)	Full	5m	Intermediate	Small	High	High	Moderate	Slight	CM2,CM8, CM9, OM2, OM8, OM9	Moderate	Insubstantial	Insubstantial
C9	Olympian City Development – Site A	Full	40m	Small	Negligible	Medium	Medium	Moderate	Insubstantial	CM2,CM8,CM9, OM7	Moderate	Insubstantial	Insubstantial
C11	Commercial Development along Peking Road	Glimpse	130m	Intermediate	Negligible	Medium	Medium	Moderate	Insubstantial	CM2,CM8,CM9, OM4, OM9	Moderate	Insubstantial	Insubstantial

VSR Type & ID.	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, partial, glimpse)	Minimum Distance Between VSR & Source(s) of Impact	Magnitude of Change in View before Mitigation (Negligible, Small, Intermediate, Large)		Receptor Sensitivity (Low, Medium, High)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
											Construction	Operation	
				Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
C14	Commercial Development at No.1 Peking Road & Former Marine Police HQ and Old Fire Station	Full	5m	Intermediate	Small	High	High	Substantial	Slight	CM2,CM8,CM9, OM9	Substantial	Insubstantial	Insubstantial
C/R1	MTRC development	Full	200m	Intermediate	Negligible	High	High	Moderate	Insubstantial	CM2,CM8,CM9, OM8,OM9	Moderate	Insubstantial	Insubstantial
C/R2	Olympian City Development – Site C	Full	50m	Large	Negligible	High	High	Substantial	Insubstantial	CM2,CM8,CM9, OM7	Substantial	Insubstantial	Insubstantial
C/R3	Olympian City Development – Site B	Full	100m	Small	Negligible	High	High	Slight	Insubstantial	CM2,CM8,CM9, OM7	Slight	Insubstantial	Insubstantial
C/R4	Planned C/R development at WKN	Full	5m	N/a	Small	N/A	High	N/A	Slight	OM2, OM7, OM8, OM9, OM10	N/A	Insubstantial	Insubstantial
C/R5	Future West Kowloon Cultural District	Full	50m	N/a	Negligible	N/A	High	N/A	Insubstantial	OM8, OM9	N/A	Insubstantial	Insubstantial
GIC1	Visitors and users at Cultural Centre/Museum of Art/Space Museum complex & gardens	Full	5m	Large	Negligible	High	High	Substantial	Insubstantial	CM2,CM8,CM9, , OM2	Substantial	Insubstantial	Insubstantial
GIC2	YMCA	Full	10m	Large	Negligible	High	High	Substantial	Insubstantial	CM2,CM8,CM9, OM2	Substantial	Insubstantial	Insubstantial
GIC5	Canton Road Fire Station	Full	15m	Large	Negligible	Low	Low	Moderate	Insubstantial	CM1,CM2, CM8,CM9, OM3, OM6, OM7	Moderate	Insubstantial	Insubstantial
GIC6	GIC uses on east side of Canton Road	Full	15m	Negligible	Negligible	Low	Low	Insubstantial	Insubstantial	CM1,CM2, CM8,CM9, OM3, OM6,OM7	Insubstantial	Insubstantial	Insubstantial
GIC7	GIC uses on Bowring Street	Full	150m	Small	Negligible	Low	Low	Slight	Insubstantial	OM2,OM8,OM9	Slight	Insubstantial	Insubstantial
GIC8	Planned GIC uses west of Lin Cheung Road	Full	150m	N/A	Negligible	N/A	Low	N/A	Insubstantial	OM2,OM8,OM9	N/A	Insubstantial	Insubstantial
GIC9	Planned GIC uses on Hoi Wang Road	Full	130m	N/A	Negligible	N/A	Low	N/A	Insubstantial	OM2,OM8,OM9	N/A	Insubstantial	Insubstantial

VSR Type & ID.	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, partial, glimpse)	Minimum Distance Between VSR & Source(s) of Impact	Magnitude of Change in View before Mitigation (Negligible, Small, Intermediate, Large)		Receptor Sensitivity (Low, Medium, High)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
											Construction	Operation	
				Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
GIC10	Planned GIC uses on WKE	Full	30m	N/A	Negligible	N/A	Low	N/A	Insubstantial	CM1,CM2,	N/A	Insubstantial	Insubstantial
GIC11	Planned GIC uses next to Nam Cheong Park	Full	50m	N/A	Negligible	N/A	Low	N/A	Insubstantial	CM1,CM2	N/A	Insubstantial	Insubstantial
GIC13	Planned GIC users along Yan Cheung Road	Full	120m	Large	Negligible	N/A	Low	N/A	Insubstantial	CM1,CM2	N/A	Insubstantial	Insubstantial
I1	Industrial uses in Tai Kok Tsui	Full	50m	Large	Negligible	Low	Low	Slight	Insubstantial	CM1, CM2	Slight	Insubstantial	Insubstantial
O1	Visitors and park users at Signal Hill and Middle Road Children's Playground	Partial	250m	Intermediate	Negligible	High	High	Moderate	Insubstantial	CM1, CM2	Moderate	Insubstantial	Insubstantial
O2	Open Space users along Tsim Sha Tsui Promenade	Glimpse	20m	Negligible	Negligible	High	High	Insubstantial	Insubstantial	CM2,CM8,CM9, OM2	Insubstantial	Insubstantial	Insubstantial
O3	Park users at existing open space at corner of Nathan and Peking Roads	Partial	100m	Small	Negligible	High	High	Slight	Insubstantial	CM2,CM8,CM9, OM2	Slight	Insubstantial	Insubstantial
O8	Visitors and park users at King George IV Park	Partial	150m	Small	Negligible	High	High	Slight	Insubstantial	CM2,CM8,CM9, OM8, OM9	Slight	Insubstantial	Insubstantial
O9	Visitors and park users at planned Local Open Space on Jordan Road (west)	Partial	20m	N/A	Small	N/A	High	N/A	Slight	OM2,OM8,OM9	N/A	Insubstantial	Insubstantial
O10	Visitors and park users at planned District Open Space on Hoi Wang Road	Glimpse	50m	N/A	Negligible	N/A	High	N/A	Insubstantial	OM2,OM8,OM9	N/A	Insubstantial	Insubstantial
O11	Existing amenity area at Man Cheong Street	Full	15m	Large	Negligible	High	High	Substantial	Insubstantial	CM1,CM2, OM2	Substantial	Insubstantial	Insubstantial

VSR Type & ID.	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, partial, glimpse)	Minimum Distance Between VSR & Source(s) of Impact	Magnitude of Change in View before Mitigation (Negligible, Small, Intermediate, Large)		Receptor Sensitivity (Low, Medium, High)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
											Construction	Operation	
				Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
O12	Visitors and park users at planned Local Open Space on Man Cheong Street	Glimpse	500m	N/A	Negligible	N/A	High	N/A	Insubstantial	CM1,CM2 OM2	N/A	Insubstantial	Insubstantial
O13	Visitors and park users at planned Local Open Space on Jordan Road (west of Lin Cheung Road)	Glimpse	250m	N/A	Negligible	N/A	High	N/A	Insubstantial	OM2,OM8, OM2,OM8,OM9	N/A	Insubstantial	Insubstantial
O14	Visitors and park users at Nam Cheong Park	Full	5m	Large	Small	High	High	Substantial	Moderate	CM1,CM2,CM8, CM9,OM5	Substantial	Insubstantial	Insubstantial
R1	Residential development at j/o Canton Road and Austin Road	Full	25m	Large	Negligible	High	High	Substantial	Insubstantial	CM2,CM8,CM9, OM8, OM9	Substantial	Insubstantial	Insubstantial
R2	Existing residential development at j/o Canton Road and Austin Road	Full	150m	Large	Negligible	High	High	Substantial	Insubstantial	CM2,CM8,CM9, OM8, OM9	Substantial	Insubstantial	Insubstantial
R3	Residential development at Jordan Road	Full	30m	Intermediate	Negligible	High	High	Moderate	Insubstantial	CM8,OM8,OM9	Moderate	Insubstantial	Insubstantial
R4	Man Cheong Street	Full	30m	Large	Negligible	High	High	Substantial	Insubstantial	CM2,OM6,OM7 OM8,OM9	Substantial	Insubstantial	Insubstantial
R6	Charming Garden residential development	Full	50m	Large	Small	High	High	Substantial	Slight	CM2,CM8,CM9, OM2	Substantial	Slight	Insubstantial
R7	Olympian City Site D	Glimpse	750m	N/a	Negligible	N/a	High	N/a	Insubstantial	CM2	N/a	Insubstantial	Insubstantial
T1	Pedestrians (including tourists) on Salisbury Road	Full	5m	Large	Negligible	High	High	Substantial	Insubstantial	CM2,CM8,CM9, OM2	Substantial	Insubstantial	Insubstantial
T2	Pedestrians (including tourists) outside Star Ferry Terminal	Partial	120m	Intermediate	Negligible	High	High	Moderate	Insubstantial	CM2,CM8,CM9, OM2	Moderate	Insubstantial	Insubstantial

VSR Type & ID.	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, partial, glimpse)	Minimum Distance Between VSR & Source(s) of Impact	Magnitude of Change in View before Mitigation (Negligible, Small, Intermediate, Large)		Receptor Sensitivity (Low, Medium, High)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
											Construction	Operation	
				Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
T3	Pedestrians (including tourists) on Canton Road	Full	5m	Large	Intermediate	High	High	Substantial	Moderate	CM2,CM8,CM9, OM2,OM8,OM9	Substantial	Insubstantial	Insubstantial
VSRs in Shek Mun													
C13	Commercial Development along Tai Chung Kiu Road	Full	200m	Negligible	N/A	Medium	Medium	Slight	N/A	CM1	Slight	N/A	N/A
GIC12	GIC uses on On Muk Street	Full	15m	Negligible	N/A	Low	Low	Slight	N/A	CM1	Slight	N/A	N/A
O16	Visitors and park users at Open Space on Siu Lek Yuen Road	Full	100m	Negligible	N/A	High	High	Slight	N/A	CM1	Slight	N/A	N/A
OU1	Other Specified Uses on On Muk Street	Full	15m	Negligible	N/A	Medium	Medium	Slight	N/A	CM1	Slight	N/A	N/A
R8	Residential Development on On Muk Street	Full	100m	Negligible	N/A	High	High	Slight	N/A	CM1	Slight	N/A	N/A
R9	City One Shatin Residential Development	Full	300m	Negligible	N/A	High	High	Slight	N/A	CM1	Slight	N/A	N/A
R10	Residential Development on On Muk Street	Full	150m	Negligible	N/A	High	High	Slight	N/A	CM1	Slight	N/A	N/A

* C = Commercial; C/R = Commercial/Residential; GIC = Government/Institution/Community; I = Industrial; O = Open space; OU = Other use; R = Residential; S = Sea-borne travellers; T = Transport related (land).

11.7 CONCLUSIONS

11.7.1 *Summary of Landscape and Visual Mitigation Measures.*

A summary of the proposed landscape and visual mitigation measures for the construction and operation phases of the project are located in Tables 11-8 and 11-9 below.

Table 11-8 : Proposed construction phase landscape and visual mitigation measures

ID No.	Landscape and Visual Mitigation Measure	Funding Agency	Implementation Agency
CM1	The construction area and contractor's temporary works areas shall be minimised to avoid impacts on adjacent landscape. Existing trees within contractor's temporary works areas should be retained and protected where practical (see also CM5 and CM6).	KCRC	KCRC
CM2	Regular checks shall be carried out to ensure that the work site boundaries are not transgressed, hoardings are properly maintained and that no damage is being caused to the surrounding landscape areas.	KCRC	KCRC
CM3	Topsoil, where identified, shall be stripped and stored for re-use in the construction of the soft landscape works, where practical. The Contract Specifications shall include for identification, storage and reuse of topsoil as appropriate. Under the Specification, the Contractor shall be required to identify at the commencement of the contract any existing topsoil for preservation, storage and re-use, for comment and approval by the Engineer.	KCRC	KCRC
CM4	The potential for soil erosion shall be reduced by minimising the extent of vegetation disturbance on site and by providing a protective cover (e.g. plastic sheeting or a grass cover established by hydroseeding) over newly exposed soil.	KCRC	KCRC
CM5	All works shall be carefully designed to minimise impacts on existing trees. All retained trees shall be recorded photographically at the commencement of the contract, and carefully protected during construction by fencing them off from the rest of the works. A detailed Tree Protection Specification shall be provided in the Contract Specifications. Under this specification, the Contractor shall be required to submit, for approval, a detailed Working Method Statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas. The project proponent shall review the site works in order to maximize the preservation of the trees of high amenity value in situ. A total of no more than 1200 trees shall be affected (i.e. felled or transplanted) by the works, of which no more than 105 shall be of high amenity value.	KCRC	KCRC

ID No.	Landscape and Visual Mitigation Measure	Funding Agency	Implementation Agency
CM6	The project proponent shall maximize the transplantation of trees of high amenity value if preservation in situ is not feasible. A detailed Tree Transplanting Specification shall be provided in the Contract Specifications, if applicable. Sufficient time for necessary tree root and crown preparation periods prior to moving the trees shall be allowed in the project programme. Precise numbers of trees to be retained, transplanted and felled shall be determined and agreed separately with Government during the Tree Felling Application process under ETWBTC 14/2002. (See also OM2 and OM3). However, a minimum of 80% of the affected trees of high amenity value shall be transplanted. Destination locations for the transplants and arrangement for transplantation shall be resolved and agreed with relevant department in advance. Potential destination locations include: • Roadside landscape areas in West Kowloon; • Vacant lots in West Kowloon zoned for development as public open space; and • Existing public open spaces. If potential destination locations cannot be found by the time the trees are removed from site, they will be located to a holding nursery until destination locations are found. If no locations outside the project area can be found, they will be stored in the holding nursery for the duration of the contract and transplanted back into the project area at the end of the project.	KCRC	KCRC
CM7	Large temporary stockpiles of excavated material shall be covered with visually unobtrusive sheeting (in subdued 'camouflage' colour tone) to prevent dust and dirt spreading to adjacent landscape areas and vegetation, and to create a neat and tidy visual appearance.	KCRC	KCRC
CM8	Control night lighting and prevent glare to surrounding VSRs by directing all security lighting downward into works sites and works areas.	KCRC	KCRC
CM9	Clean & tidy hoardings shall be provided. Good site practice will be adopted by the contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period.	KCRC	KCRC
CM10	Temporary noise barriers shall be designed to minimise adverse visual impacts on adjacent VSRs	KCRC	KCRC

Table 11-9 : Proposed operational phase landscape and visual mitigation measures

ID No.	Landscape and Visual Mitigation Measure	Funding Agency	Implementation Agency	Management Agency*	Maintenance Agency*
OM1	Not used				
OM2	Compensatory tree planting shall be incorporated along all roadside amenity areas affected by the construction works. Required numbers and locations of compensatory trees shall be determined and agreed with Government during the Tree Felling Application process under ETWBTC14/2002.	KCRC	KCRC	HyD	LCSD
OM3	Compensatory tree planting shall be incorporated into any public open spaces affected by the construction works. Required numbers and locations of compensatory trees shall be determined and agreed with Government during the Tree Felling Application process under ETWBTC14/2002	KCRC	KCRC	LCSD	LCSD

ID No.	Landscape and Visual Mitigation Measure	Funding Agency	Implementation Agency	Management Agency*	Maintenance Agency*
OM4	The total number of compensatory trees planted in the project area, for OM2 and OM3 combined, shall be not less than 130% of the number of affected trees. (Compensatory trees may be either new trees, or existing trees that are transplanted to a holding nursery and then back to the project area). Compensatory trees shall be at least heavy standard size, unless planting is on a slope, in which case tree size will be the largest practical size given technical restrictions due to slope angle. Semi-mature size trees shall be used where appropriate at sensitive and prominent locations (e.g. Salisbury Garden).	KCRC	KCRC	HyD or LCSD	LCSD
OM5	Sensitive design and reprovision of the affected areas of Nam Cheong Park incorporating replacement facilities for those provided at present, using materials of a quality suitable for long term use and acceptable to relevant Government departments, plus provision of a new toilet block..	KCRC	KCRC	LCSD	LCSD/ ArchSD (hard landscape works)
OM6	Reinstatement of levels at planned open spaces allowing adequate structural loading for future flexibility in open space design, particularly for landform, earth mounding, typical park structures (pergolas, pavilions, store rooms, toilet blocks etc.) and tree planting works (requiring a minimum soil depth of 1.5m).	KCRC	KCRC	-	-
OM7	Reinstatement of works areas to former condition, subject to applicable Government standards.	KCRC	KCRC	-	-
OM8	Attractive streetscape design shall be incorporated at all station entrances areas and above ground structures, including the provision of tree planting where space permits. All streetscape areas and hard and soft landscape areas disturbed during construction shall be reinstated to equal or better quality, to the satisfaction of the relevant Government departments.	KCRC	KCRC	HyD	HyD / LCSD
OM9	All above ground structures, including Station Entrances, Vent Shafts, Emergency and Firemen's' Accesses etc shall be sensitively designed in a manner that responds to the existing and planned urban context, which may include soft landscape measures, to minimise the potential adverse landscape and visual impacts.	KCRC	KCRC	KCRC within KCRC boundary, elsewhere HyD	KCRC within KCRC boundary, elsewhere LCSD
OM10	The Footbridge Link between WKN Station and existing footbridge FB14 shall be designed to the satisfaction of ACABAS.	KCRC	KCRC	HyD	HyD
OM11	Temporary planting shall be implemented along east side of WKN station structure to provide partial screening and to create a more pleasant pedestrian environment prior to any future property development on the sites.	KCRC	KCRC	KCRC	KCRC

ID No.	Landscape and Visual Mitigation Measure	Funding Agency	Implementation Agency	Management Agency*	Maintenance Agency*
OM12	Tall shrubs and climbing plants shall be planted against the face of the Canton Road Plant Building so as to soften building façade. Trees shall also be planted in locations around the building where traffic sightlines permit.	KCRC	KCRC	KCRC within KCRC boundary, elsewhere HyD	KCRC within KCRC boundary, elsewhere LCSD
OM13	Creation of attractive public streetscape area in front of West Kowloon Station (at least 400sq.m.), with shade trees in paving and adequate seating facilities, as partial mitigation for the permanent alienation of public open space at corner of Canton Road and Kowloon Park Drive	KCRC	KCRC	KCRC within KCRC boundary, elsewhere HyD	KCRC within KCRC boundary, elsewhere LCSD

Note:
*Management and Maintenance Agencies are identified as per ETWBTC 2/2004[11-25]
**Agreement and approval, including precise delineation of boundaries, etc., of the implementation, management and maintenance agencies of the project will be sought from all relevant authorities during the detail design stages of the project.

11.7.2 *Summary of Predicted Residual Landscape and Visual Impacts in the Construction Phase*

Residual landscape impacts in the construction phase are listed in Table 11-4 and mapped in **Figures 11-5-1, 11-5-3 and 11-5-4**. Residual visual impacts in the construction phase are listed in Table 11-7 and mapped in **Figures 11-5-6 and 11-5-7**.

All the landscape resources in the vicinity of the alignment have been identified, including the Champion trees in the KPDCP and along Haiphong Road. All these Champion trees will be kept intact during both the construction and operational phases of the KSL.

The potentially most significant construction phase residual **landscape** impacts caused by the railway development would be adverse impacts of substantial significance on:

- **Nam Cheong Park Temporary Open Space** (LR43) and **Nam Cheong Park Character Area** (LCA30). This is due to the need to annex a large area of the park (approximately 12,000m^2) for use as a works area. This is to enable the cut and cover construction of the tunnel connection to the existing Nam Cheong Station, which was constructed under the KCRC West Rail project. The works area required for the KSL project has been utilised previously under the West Rail contract for the same purpose. In effect, this area of the park area will remain out of the public domain until the end of the KSL project. However, it should be noted that there will be minimal impact on trees in the park, since tree planting scheduled for this part of the park has been deferred until after the completion of the KSL works.
- **Salisbury Road Character Area** (LCA2), **Tsim Sha Tsui Waterfront Character Area** (LCA3), and the **Public Landscape Area** (LR6) in the Hong Kong Cultural Centre, Space Museum and Museum of Art complex. This is due to the disruption caused by the cut-&-cover tunnel excavation along Salisbury Road, the temporary works area in Salisbury Garden (approximately 2,000m^2) and the associated impacts on trees, streetscape, public open space, the fountain and pedestrian access and entrance to the Space Museum.
- **Canton Road (Southern section) Character Area** (LCA15), an important tourist area in TST, will be disrupted by the temporary mucking out area for the tunnel construction, the construction of the Canton Road Plant Building at the j/o Canton Road and Kowloon Park Drive, the contraction of the Emergency Egress Point near No.1 Peking Road, and the associated temporary traffic diversions.

- **Landscape Forecourt at Olympian City 2 development** (LR53), due to the temporary occupation of the forecourt due to the excavations for utilities and drainage diversions, culvert access, temporary traffic measures and contactor's lay down and storage areas, and the need to remove attractive mature palm trees of high amenity value.
- **Public Open Space at Corner of Canton Road and Kowloon Park Drive** (LR54), due to the permanent loss of approximately 300sq.m. of public open space and 12 trees (of which 6 are of high amenity value) due to the construction of the Canton Road Plant Building.

The potentially most significant construction phase residual **visual** impacts caused by the railway development would be adverse impacts of substantial significance on:

- **Groups of VSRs along Salisbury Road and in Salisbury Garden** due to the cut-&-cover tunnel construction, temporary works area and temporary traffic diversions which will disrupt a key tourist area with hotels, shopping and cultural facilities, and localised visual obstruction arising from the hoardings;
- **Groups of VSRs along Canton Road** due to the temporary mucking out area for the tunnel construction, the construction of the Canton Road Plant Building at the j/o Canton Road and Kowloon Park Drive, the construction of the Emergency Egress Point near No.1 Peking Road, the associated temporary traffic diversions which will disrupt a key tourist area with hotels and shopping facilities, facilities, and localised visual obstruction arising from the hoardings;
- **Groups of VSRs along the cut-&-cover tunnel excavation in West Kowloon and Nam Cheong Park** due to the extensive cut and cover tunnel construction, the stockpile areas and temporary works areas.

This assessment is based on the following assessments of quantified landscape impacts:

- The temporary loss of public open space during the construction phase will not exceed 15,000sq.m.;
- The project proponent shall review the site works in order to maxmize the preservation of the trees of high amenity value in situ. The maximum number of existing trees affected (not counting any new trees planted after the date of this report) will not exceed 1,200, of which not more than 105 will be of high amenity value according to the criteria defined in the tree survey methodology in **Appendix 11-2**. The distribution of affected trees is illustrated in **Figure 11-5-1**;
- There will be no impacts on Champion trees as defined in the LCSD publication;
- There will be no impacts on any trees in the site of the Former Marine Police Headquarters site;
- The project proponent shall maximize the transplantation of trees of high amenity value if preservation in situ is not feasible. A minimum of 80% of the affected trees of high amenity value shall be transplanted.
- The number of compensatory trees planted as part of the mitigation measures shall be at least 130% of the total number of affected trees. The compensatory tree planting shall be at least heavy standard size, unless planting is on a slope, in which case tree size will be the largest practical size given technical restrictions due to slope angle. Semi-mature trees shall be used at sensitive and prominent locations e.g. Salisbury Garden.

11.7.3 *Summary of Predicted Landscape and Visual Impacts in the Operational Phase*

Residual landscape impacts in the Operational Phase are listed in Table 11-4 and mapped in **Figures 11-5-2 and 11-5-5**. Residual visual impacts in the Operational Phase are listed in Table 11-7 and mapped in **Figures 11-5-8**.

After the proposed mitigation measures and have been implemented and the proposed tree planting has matured over 10 years, all residual adverse landscape and visual impacts in the operational phase will be of insubstantial significance, with the exception of the impact on the Public Open Space at the corner of Canton Road and Kowloon Park Drive (LR54), which will be subject to an adverse impact of moderate significance due to the permanent loss of approximately 300sq.m. of public open space and 12 trees (including 6 of high amenity value) due to the proposed Canton Road Plant Building.

This assessment is based on the following assessment of quantified landscape impacts and mitigation measures:

- The permanent loss of public open space in the operation phase will not exceed 400sq.m.;
- The permanent loss of this public open space will be partially mitigated by the provision of an attractive public streetscape area in front of the West Kowloon Station building (at least 400 sq.m.), with shade planting and adequate seating facilities (mitigation measure OM13 in Table 11-3); and
- There will be no further tree impacts in addition to those described for the construction phase in section 11.7.2.

11.7.4 *Conclusion with reference to Annex 10 of the EIAO TM*

With reference to the five criteria defined in Annex 10 of the EIAO TM, it is considered that the landscape and visual impacts in the construction and operation phases are **acceptable with mitigation measures**.

12. CULTURAL HERITAGE IMPACT ASSESSMENT

12.1 Legislation

The Antiquities and Monuments Ordinance (Cap.53) [12-1] was enforced in 1976 to ensure that the best examples of Hong Kong's heritage are protected appropriately.

12.1.1 *The Antiquities and Monuments Ordinance (Cap. 53) Section 3: Declaration of monuments and plans thereof*

1) Subject to section (4), the Authority may, after consultation with the Board and with the approval of the Chief Executive, by notice in the Gazette, declare any place, building, site or structure, which the 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. (Amended 38 of 1982 s. 4. 59 of 2000 s. 3)

2) A declaration under subsection (1) may include as part of a monument any land adjoining the place, building, site or structure required for fencing, covering or protecting the monument or for providing or facilitating access thereto.

3) A notice under subsection (1) shall include a reference to the appropriate plan deposited under subsection (4).

4) The Authority shall, before publication of a declaration under subsection (1)-
   (a) sign and deposit in the appropriate Land Registry a plan clearly showing the situation of the place, building, site or structure intended by the Authority to be declared to be a monument; and (Amended 38 of 1982 s. 4)
   (b) if the declaration relates to a monument within private land, register the declaration in the Land Registry. (Amended 8 of 1993 s. 2)

5) The Authority shall-
   (a) keep available at his office, for public inspection at all reasonable times, a copy of every plan deposited under subsection (4); and
   (b) at the request of the owner or a lawful occupier of a monument which is shown on a plan so deposited, deliver a copy of the plan free of charge to the owner or occupier.

12.1.2 *The Antiquities and Monuments Ordinance (Cap. 53) Section 6: Acts prohibited in relation to certain monuments except under permit*

1) Subject to subsection (4), no person shall-
   (a) excavate, carry on building or other works, plant or fell trees or deposit earth or refuse on or in a proposed monument or monument; or
   (b) demolish, remove, obstruct, deface or interfere with a proposed monument or monument,

   except in accordance with a permit granted by the Authority. (Amended 38 of 1982 s. 7)

2) A person aggrieved by the refusal of the Authority to grant him a permit may, within 14 days after the date of such refusal, appeal by way of petition to the Chief Executive who may confirm, vary or reverse the refusal.

3) The decision of the Chief Executive on the appeal shall be final.

4) The Authority may, after consultation with the Board and with the approval of the Chief Executive, by notice in the Gazette, declare any proposed monument or monument to be exempt from this section. (Amended 38 of 1982 s. 7)

12.1.3 *Environmental Impact Assessment Ordinance*

The EIAO provides additional legislative protection to sites of cultural heritage which are threatened by development and EPD is its authority. The TM-EIA contains the guidelines and criteria for the assessment of sites of cultural heritage interest.

With reference to paragraph 7.3(a) of the TM-EIA, "conditions which would be imposed through other applicable ordinances", (in this case the Antiquities and Monuments Ordinance: Chapter 53) "shall not normally be imposed in Environmental Permit issued under the Environmental Impact Assessment Ordinance". Any archaeological monitoring for implementation under the EIAO can only be applicable to sites that have been identified as sites of cultural heritage.

12.2 Background Information

12.2.1 *Geological and Topographical Background*

The basic geology of the Kowloon Peninsula consists of medium grained granite with some fine granite outcrops. Early maps and photographs show flat, low-lying land behind the beach of TST Bay with a raised area, Kowloon Hill, on the west. An early photograph (**Image A in Figure 12-1-1**) which dates to the 1860's, shows the hill had been modified by cutting (Hacker 1997). At present the top surface of the hill, which is approximately 10 metres in height has been completely levelled.

12.2.2 *Archaeological Background*

12.2.2.1 *Original Coastline and Landforms*

Image B in Figure 12-1-1 shows topography as it was mapped in 1863 (Empson 1992:178). The proposed KSL alignment runs along Canton Road, which may contain pockets of residual soil with archaeological potential, as indicated by borehole data (CEO Library: 15352 and 8407). The alignment may also impact on the original shoreline on the eastern side of the FMPHQ hill. The alignment in these areas is shown in **Image C in Figure 12–1-1**.

12.2.2.2 *Early Reclamations*

Very little is known about the construction methods and technologies of the reclamations dating to the end of the 19th century. **Image D in Figure 12-1-2** shows a sketch of the limits of early reclamations. The proposed railway will impact on areas of early reclamations pre-dating 1904 in TST Bay and along the west side of the Kowloon peninsula, along Canton Road. **Image E in Figure 12-1-2** shows a plan of TST with reclaimed and planned reclamations dating to 1887 (Empson 1992: 179).

12.2.3 *Historical Background*

12.2.3.1 *General*

Early colonial accounts document that, prior to European settlement, TST was not heavily populated, although it did contain villages and Chinese forts, one of which was located on the hill currently occupied by the FMPHQ (Welsh: 1997). The early British occupation was primarily for military purposes, as can be seen in the large portions of the district that were controlled by the War Department at the time, see **Image E in Figure 12-1-2**. Civilian expansion in TST can be seen to have been well established in the early decades of this century, and the progression can still be accessed visually, through collections of historical photographs, for example that collection maintained by the Hong Kong Museum of History and collections published by the museum, e.g. *The Hong Kong Album (A Collection of the Museum's Historical Photographs)* (Lam 1983).

Reclamation was an ongoing activity in TST in the late 19th and early 20th centuries. The KCR Terminus Station was constructed on reclaimed land in the first decade of the last century, the line to the border being opened in 1910 and to Guangzhou 1912 (Welsh 1997). The Peninsula Hotel constructed in 1927 and opened in 1928 (Rodwell 1992) was also situated on land reclaimed from TST Bay.

Aerial photographs from 1949 (GEO Y01584), **Image F in Figure 12-1-2** and 1984 (GEO 56885), **Image G in Figure 12-1-2** clearly show that urban development proceeded rapidly in the decades following the Second World War.

12.2.3.2 *FMPHQ*

The FMPHQ became a Declared Monument on December 23rd 1994 (AMO files). The original portion of the station dates to the 1880's. Additional features were added over the years, including an extra storey to the front section of the station building. The signal tower was also constructed in the 1880's. It is a round house, of similar decorative style to the main station building. The original function of the tower was as a time signal station, from which a time ball was dropped at 1 p.m. each day, so that ships could set their chronometers accurately. It was later used as an exhibit centre by the Marine Police Force (AMO files). It should be noted that the area between the station and signal tower, currently occupied by concrete structures was formerly a landscaped garden (AMO files).

12.2.3.3 *World War II Tunnels*

The compound also contains a number of World War II tunnels. These tunnels date to the Japanese Occupation, during which, the site was used by the Japanese navy. The tunnels were dug by the Japanese as air raid shelters. The tunnels were filled in after the war. Evidence of the tunnels can still be seen in the form of a bricked up portal in the retaining wall along Canton Road.

In the "Study on the Development Opportunities of the Former Marine Police Headquarters Site in TST", Final Report, June 2001", a land gravity survey was carried out as part of the study. The results of this study are as follows:

- Six potential zones of low density underneath the platform were identified;
- A significant void was identified at the south-western corner of the platform;

- A potential tunnel section running from the south western corner of the main building toward the south west was identified;
- A potential tunnel running from the northernmost barrack building to the south east was also identified.

The study also investigated two portals A and B. It is stated in the report that the portals, located along Canton road at street level, are approximately 2m in diameter and probably access two tunnels that run in an east west direction. The tunnels were most likely excavated in decomposing rock stratum, as the rockhead level at the site is for the most part below street level.

The report also refers to a GEO study from 1994 (GEO Advisory Report, ADR 9/94) in which ground investigation works were attempted. It was found that Portal A consisted of a single layer of brick wall and that it was backed by fill material. Portal B was found to consist of 2.9m thick wall. Bricked up entrance and that a fill layer existed behind it. Based on these findings, it was surmised that these two tunnel sections had been backfilled at some point.

A GEO study from 2000 (GEO Preliminary Geotechnical Assessment Report, PGA 5/2000) is also mentioned in the text. The results of it indicated the possible presence of maintenance accesses, a sunken water tank and disused tunnels beneath the main building. A third tunnel opening was also identified on the southern slope of the site facing the OFSB.

It has been inferred (GEO study 2000) that the tunnel network beneath the FMPHQ site consists of two to three sub-parallel east-west trending drives separated by between 40m and 50m.

FMPHQ development is a Designated Project under the EIAO and an EP has been issued (ref EP-184/2004) on February 2004. Liaison with the FMPHQ site developer reveals that the platform in front of the FMPHQ main building will be lowered to approximately the current street level. Some of the tunnels are likely to be removed by the FMPHQ development.

However, under the lease conditions, the developer of FMPHQ is required to excavate, expose and make a full photographic and cartographic record of at least 30m of the disused tunnels beginning from Portal B. The Project Profile of the FMPHQ development also states the developer's commitment to record in photographic and cartographic means the disused tunnels that will be excavated and exposed. The recordings will also be submitted to AMO for record.

12.2.3.4 *The Old Fire Station Buildings*

The station consists of two structures, the main fire station hall (a Grade III building) and the former accommodation block (Part of a Declared Monument). The structures date from the 1920's. The station hall originally consisted of a main garage on the ground floor and accommodation quarters above. Original plans can still be seen in the Public Records Office and in AMO files. The fire station was decommissioned in 1970, when it became a parcel sorting office as part of the post office. It has been used as an exhibition hall and as cultural and arts offices since 1986.

12.2.3.5 *Whitfield Barracks*

The site of the former Whitfield Barracks (established in 1861) is now the location of Kowloon Park. There are four remaining former barracks buildings, two of which served until recently as the ex-Hong Kong Museum of History. They all are Grade III buildings.

The park also contains the former Kowloon West II Battery (a Grade I structure). The battery was constructed during the 19th century and abandoned in 1916, and has been converted into an adventure playground within Kowloon Park.

The park also contains historical retaining walls. An interesting feature located at the south west corner of the southern retaining wall on Haiphong Road is a War Department Boundary Marker. This marker shows the location of the exact southwest corner of the original Whitfield barracks, one of the earliest mapped lots in Kowloon (AMO Files). Tunnels running under the park were constructed by the Hong Kong Government between 1940 and 1941.

12.3 Summary of Railway Design and Construction Methodology

Detailed descriptions of the railway system and construction methodology for various work sites along the proposed alignment are given in **Chapter 4** of this EIA Report and illustrated in **Figures 4-1-1** to **4-1-3**. A summary is given in the following sections.

12.3.1 *Above-Ground Structures*

The current design of the KSL is to have all the tunnels and most of the station facilities underground except some isolated structures as summarised in the following table. None of these structures are along Canton Road and Kowloon Park Drive. **Figures 4-1-1** to **4-1-5** show the locations of these above ground structures**.**

Table 12-1 : Summary of above-ground structures

Above-ground Structure	Location
Emergency escape entrance	Canton Road, south of No 1 Peking Road
Canton Road Plant Building	Junction of Canton Road and Kowloon Park Drive
WKN	West Kowloon
YMT ventilation building	Between YMT Interchange and Cherry Street

12.3.2 *Construction Methodology*

As described in **Chapter 4** and illustrated in **Figures 4-1-1** to **4-1-3**, various construction methods including bored tunnelling, cut-&-cover-and mined tunnelling have been considered for various sections along the alignment.

For the tunnel section underneath FMPHQ, a clear separation of about 6m between the tunnels and the OFSB, and 16m from the Main Building will be maintained. The construction of this short tunnel section would take approximately 1 year within the 3-year construction period of KSL.

Construction methodologies including bored tunnelling and cut-&-cover tunnelling have also been considered for this section of tunnels (see **Chapter 4**). It is concluded that bored tunnelling is not feasible in this section. In addition, using cut-&-cover tunnelling would require temporary dismantling of the OFSB during the construction period and reinstatement afterwards. Since the OFSB is an integral part of the FMPHQ redevelopment, it is also not feasible to use cut-&-cover tunnelling.

Mined tunnelling (drill-and-blast) will therefore be adopted. The access shaft will be located near to the junction of Canton Road and Peking Road. Similar drill-&-blast technique had been adopted during the tunnel construction for East Rail Extension in Hung Hom underneath the

Signal Hill complex in East TST. The EIA Report [12-2] has stated that blasting is tightly controlled under the Mines Division of CEDD. A blasting assessment would be conducted by qualified blasting specialists to recommend necessary control measures to be included in the construction contract. The report concluded that the mitigation measures recommended are adequate to protect the Signal Hill Complex from the proposed drill-&-blast tunnelling work underneath.

12.4 Assessment Methodology

12.4.1 *Archaeological Impact Assessment*

As TST is an urban area a field survey programme was not feasible. Potential areas of archaeological interest were therefore identified and assessed through desk based research. This was achieved through collection of information on geology, geomorphology and topography of the study area (from geological maps, bore hole data, early maps of the area and historical and aerial photographs). Information was also collected on historical land use and any possible structural remains, which may be under the present surface. Data from the previous task was assessed with respect to the planned engineering works.

The study area of the baseline study covers an area that stretches 500m along both sides of the KSL alignment.

12.4.2 *Built Heritage Impact Assessment*

12.4.2.1 *Baseline Study*

The built heritage baseline study requires compiling a comprehensive inventory of structures and man-made landscapes with historical or architectural significance, as well as any structure or man-made landscape constructed prior to 1950. The first task is to undertake a desk-based study using sources such as, publications on local history, architectural, anthropological, archaeological and other cultural studies, such as journals of the Royal Asiatic Society (Hong Kong Branch), archival and historical documents through public libraries, archives and tertiary institutions. If information gathered in the desk-based study is not sufficient to make an impact assessment, an historical buildings and structures survey must be carried out.

12.4.2.2 *Built Heritage Survey*

The objectives of the Built Heritage Survey entail the identification and recording of all heritage resources as required in the Study Brief. The built heritage resources have been surveyed and assessed on an individual basis. The survey consists of a field evaluation, with the incorporation of information from the following, on the architecture and history of all structures to be impacted by the proposed railway development:

- Collection of photographic information
- Collection of oral and written information
-

This information was recorded in the field on specially designed forms. These forms have been designed to provide a complete documentation of all identifiable pre-1950 structures, as well as any more recent structures of cultural/ historical significance and any pre-war clan graves, within the study area. The written information recorded by hand in the field has been typed onto resource record forms, which have been included in this report (See **Appendix 12-1**) to provide a

detailed inventory of the recorded cultural heritage resources. Field sketches and photographs have also been included in **Appendix 12-1**.

12.4.2.3 *Preliminary Built Heritage Condition Survey*

Construction works associated with this project have the potential to cause damage to historical structures through vibration. The purpose of the condition survey is to assess the condition of heritage features predating 1950 (i.e. historical structures), as these buildings contain structural elements that may require special attention due to their age and often non-robust building materials that were used in the past. The scope of this survey will include the structures associated with the FMPHQ, including the two OFSB, as the tunnelling for the project will be located directly beneath the FMPHQ site and the OFSB.

The preliminary condition survey consists of a visual inspection of the general condition of structures, noting presence of cracks and breakage, the identification of fragile architectural elements and the presence of destructive processes, such as vegetation growth, water and moisture damage and fabric degradation resulting from these processes. The results are recorded on forms containing space for the following information.

- General description of the structure;
- Description of fragile elements;
- Description of condition;
- Photographs illustrating condition;
- Floor plan showing location of photographed feature; and
- Need for further assessment

The preliminary assessment has been used in the formulation of mitigation measures, including recommendations for further detailed assessments if required and modification of design plans where practicable.

12.5 Assessment Results

12.5.1 *Landuse Interface with FMPHQ*

It is noted that the FMPHQ site redevelopment has assumed the KSL will be within a designated area between the levels at 2m above and 23m below the HK Principal Datum. According to the latest alignment, the KSL will be within this designated zone and hence would not have any conflict with the landuse of FMPHQ redevelopment.

12.5.2 *Archaeology*

The desk based research identified that the works will impact on areas that may contain traces of original landforms and early reclamations. It is noted, however, that the works area is located in a highly urbanized district that has undergone extensive underground disturbance from construction of roads, buildings and the installation of underground utilities over the past century. The likelihood that any undisturbed landforms still in existence are extremely low and hence, the archaeological potential of these areas is also extremely low. Before commencement of the construction work, the Contractor shall consult AMO on any other mitigation measures that

would be required administratively or under the Antiquities and Monuments Ordinance. The Contractor shall implement these requirements from AMO during the construction period.

12.5.3 *Results of Built Heritage Baseline Study and Survey*

The following section highlights the results of the Built Heritage baseline study, as mentioned previously a complete inventory of the resources can be found in **Appendix 12-1**. A number of structures were recorded in the survey (**Figure 12-2-1**). Nine of these structures were associated with the FMPHQ.

12.5.3.1 *FMPHQ*

Built heritage resources in FMPHQ (see **Figure 12-2-2**) include:

- The former signal tower (KSL-02-01);
- Three blue metal lamp posts (KSL-02-02, 03 and 04);
- The former Stable/ garage (KSL-02-05);
- The former station building (KSL-02-06);
- A small brick out building located behind the main station building (KSL-02-07);
- A metal pylon mast (KSL-02-08);
- Three sections of historical retaining walls: 1) The first on the western boundary slope of the compound (along Canton Road) supporting the vehicular access ramp up to the FMPHQ compound (KSL-02-09-A); 2) the second running along the southern boundary slope of the FMPHQ compound on Salisbury Road (KSL-02-09-B) and 3) the third running along the western side of the upper part of the vehicular access ramp leading to the compound (KSL-02-09-C);
- The former accommodation block (KSL-02-11), a Grade II Building, of the Old Fire Station Buildings; and
- The former main hall (KSL-02-10), a Grade III building, of the Old Fire Station Buildings.

The station building and signal tower have a very high level of architectural significance as they are excellent examples of colonial buildings and both contain numerous examples of classically inspired decorative features, such as columns, arches, capitals and keystones. The cultural significance of the site is also very high, this is firstly seen through the fact that the compound still retains all of the major buildings that have been associated with it historically (apart from the original Water Police Station that was demolished prior to the construction of the existing headquarters building in the 1880's), thus creating a high group value, that many historical sites in Hong Kong have lost. Secondly, the alterations to the site have been for the most part superficial and have not infringed upon the integrity of the site. Thirdly, the site and the operations of the Marine Police are intrinsically tied to the location, as it has been the site of the Marine Police (formerly known as the Water Police) Headquarters from the time of the construction of the original station (now demolished) in the 1860's.

The two fire station buildings are stylistically of the same design, red brick walls (the majority being in English bond) with cement dressing. The decorative features include flat arches above some of the windows and a decorative keystone above the round vent opening on the facade of the front building. Both buildings have undergone only superficial alterations and retain high architectural value in terms of rarity. The cultural significance of the buildings is also high, as they represent a highly visible and easily accessible link to the past.

12.5.3.2 *Former KCRC Clock Tower*

The Former KCR terminus clock tower (KSL-02-20) which is a Declared Monument. The location of the clock tower is illustrated on the map in **Figure 12-2-3**. The tower is constructed of red brick with cut stone dressing. The main decorative feature is an elaborate cupola at the top of the tower. The architectural significance of the tower is high, as it is a unique example of early 20th century railway station building style in Hong Kong. The cultural significance of the tower is extremely high, as it represents not only a local landmark, but an easily identifiable symbol of historical Hong Kong.

12.5.3.3 *Peninsula Hotel*

The Peninsula Hotel (KSL-02-19), a privately owned historical building, dating to the 1920's, that has not been graded (see **Figure 12-2-2** for location). The hotel has been modified and modernised on a number of occasions. The original style of the exterior has been maintained in the older sections of the building and the additions have been designed to compliment that style. The architectural value of the building lies mainly in its value as a landmark. The cultural significance of the building is extremely high. The hotel has a high symbolic value that has incorporated contemporary usage and historical notoriety. The hotel also has strong ties with the history of Hong Kong during the Second World War.

12.5.3.4 *Fuk Tak Koo Temple*

The Fuk Tak Koo Temple (KSL-02-12) a modern temple building located near the corner of Canton and Haiphong Roads, see **Figure 12-2-3**.

12.5.3.5 *Former Whitfield Barracks*

Buildings and features associated with the former Whitfield Barracks (now located in Kowloon Park) include:

- Historical retaining wall running along Haiphong Road (KSL-02-13);
- Old War department stone marker at the southwest corner of Kowloon Park (KSL-02-21); and
- Former Whitfield barracks buildings blocks 58 (KSL-02-14) and S4 (KSL-02-18), Grade III buildings.

The locations of the above resources can be found on the map in **Figure 12-2-3**. In addition to the above, the former history museum in Kowloon Park contains two Grade III former barracks buildings, S61 and S62 (KSL-02-15). Two other resources were recorded in Kowloon Park, an historical retaining wall (KSL-02-16) and Kowloon West II Battery of the former Whitfield Barrack, a Grade I structure (KSL-02-17), which has since been converted into a children's adventure playground. These locations of (KSL-02-15, 16 and 17) are all shown on the map in **Figure 12-2-4**.

The buildings and battery associated with the former Whitfield Barracks are of moderate architectural significance. They have undergone various degrees of modification and modernisation. The structures represent an excellent example of adaptive reuse that span over a century of historical occupation. This reflects a high level of cultural significance.

12.5.3.6 *Signal Hill Tower*

The Signal Hill Tower (KSL-02-22), a Grade II building, whose location can be seen on the map in **Figure 12-2-5**. This building is predominantly made of red brick in English bond with dressed granite and decoration in classical style. The tower has relatively high architectural significance, because of its rarity value. The cultural significance of the building is also relatively high, as its usage as a signal tower that was in use for many years, made it a well known local landmark.

12.5.3.7 *Former Kowloon British School*

The former Kowloon British School building, currently housing the Antiquities and Monuments Office (KSL-02-23), is also a Declared Monument. The brick building has been painted a pale pink colour in recent years. The building represents an eclectic architectural style, including Chinese style roofs and neo-gothic colonnade arches. The building has a high rarity value and hence is of high architectural significance. The cultural significance of the building is also high, as again it is highly visible symbol of the history of Hong Kong.

12.5.3.8 *Saint Andrew's Church*

Saint Andrew's Church (KSL-02-24), as shown in **Figure 12-2-6**, is constructed of red brick in a neo-gothic style. It is of relatively high architectural significance and is a Grade II historic building. Its cultural significance is very high, as it is the oldest protestant church in Kowloon and has been in use as a church for all of its history, excepting a period during the Japanese Occupation, when it was converted to a Shinto Shrine.

12.5.3.9 *#190 Nathan Road*

#190 Nathan Road (KSL-02-25) is a mid-twentieth century high rise building. The architecture of the building incorporates art-deco style decorative features, such as balcony details and a parapet. The remaining number of buildings such as this in Hong Kong is low and as one of the few remaining examples, the architectural significance of the building is increased. The cultural significance of the building is moderate to low.

12.5.3.10 *Others*

Three shop house buildings in the blocks between Jordan Road and Kansu Street, specifically, 176 – 178 Shanghai Street (KSL-02-26), currently housing the Tak Sang Pawn shop and a tailors shop, and #530 Canton Road (KSL-02-27), which houses a jewellery shop and a restaurant. Both of these buildings can be found on the map in **Figures 12-2-6 & 12-2-7**.

The final building consists of two units of a shop house terrace at #506 - 508 Canton Road (KSL-02-28). The shop house was once a common feature in the commercial districts of Hong Kong. The style has for the most part not been maintained or copied in modern reconstructions.

All of the buildings have been modified to some degree. The buildings on Canton Road, more so than the example noted on Shanghai Street. The buildings do not possess any outstanding architectural significance. One of the units of the Shanghai Street building is functioning as a pawnshop and has maintained the traditional style of such a shop. The cultural significance of the buildings is low to moderate.

12.5.4 *Results of Preliminary Condition Survey*

The structures assessed in the survey included the historical buildings associated with the FMPHQ and OFSB on Salisbury Road. The following paragraphs summarise the findings of the Preliminary Condition Survey and full details are given in **Appendix 12-2**.

12.5.4.1 *The Signal Tower*

The structure shows no visible signs of cracks on the exterior walls. Internally, there are cracks on the second storey ceiling and damage from water and damp, promoting mould growth. Some of the wooden window frames were becoming separated from the main wall structure.

12.5.4.2 *The Former Stables / Garage*

The structure for the most part appears to be in fair condition, with no evidence of any major external or internal cracks in the walls or floors. The wooden ceiling in the eastern rooms on the second story could be seen to be in poor condition and in danger of possible collapse.

12.5.4.3 *The FMPHQ Station Building*

The building shows a number of signs of being in poor structural condition, including large cracks in exterior and interior walls, rotting woodwork, vegetation growth and water and damp damage. Measures are all ready in progress in the form of crack monitoring and detailed condition surveys have been carried out on the structure.

12.5.4.4 *The Old Fire Station Hall*

The brickwork of the structure shows signs of decay. The repair techniques of applying concrete patches are not conducive to preservation of the bricks. There are cracks visible on the external walls, one of which runs down from the eaves into the brick wall underneath. The brick trim around many of the windows is fragile and in poor condition, with pieces having either broken off or degraded.

12.5.4.5 *The Old Fire Station Accommodation Block*

The brickwork of this structure also shows signs of decay. The brick trim around several of the windows also shows signs of breakage. There were no visible cracks in the external walls.

12.5.5 *Impacts to Built Heritage Features – Construction Phase*

The assessment of the built heritage resources located in the Study Area required a field survey, as desk-based research could not provide sufficient information for such an assessment. Two surveys were carried out as part of this project, one for the identification and description of the resources and one for a preliminary assessment of the condition of the buildings within the FMPHQ compound. The World War II period tunnels located underneath the FMPHQ could not be accessed during the survey due to safety reasons.

The location of the preferred alignment with respect to the identified heritage features is highlighted in **Figure 12-2-1**.

The impacts to heritage resources will vary depending on the chosen construction methods. The main issue involved is the possible structural damage to the historical buildings and tunnels at the FMPHQ site due to the mined tunnel activities. The impacts are described as follows:

12.5.5.1 *Buildings in FMPHQ Compound*

The heritage value of the site is extremely high, as can be seen in its designation as a Declared Monument. Preliminary visual inspection of the conditions of the historical structures has indicated that the headquarters building, especially, is in poor physical condition. This is evident through the large crack currently being monitored in its north-west wall (see relevant photographs in **Appendix 12-2**).

A vertical clearance of 6-16m will be maintained between the mined tunnels of KSL and any part of the historic buildings. Similar construction methodology has been adopted for the East Rail Extension Hung Hom to TST (ie another Designated Project currently being implemented) in which drill-&-blast tunnelling was adopted to construct the subway underneath heritage buildings in Signal Hill. The distance between the subway and the nearest heritage resources (i.e. large masonry walls associated with the retaining wall of the south side of the Signal Hill) is 20m.

It can be seen that the separation distance between the KSL mined tunnel and FMPHQ is generally shorter than that in East Rail Extension. However, as stated in the East Rail Extension EIA Report, a blasting assessment will be conducted by the Contractor before the commencement of mined tunnelling to ensure the vibration caused by the drill-&-blast activities will not cause adverse impacts on the conditions of the buildings in the FMPHQ. It is anticipated the construction phase impacts on these buildings could be controlled to be acceptable. Other mitigation measures are detailed in **S 12.6**.

12.5.5.2 *Air-raid Tunnels in FMPHQ Compound*

The FMPHQ site being developed will demolish the majority of the disused tunnel network. The demolition work to be carried out within FMPHQ site is more likely to have more direct and significant impacts on tunnel Portal A and the section of tunnel to be preserved, rather than the KSL's mined tunnelling works which have a vertical separation of approximately 6-16m.

However, as the air-raid tunnels (including the portals) were constructed over 50 years ago and have not received regular maintenance, it is quite likely that their structural condition is poor and that they may be susceptible to some degree of damage from vibration associated with the mined tunnelling. Recommended precautionary mitigation measures are detailed in **S 12.6**

12.5.5.3 *The Old Fire Station Buildings*

The heritage value of these structures has also been confirmed through designation of the accommodation block as a Declared Monument and Grade III status for the main hall. The impacts on the 2 buildings will be minimal during the construction phase as the running tunnels are located below street level and separated by about 6m. Also, the loading of the 2 buildings is considered minimal and with good support system to avoid direct physical contact with the heritage buildings.

12.5.5.4 *The Fuk Tak Koo Temple*

There will not be any construction works within the Haiphong Road Temporary Market and hence this temple will not be affected.

12.5.5.5 *The Former Whitfield Barracks*

None of the structures, including the tunnels, will be directly impacted by the proposed construction works. The structures within the confines of Kowloon Park are of sufficient distance from the proposed works to not receive any negative impacts from the project.

12.5.5.6 *Others*

As there is sufficient distance between the alignment and the following built heritage, negative impacts are not anticipated.

- The Peninsula Hotel;
- The KCR Clock Tower;
- The Signal Hill Tower;
- The Former Kowloon British School (AMO Office);
- St. Andrew's Church;
- #190 Nathan Road;
- #176 – 178 Shanghai Street;
- #530 Canton Road; and
- #508 Canton Road.

12.5.6 *Impacts to Built Heritage Features - Operational Phase*

There will be no adverse aesthetic impacts to resources during the operational phase as the rail line is located underground and will not be visible, any associated above-ground structures will be incorporated into an existing urban setting and will not affect the environmental character of the site. There will be no above-ground structures, entrances or ventilation shafts along Salisbury Road.

12.6 Recommendations for Mitigation Measures

12.6.1 *Archaeology*

The impact assessment has found that the areas identified in the desk based study contain very low potential of retaining patches of original shoreline or early reclamation as the area has been heavily disturbed through construction and installation of utilities over the past century. Before commencement of the construction work, the Contractor shall consult AMO on any other mitigation measures that would be required administratively or under the Antiquities and Monuments Ordinance. The Contractor shall implement these requirements from AMO during the construction period.

12.6.2 *Built Heritage Features (Construction Phase)*

The nature of the impacts will depend on the construction method employed. The mitigation measures are presented below for each specific location. As some of the structures cited in this section as requiring mitigation measures (including condition monitoring and structural integrity monitoring works) are part of a Declared Monument, specifically the FMPHQ, Section 6 permits may be required for the implementation of mitigation measures.

These mitigation measures must also take into account that the site of the FMPHQ, including the OFSB is being redeveloped as a heritage resource site. The primary interface issue between the KSL project and the redevelopment project is that minimal impacts to the environmental character of the redevelopment area should be incorporated into the KSL design.

12.6.3 *FMPHQ Compound & Air-Raid Tunnels*

The FMPHQ compound (including the accommodation block of the OFSB) is a declared monument under the Antiquities and Monuments Ordinance. With reference to paragraph 7.3(a) of the TM-EIA, "conditions which would be imposed through other applicable ordinances", (in this case the Antiquities and Monuments Ordinance: Chapter 53) "shall not normally be imposed in Environmental Permit issued under the Environmental Impact Assessment Ordinance".

The Headquarters building as mentioned above shows obvious signs of structural damage that could be exacerbated by even minor construction works in its vicinity. Even though the other historical buildings on the site, i.e. the signal tower, the former stables and other buildings, did not show such extreme evidence of structural unsoundness, monitoring of the structural integrity of the buildings by the contractor should still be implemented during the construction phase, as a precautionary measure. Based on desk-top assessment, the air-raid tunnel section and Portal A to be preserved should also receive these precautionary measures.

A blasting assessment should be conducted by the Contractor before commencement of the construction works to demonstrate that the proposed blasting work will not adversely affect the structural integrity of the FMPHQ compound in accordance with the requirements from Mines Division of CEDD.

Precautions should be taken during the mined tunnelling to prevent any damage to the historic buildings. Structural monitoring system should be designed and supervised by a Registered Structural Engineer from the Contractor during the period for mined tunnelling to ensure compliance with the Buildings Ordinance.

Liaison with the FMPHQ developer has indicated that they are prepared to conduct the condition and impact monitoring during the construction period that overlaps with the KSL construction. After this period, they will allow access to the site by the KSL contractor to carry out the necessary monitoring.

Details of the monitoring system, including coordination with the FMPHQ developer, shall be submitted to AMO for approval before the mined tunnelling commences. Any proposed site works (including ground investigation and tunnelling work) and structural monitoring measures within the boundary of the declared monument would need to comply with the requirements under Section 6 of the Antiquities and Monument Ordinance.

12.6.3.1 *Others*

No mitigation measures are required for the following:

- Fuk Tak Koo Temple;
- The Former Whitfield Barracks;
- The Peninsula Hotel;
- The KCR Clock Tower;
- Tunnels within Kowloon Park
- The Signal Hill Tower;
- The Former Kowloon British School (AMO Office);
- St. Andrew's Church;
- #190 Nathan Road;

- #176 – 178 Shanghai Street;
- #530 Canton Road; and
- #508 Canton Road.

12.6.4 *Built Heritage Features (Operational Phase)*

No mitigation measures will be required during the operational phase.

12.7 Conclusion

A cultural and heritage impact assessment has been conducted according to the requirements given in the TM-EIAO. Results indicate that the archaeological potential of the works area is low.

A vertical separation distance of 6-16m between the KSL tunnels and the heritage elements in the FMPHQ compound will be maintained to minimise the potential impacts to the structural integrity of the FMPHQ compound and the disused air raid tunnels. A structural monitoring has been recommended for the FMPHQ compound, and the air-raid tunnels and the portal A to be preserved, to ensure their conditions are maintained throughout the mined tunnelling period.

Mitigation measures are not required for other built heritage elements identified. All recommended mitigation measures, the implementation responsibility and programme are included in the Environmental Mitigation Implementation Schedule for implementation by the respective parties.

13. HAZARD ASSESSMENT

The Study Brief specified that a hazard assessment has to be conducted if there is overnight storage of explosive. According to the latest design information, there will not be overnight storage of explosive and hence it is not necessary to conduct a hazard assessment.

14. ENVIRONMENTAL MONITORING AND AUDITING REQUIREMENTS

The findings and recommendations of the EIA report will constitute a formal commitment by the Project Proponent to achieve the levels of environmental protection. It also states the Project Proponent's environmental performance criteria for KSL. In order to ensure the performance commitments are incorporated throughout various implementation phases (e.g. detailed design, tendering, construction and operation of the project), a number of contractual, managerial and administrative mechanisms will be implemented, including:

- Setting up of a project organization and hierarchy;
- Development of Environmental Monitoring and Auditing (EM&A) programme;
- Outline of Environmental Mitigation Implementation Schedule;
- Formulation of Environmental Management Plan;
- Approval of Contractor's Work Method Statement; and
- Provision of community liaison office.

14.1 Project Organisation

A project organisation consisting of the Project Proponent's Environmental Manager (EM), Independent Environmental Checker (IEC), Contractor's Environmental Team (ET), Engineer's Representative (ER), and Contractor shall be formed to take the responsibilities of the environmental protection for this project. The EM will be responsible for overall supervision of the EM&A programme, and will take proactive measures to avoid and resolve any environmental problems. An IEC will also be appointed by the Project Proponent to conduct independent auditing on the overall EM&A programme including the implementation of all environmental mitigation, submissions relating to EM&A, and any other submission required under the Environmental Permit (EP). The organisation, responsibilities of respective parties and lines of communication with respect to environmental protection works are given in the EM&A Manual.

14.2 EM&A Manual & Implementation Schedule

EM&A is an important aspect in the EIA process that specifies the time frame and responsibilities for the implementation of the environmental mitigation measures identified. Requirements on environmental monitoring (including baseline and impact monitoring) will be given.

A project specific EM&A Manual has been prepared based on the latest design information available and EPD's generic EM&A Manual. The project specific EM&A Manual specifies the following:

- Organisation, hierarchy and responsibilities of the EM, Contractor, the Engineer or ER, ET, and IEC with respect to the EM&A requirements during construction;
- Information on project organisation and programming of construction activities for the project;
- Requirements with respect to the construction schedule and the necessary EM&A programme to track the varying environmental impact;

- Full details of the methodologies to be adopted, including all field, laboratory and analytical procedures, and details on quality assurance;
- Procedure for undertaking on-site environmental audits;
- Definition of Action and Limit levels;
- Establishment of event and action plans;
- Requirements of reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria and complaints;
- Requirements for review of EIA predictions, implementation of mitigation measures, and the effectiveness of the environmental protect and pollution control measures adopted; and
- Presentation requirements for EM&A data and appropriate reporting procedures.

An Environmental Mitigation Implementation Schedule (EMIS) has been prepared to summarise all the required mitigation measures that need to be implemented during the design, construction and operation of the proposed project (**Appendix 14-1**). The implementation responsibilities are also identified. This EMIS will also be included in the EM&A manual for submission to EPD.

14.3 Amendments to EM&A Manual

The Contractor shall be requested to review the mitigation measures and EMIS with respect to the design developments and construction methodology. In case where the Contractor needs to update the mitigation measures and the EMIS, an updated EM&A manual shall be submitted to the EM for approval. The Contractor shall seek EPD's prior approval on these amendments before construction commences.

14.4 EM&A programme

The Contractor will be requested to implement and operate a continuous noise monitoring mechanism throughout the entire construction period of the Project. This mechanism will include a system to report the real time monitoring results on the Project Proponent's website within a period of time, to be agreed by EPD, after the relevant noise monitoring data are collected. In cases where exceedance are found, the Contractor and ET should take immediate actions to implement remediation measures following the procedures specified in the EM&A Manual.

Detailed requirements of the EM&A programme are described in the EM&A Manual. Measurements and activities that shall be conducted in accordance with the requirements in the EM&A Manual are summarised in the following:

- baseline monitoring (on noise, air quality & groundwater);
- impact monitoring (on noise, air quality & groundwater);
- remedial actions in accordance with the Event and Action Plan within the time frame in cases where specified criteria in the EM&A Manual are exceeded;
- logging and keeping records of the details of monitoring results;
- preparing and submitting monthly EM&A Reports

14.5 Environmental Management Plan

A systematic Environmental Management Plan (EMP) shall be set up by the Contractor to ensure effective implementation of the mitigation measures, monitoring and remedial requirements presented in the EIA, EM&A and EMIS. The Project Proponent and IEC will audit the implementation status against the EMP and advise the necessary remedial actions required. These remedial actions shall be enforced by the ER through contractual means.

The EMP will require the Contractor (together with it's sub-contractors) to define in details how to implement the recommended mitigation measures in order to achieve the environmental performance defined in the Hong Kong environmental legislation and the EIA documentation.

The review of on-site environmental performance shall be undertaken by The Project Proponent and IEC through a systematic checklist and audit once the project commences. The environmental performance review programme comprises a regular assessment on the effectiveness of the EMP.

14.6 Method Statements

The environmental aspects of working methods will be controlled through the checking of the Contractor's method statements which will be submitted and approved by the ER prior to the works being carried out. The Project Proponent will specify an arrangement whereby method statements will be scrutinised and signed off by Project Proponent's EM before being approved. This will ensure that the environment is consistently and routinely considered in all works processes.

14.7 Community Liaison Office

The Project Proponent will establish a Community Liaison Office with a telephone action line which enables the public to raise any matters of concern regarding the project such as complaints, comments, suggestions or requests for information.

15. SUMMARY OF ENVIRONMENTAL OUTCOMES

15.1 Population Benefited and Environmental Sensitive Areas Protected

15.1.1 *Population Benefited*

Environmental concern has been one of the key considerations during development stages of the proposed KSL railway, from planning, design to construction. From a planning perspective, the proposed KSL railway connecting WR NAC Station to ER ETS Station will provide passengers an efficient and environmental friendly transportation system. The proposed KSL will greatly enhance the public transport infrastructure network in Sham Shui Po and Yau Tsim Mong districts, especially for the areas near Man Cheong Street and Canton Road North where there is currently no railway station in the vicinity. The proposed WKN will enable the people in this area to get access to an efficient and modern transportation system very easily.

According to the latest statistics[15-1], there are approximately 443,600 population planned by Year 2011 for Sham Shui Po district and 320,100 population for Yau Tsim Mong district. All these population (a total of 763,700 population) will be directly benefited by the operation of KSL.

In addition, all the KSL passengers will enjoy the benefits and flexibility of commuting efficiently with WR in NAC, MTR and ER in TST. According to the latest information, there will be a population of about 1.8 millions by Year 2011 in Tsuen Wan, Tuen Mun, Yuen Long and North Districts that would be served by the WR.

15.1.2 *Environmental Sensitive Receivers Protected*

Sensitive receivers along the proposed alignment have been identified as residential buildings, education institutions, quarters, performance venues (ie HKCC & HKSM), and heritage buildings (FMPHQ and OFSB). A package of mitigation measures has been recommended to protect these sensitive receivers to the maximum practicable extent.

Assessments indicate that all the sensitive receivers can be protected to meet the relevant criteria during both the construction and operational phases. Residual environmental impacts are not anticipated except there would be residual construction noise impacts on some of the noise sensitive receivers even after exhausting all practicable direct noise mitigation measures. However, assessment results indicate that none of the remaining affected NSRs would be qualified for Indirect Technical Remedies.

15.2 Key Environmental Problems Avoided

15.2.1 *Avoidance of Open Track & Minimisation of Above-Ground Structure*

The entire railway is designed to be underground except for a short at-grade section of about 150m to interface with the WR NAC Station. This at-grade section will be fully enclosed in a concrete box and hence any noise impacts are avoided.

There will be neither viaduct nor other at-grade sections along the alignment. This has avoided any permanent visual impacts associated with viaducts and at-grade sections. Only those associated structures that are essential to the operation of the railway will be above-grade. These include ventilation buildings, station entrances and E&M plant areas.

15.2.2 *Minimisation of Excessive Noise and Dust Impacts*

The construction methodology has been designed to minimise environmental impacts where practicable. The use of bored tunnelling, a more environmental friendly construction methodology, will be adopted along Canton Road where there are high-rise buildings along both sides of the road and is one of the major tourist attraction spots.

The majority of the construction activities for bored tunnelling are restricted to the launching and access shafts and hence the associated construction noise and dust impacts on the neighbouring sensitive receivers are generally less significant. Road decking will also be installed to cover a large portion of the launching. This will further reduce the construction noise and fugitive dust.

15.2.3 *Minimisation of Disruption to Business Activities*

The use of boring tunnelling along Canton Road will also minimise the need for construction activities at road level. Most of the activities will be conducted underground except initial excavation, final reinstatement near the mucking-out points and ground treatment from road level in advance of tunnel boring operation. This will ensure that most of the retails along Canton Road will be much less affected as compared to other construction techniques (e.g. cut-&-cover technique).

15.2.4 *Avoidance of Damage to Champion Trees*

The current design has avoided temporary possession of the KPDCP which has a high value from landscape and visual perspective, except for a relatively small open space at the junction of Canton Road and Kowloon Park Drive. All the Champion trees along Haiphong Road will not be affected during both the construction and operational phases.

15.2.5 *Avoidance of Encroachment to Heritage Buildings & Monument*

The current design has avoided the need to temporarily dismantle the OFSB in the FMPHQ site. A vertical separation of about 6-16m will be maintained between the railway tunnel and the buildings through the entire construction period.

15.3 Environmental Friendly Designs Adopted & Environmental Benefits

15.3.1 *Floating Track Slab*

The railway design has taken into account neighbouring performance venues (including HKCC and HKSM) that are particularly sensitive to train induced groundborne noise. Floating track slab will be installed at different sections of the railway to provide a high degree of vibration and groundborne noise attenuation.

15.3.2 *Fresh-Water Cooling*

Fresh-water cooling facilities will be located at the WKN to serve both the station and the tunnel. The specific power consumption for fresh water-cooling system is approximately 50% of a conventional air-cooling system and thus achieve higher energy efficiency. The above-grade plant space occupied by the fresh water-cooling system is also much less than that of a conventional air-cooling system.

15.3.3 *Orientation of Ventilation Shafts & ECS Plant*

Ventilation shafts and E&M plant are essential elements for the operation of modern underground railway. In order to minimise the associated noise impacts from these ventilation shafts and E&M plant, the detailed design will maximise the possibility of louver orientation to face away from the neighbouring sensitive receivers, where practicable. This will ensure the noise emanating are self screened as much as possible. Noise control measures with adequate attenuation will also be incorporated into the detailed design to ensure compliance with the relevant statutory noise criteria.

15.3.4 *Environmental Friendly Construction Method*

Bored tunnelling will be adopted along Canton Road where lots of retails are located. Whilst cut-&-cover activities are still inevitable for the access shaft and the associated ventilation buildings, temporary decking will be installed where practicable. The majority of the construction plant will be working underneath the deck during the majority of the excavation activities. Similar road decks have been adopted in the ERE construction and can provide significant attenuation to reduce the noise impacts caused by the construction plant operating underneath.

Only limited construction plant will be required to operate at-grade and near to the mucking out locations. Together with the use of other mitigation measures (e.g. quieter plant, mobile noise barriers), the noise impacts caused by the current construction method have been minimised to the maximum practicable extent.

These road decks will also reduce dust dispersion very efficiently and minimise the visual impacts to the pedestrians during the construction period.

15.3.5 *Reduction of Nitrogen Dioxide*

KSL is planned to carry up to approximately 640,000 passengers each day in Year 2016. If these passengers travel on buses between NAC and TST instead of KSL, it is estimated that 5,300 buses per day would be required. With the implementation of the KSL, this would reduce the reliance on road-based transport and translate to environmental benefits of reduction in air pollutants. Assuming the EURO III emission levels (at Year 2008), these vehicles would generate approximately 11 tonne of nitrogen dioxide (a major air pollutant from vehicular emission) per year within Sham Shui Po and Yau Tsim Mong districts. It represents a positive contribution to the enhancement of the local environment. Details of the calculations are given in **Appendix 15-1.**

16. CONCLUSIONS

16.1 Overall

An EIA Report has been prepared to satisfy the requirements given in the EIA Study Brief ESB-097/2002 and the Technical Memorandum on Environmental Impact Assessment Process. All the latest design information has been incorporated into the EIA process. Aspects that have been considered in this EIA Report include:

- Selection of preferred alignment
- Description of construction methodology
- Construction dust
- Airborne noise
- Groundborne noise
- Water quality
- Waste management
- Land contamination
- Landscape and visual impacts
- Cultural heritage
- Hazard
- Environmental monitoring and auditing

All the existing and planned environmental sensitive receivers in the vicinity of the alignment have been identified by conducting site surveys and reviewing relevant planning information. The receivers identified include residential blocks, schools, quarters, performance venues, sea water abstraction points, Champion trees and heritage buildings. These receivers have all been considered in this EIA study.

16.2 Selection of Preferred Route Alignment

A total of 4 alignment options have been considered, including

- Canton Road Scheme;
- Kowloon Park Drive Scheme;
- Kowloon Point Scheme; and
- Harbour City Scheme.

The Canton Road and Kowloon Park Drive Scheme are land-based schemes while the other two are sea-based schemes. Various factors have been taken into consideration during the route selection process including resumption of buildings, accessibility and connectivity, landscape resources, construction impacts (e.g. noise, dust etc), heritage buildings, waste generation, train

services, impacts on parks, disruption to harbour activities, ecology and water quality, and commercial and cultural activities.

Assessment indicates that the sea-based schemes will inevitably affect the harbour activities in TST and would require dredging activities in the harbour which will cause adverse water impacts. In addition, the Kowloon Point Scheme will also involve reclamation work and hence is not consistent with the general principle of the "Protection of Harbour Ordinance". These sea-based schemes are therefore not preferred.

The Kowloon Park Drive Scheme would require resumption of the YMCA Building which is one of the favourite locations in TST for tourists. The tight curvature near the junction between Salisbury Road and Kowloon Park Drive will also impose unacceptable constraints on the line capacity and will cause higher vibration impacts on the Hong Kong Cultural Centre. This scheme will also encroach onto Kowloon Park and hence may affect the champion trees along Haiphong Road.

The latest design of Canton Road Scheme, on the other hand, can avoid encroaching onto Kowloon Park. All the champion trees along Haiphong Roads will also be kept intact during both the construction and operational phases. The use of bored tunnelling along Canton Road will also minimise the construction noise and dust impacts, and disruption to the retail areas along Canton Road. On this basis, Canton Road Scheme has been selected as the preferred alignment for this EIA Study.

16.3 Construction Methodology

Various construction methodologies have been considered during the design process. Bored tunnelling has been adopted for the tunnel along Canton Road. This will minimise the construction noise and dust impacts on the sensitive receivers in the vicinity. Most of the construction activities will be conducted underground except near the access shafts where lorries and cranes may be required. The disruption to the business activities along Canton Road will also be minimised by using bored tunnelling.

Mined tunnelling will be adopted for the tunnel section under the FMPHQ and OFSB. This approach will ensure that these heritage buildings will not be adversely affected by the construction of KSL and temporarily dismantling of the OFSB, a building with high heritage value, is not required.

Other tunnel sections will be constructed by cut-&-cover technique. Road deck will be installed whenever necessary to facilitate traffic management during the construction period. These road decks will also help reducing the construction noise and dust impacts on the neighbouring sensitive receivers.

16.4 Construction Dust Impacts

Potential dust impact may be generated from the soil excavation activities, backfilling, site erosion, storage of spoil on site, transportation of soil, as well as underground blasting activities during the construction phase. Quantitative fugitive dust assessments have been conducted, taking into account the cumulative impact caused by nearby concurrent project.

Results indicate that, with proper watering of at least 4 times per day for WKN and 2 times per day for the remaining sections throughout the construction phase of KSL, the predicted TSP concentrations will comply with the statutory requirements. Effective dust control can also be achieved by implementing the procedures and requirements given in the Air Pollution Control

(Construction Dust) Regulation and in accordance with the EM&A programme during construction. With the implementation of dust suppression control and good site practice, adverse fugitive dust impact is not anticipated.

16.5 Airborne Noise Impacts

16.5.1 *Construction Noise*

Potential construction noise impacts would be caused by the various construction activities including excavation, backfilling and construction of superstructure etc. The use of bored tunnelling along Canton Road has minimised the potential construction noise impacts on the receivers along Canton Road to the maximum practicable extent.

Construction noise assessment has concluded that the unmitigated construction noise impacts would be high at the neighbouring NSRs. Suitable noise mitigation measures have been identified which could reduce the noise impacts at most of the NSRs. Careful selection of construction equipment and working methods including the use of smaller, electrically driven and quiet plant are adopted, where practicable. Other measures including good site practice, the use of site hoarding, installation of movable barriers and sequential operation of construction plant should be incorporated into the Contract Specifications and Implementation Schedule. With the incorporation of the recommended mitigation measures, the predicted construction noise levels could be reduced by about 10dB(A). However, the construction noise levels at some NSRs will still exceed the daytime criteria.

Specific noise measures including temporary noise barriers for particular equipment, large full enclosure, sequencing of construction activities, have been further considered for those affected receivers. The use of temporary noise barriers and sequencing of construction activities have been adopted to further reduce the noise impacts. Large full enclosures will create secondary adverse environmental impacts (e.g. visual) and have been concluded to be not practicable and hence are not recommended. There are still minor noise exceedance at Canton Road Government School, Lai Chack Middle School and Man King Building even after implementing the specific noise mitigation measures. The eligibility of providing Indirect Technical Remedies (ITR) has also been tested for these receivers. However, none of these receivers satisfies the eligibility criteria and hence ITR is not recommended for these receivers.

16.5.2 *Operational Noise*

Fixed noise sources during the operational phase include ventilation / plant buildings, ventilation shafts and E&M plant in the station. Operational noise impacts can be effectively mitigated by implementing noise control treatment (e.g. sound attenuator, noise enclosures) at source during the design stage and hence residual operational airborne noise impacts are not anticipated.

The requirements for carrying out noise commissioning tests for fixed noise sources should be included in the Contract Documents.

16.6 Groundborne Noise Impacts

16.6.1 *Construction Phase*

A groundborne noise assessment has been conducted for the Hong Kong Cultural Centre (HKCC), the Hong Kong Space Museum (HKSM) and other NSRs. The most significant groundborne noise sources have been identified to be the rock breaking process that utilise

hydraulic breakers and rockdrills at HKCC. There are no residual construction groundborne noise impacts on noise sensitive receivers over the statutory requirement and hence mitigation measures are not required. A groundborne noise monitoring at HKCC and HKSM is recommended for assurance checking.

16.6.2 *Operational Phase*

Potential groundborne noise will be caused by the trains running along the alignment. Special trackform has been recommended to be installed at various sections to ensure the groundborne noise from train can be controlled to within the established criteria. A noise commissioning test is specified in the KSL contract for assurance checking during the initial period of KSL operation.

16.7 Water Quality Impacts

16.7.1 *Construction Phase*

Potential water pollution sources have been identified as construction runoff, sewage from site workforce, drainage diversion and groundwater contamination. Mitigation measures including covering excavated materials, carrying out excavation during dry seasons as far as possible and providing sedimentation tanks etc are recommended to mitigate any adverse water quality impacts.

Chemical tests have been conducted for ground water samples collected during the site investigation. Results indicate that some of the samples near the WKN would be contaminated. However, the intrusion of ground water is anticipated to be minimal given the current construction method (ie D-wall for WKN). Any groundwater should be re-charged within the works areas.

16.7.2 *Operational Phase*

The operational water quality impact for track run-off and tunnel seepage will have no adverse water quality impact provided that mitigation measures are incorporated in the design. The fresh water cooling system for station and tunnels will not cause adverse water quality impacts.

16.8 Waste Management Implications

16.8.1 *Construction Phase*

The quantity and timing for the generation of waste during the construction phase have been estimated. Measures, including the opportunity for on-site sorting, reusing excavated fill materials (stored in stockpiles) etc, have been maximised in the construction methodology to minimise the surplus materials to be disposed off-site via the barging facilities in West Kowloon. The annual disposal quantities for C&D materials and their disposal methods have also been assessed.

Recommendations have been made for the Contractor to implement during the construction period to minimise the waste generation and those for off-site disposal.

16.8.2 *Operational Phase*

The types and quantities of waste that would be generated during the operational phase are assessed. Recommendations have been made to ensure proper treatment and disposal of these wastes.

16.9 Land Contamination

Relevant historical information has been reviewed and site inspection has been conducted to select location for contamination assessment. Results indicate that about 39m^3 of soil at the ex-government dockyard at Canton Road Government Office is contaminated and need to be disposed of to landfill. Recommendations have been made to handle and the contamination soil. Residual impacts are not anticipated.

16.10 Landscape and Visual Impact Assessment

All the landscape resources in the vicinity of the alignment have been identified, including the Champion trees in the KPDCP and along Haiphong Road. All these Champion trees will be kept intact during both the construction and operational phases of the KSL.

All the visually sensitive receivers within the visual envelopes during the construction and operation phases have been identified.

Landscape and visual mitigation measures have been identified for both the construction and operation phases.

After implementation of these mitigation measures, there would still be some substantial adverse landscape and visual impacts during the construction phase, due mainly to the impacts on existing trees along the alignment, impacts on public open space and landscape character at Nam Cheong Park and Salisbury Garden, and the visual impacts caused by cut and cover construction techniques, temporary noise barriers, temporary works areas and temporary traffic arrangements.

In the operation phase, after the mitigation measures have been implemented and tree planting has matured over 10 years, it is considered that the residual landscape and visual impacts would be insubstantial, with the exception of impacts on the Public Open Space at the Corner of Canton Road and Kowloon Park Drive, which are considered to be of moderate adverse impact significance.

Overall, with reference to the five criteria defined in Annex 10 of the EIAO TM, it is considered that the landscape and visual impacts in the construction and operation phases are **acceptable with mitigation measures**.

16.11 Cultural Heritage Impacts

Assessment indicates that the archaeological potential of the works area is low. Before commencement of the construction work, the Contractor shall consult AMO on any other mitigation measures that would be required administratively or under the Antiquities and Monuments Ordinance. The Contractor shall implement these requirements from AMO during the construction period. To minimise the potential impacts of the tunnelling works on the OFSB, mined tunnelling will be adopted to avoid physical contact with these heritage buildings during the entire construction period. A vertical separation distance of 6-16m between the KSL tunnels and the heritage elements in the FMPHQ compound will be maintained to minimise the potential impacts to the structural integrity of the FMPHQ compound and the disused air raid tunnels. A structural monitoring has been recommended for the FMPHQ compound, and the air-raid tunnels and the Portal A to be preserved, to ensure their conditions are maintained throughout the mined tunnelling period.

16.12 Hazard

There will not be overnight storage of explosive and hence it is not necessary to conduct a hazard assessment.

16.13 Environmental Monitoring and Auditing Requirements

It is recommended to implement an EM&A programme throughout the entire construction period to regularly monitor the environmental impacts on the neighbouring sensitive receivers. All the requirements (including noise, dust, water quality, landscape, visual, waste, land contamination, cultural heritage) in the EM&A Manual shall be complied with.

An Environmental Mitigation Implementation Schedule will also be included in the EM&A Manual to summarises all the measures, the implementation location, time frame, agency etc.

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