

Kowloon Canton Railway  
Corporation

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**KSL GSA 5100**  
**Environmental Impact**  
**Assessment &**  
**Associated Services**

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Executive Summary

Kowloon Canton Railway Corporation  
**KSL GSA 5100 Environmental Impact Assessment & Associated  
Services**

Environmental Impact Assessment Report

Executive Summary

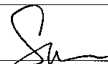
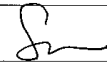
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## 1. INTRODUCTION

Ove Arup & Partners (Arup) was commissioned by Kowloon Canton Railway Corporation (KCRC) to undertake an Environmental Impact Assessment (EIA) of the proposed Kowloon Southern Link (KSL) in accordance with the requirements of the Technical Memorandum on Environmental Impact Assessment Process (TM-EIA) and the study brief (Ref No. ESB-097/2002). The scopes of the EIA study include the impact assessments of construction dust, airborne noise, groundborne noise, water quality, waste management, land contamination, landscape and visual, cultural heritage, and hazard. The selection of railway alignment, construction methodologies, requirements of EM&A, and environmental outcomes of the Project have also been detailed in the EIA report.

The proposed underground KSL will improve the accessibility to Tsim Sha Tsui (TST) and West Kowloon districts (**Figure 1-1**). It connects the new KCRC East TST Station to the current West Rail (WR) Nam Cheong Station (NAC), with its alignment running under Salisbury Road, Canton Road and West Kowloon Reclamation area. The total length of the new railway is approximately 3.7km. West Kowloon Station (WKN) will be located at West Kowloon on the west side of Canton Road between Austin Road and Jordan Road. Neither reclamation nor dredging is anticipated for KSL.

Mechanical services plant will be located within the WKN and at two ventilation / plant buildings along the route alignment including:

- Yau Ma Tei (YMT) Ventilation Building at Hoi Ting Road, and between YMT Interchange and Cherry Street; and
- Canton Road Plant Building (CRPB) at the junction of Kowloon Park Drive and Canton Road;

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.

## 2. SELECTION OF THE PREFERRED ALIGNMENT

The alignment is divided into two main sections, north and south, basically following the alignment proposed in the Railway Development Strategy 2000 (RDS-2000) Report. 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. Four alternative alignments have therefore been identified, including two inland (namely Canton Road Scheme and Kowloon Park Drive Scheme) and two seaward options (namely Kowloon Point Scheme and Harbour City Scheme). **Figures 2-1-1 to 2-4-3** indicate the routes for the four alignment options.

The four alignment options were evaluated on the basis of the critical engineering, environmental and social factors in the EIA study. A summary of the reasoning that has been considered during the route selection process is given below:

**Table 2-1 : 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
<b><u>Engineering Factors</u></b>				
Resumption of Buildings	<ul style="list-style-type: none"> <li>Resumption of private buildings not required</li> </ul>	<ul style="list-style-type: none"> <li>Resumption of YMCA Building (Not feasible)</li> <li>Resumption of Fuk Tak Koo Temple</li> </ul>	<ul style="list-style-type: none"> <li>Not required</li> </ul>	<ul style="list-style-type: none"> <li>Resumption of Star House &amp; Marco Polo HK Hotel (Not feasible)</li> </ul>
Accessibility & Connectivity	<ul style="list-style-type: none"> <li>Less attractive with CAR deferred</li> <li>Good with CAR in place</li> </ul>	<ul style="list-style-type: none"> <li>Good</li> </ul>	<ul style="list-style-type: none"> <li>Not desirable</li> <li>No connection to Kowloon Point Station</li> </ul>	<ul style="list-style-type: none"> <li>Not desirable</li> </ul>
Reclamation	<ul style="list-style-type: none"> <li>Not required</li> </ul>	<ul style="list-style-type: none"> <li>Not required</li> </ul>	<ul style="list-style-type: none"> <li>Required (reclamation will not be implemented since it is inconsistent with the Protection of Harbour Ordinance)</li> </ul>	<ul style="list-style-type: none"> <li>Not required</li> </ul>
<b><u>Environmental Factors</u></b>				
Landscape resources	<ul style="list-style-type: none"> <li>Less impact</li> <li>No impacts on champion trees<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>Higher impact</li> <li>Champion trees may be affected</li> </ul>	<ul style="list-style-type: none"> <li>Less impact</li> <li>No impacts on champion trees</li> </ul>	<ul style="list-style-type: none"> <li>Less impact</li> <li>No impacts on champion trees</li> </ul>
Construction noise & dust	<ul style="list-style-type: none"> <li>Minimal impact, use of bored tunnelling along Canton Road will minimize the construction noise and dust impacts, and other disruptions to the commercial premises.</li> </ul>	<ul style="list-style-type: none"> <li>High impact if cut-&amp;-cover needs to be adopted</li> <li>Similar impacts as Canton Road Scheme if bored tunnelling is adopted</li> </ul>	<ul style="list-style-type: none"> <li>Minimal impact (but acceptable with mitigation measures)</li> </ul>	<ul style="list-style-type: none"> <li>Minimal impact (but acceptable with mitigation measures)</li> </ul>
Visual impacts	<ul style="list-style-type: none"> <li>Minimal impact, use of bored tunnelling along Canton Road will minimize the visual.</li> </ul>	<ul style="list-style-type: none"> <li>High impact if cut-&amp;-cover needs to be adopted</li> <li>Similar impacts as Canton Road Scheme if bored tunnelling is adopted</li> </ul>	<ul style="list-style-type: none"> <li>Construction vessels will affect the attractiveness and visual appeal of the harbour</li> </ul>	<ul style="list-style-type: none"> <li>Construction vessels will affect the attractiveness and visual appeal of the harbour</li> </ul>
Heritage Buildings	<ul style="list-style-type: none"> <li>FMPHQ and Old Fire Station Building (OFSB) protected by no contact construction methodology</li> </ul>	<ul style="list-style-type: none"> <li>No impact</li> </ul>	<ul style="list-style-type: none"> <li>No impact</li> </ul>	<ul style="list-style-type: none"> <li>No impact</li> </ul>
Waste generation	<ul style="list-style-type: none"> <li>No polluted sediment generation</li> <li>Use of bored tunnelling can minimize the amount of excavated materials</li> </ul>	<ul style="list-style-type: none"> <li>More excavated materials</li> </ul>	<ul style="list-style-type: none"> <li>Potential release of polluted marine sediment</li> </ul>	<ul style="list-style-type: none"> <li>Potential release of polluted marine sediment</li> </ul>
Groundborne Noise & Vibration	<ul style="list-style-type: none"> <li>Operational noise &amp; vibration can be mitigated</li> <li>Train service &amp; passenger comfort not compromised</li> </ul>	<ul style="list-style-type: none"> <li>Unacceptable impact on the line capacity due to tight curvature of the track near the junction between Salisbury Road and Kowloon Park Drive;</li> <li>More severe operational noise and vibration problems</li> <li>Train services &amp;</li> </ul>	<ul style="list-style-type: none"> <li>Operational noise &amp; vibration can be mitigated</li> <li>Train service &amp; passenger comfort not compromised</li> </ul>	<ul style="list-style-type: none"> <li>Operational noise &amp; vibration can be mitigated</li> <li>Train service &amp; passenger comfort not compromised</li> </ul>

<sup>1</sup> Champion Trees are trees listed in the Urban Council publication “Champion Trees in Hong Kong” (Chinese Edition, 1998) by Dr C Y Jim.

Criteria	Route Alignment Options			
	#1: Canton Road Scheme	#2: Kowloon Park Drive Scheme	#3: Kowloon Point Scheme	#4: Harbour City Scheme
Impacts on parks	<ul style="list-style-type: none"> <li>No impact on Kowloon Park</li> <li>Encroach onto a relatively small open space at junction of Canton Road and Kowloon Park Drive</li> </ul>	passenger comfort compromised <ul style="list-style-type: none"> <li>Higher impact</li> <li>Temporary possession of KPDCP</li> <li>Encroachment into Kowloon Park</li> </ul>	<ul style="list-style-type: none"> <li>No impact on KPDCP &amp; Kowloon Park</li> </ul>	<ul style="list-style-type: none"> <li>No impact on KPDCP &amp; Kowloon Park</li> </ul>
Ecology & Water Quality	<ul style="list-style-type: none"> <li>No ecological impact</li> <li>No water quality impact</li> </ul>	<ul style="list-style-type: none"> <li>No ecological impact</li> <li>No water quality impact</li> </ul>	<ul style="list-style-type: none"> <li>No terrestrial ecological impact</li> <li>Dredging will affect water quality</li> </ul>	<ul style="list-style-type: none"> <li>No terrestrial ecological impact</li> <li>Dredging will affect water quality</li> </ul>
<b>Other Factors</b>				
Disruption to harbour activities	<ul style="list-style-type: none"> <li>No impact</li> </ul>	<ul style="list-style-type: none"> <li>No impact</li> </ul>	<ul style="list-style-type: none"> <li>Affect harbour activities</li> <li>Affect Star Ferry</li> </ul>	<ul style="list-style-type: none"> <li>Affect harbour activities</li> </ul>
Commercial & Cultural Activities	<ul style="list-style-type: none"> <li>Disruptions to commercial premises along Canton Road will be minimized by using bored tunnelling</li> </ul>	<ul style="list-style-type: none"> <li>Several hotels affected</li> <li>Alignment furthest away from Hong Kong Cultural Centre (HKCC)</li> <li>Ex-Museum of History would be affected</li> </ul>	<ul style="list-style-type: none"> <li>Several hotels affected but alignment closer to the HKCC</li> </ul>	<ul style="list-style-type: none"> <li>Several hotels affected but alignment closer to the HKCC</li> </ul>

It is identified that both Kowloon Point Scheme and Harbour City Scheme are not viable given the current engineering constraints with regard to building resumption, disruption to ferry operation, requirements of harbour protection, and the likelihood that Kowloon Point Reclamation will not proceed in the near future. On the other hand, the Kowloon Park Drive Scheme has severe drawbacks of YMCA resumption, unacceptable railway alignment and operations due to tight curvature of the track, disruption of Champion trees, and encroachment into Kowloon Park and Kowloon Park Drive Children Playground.

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. A summary of the environmental benefits of the Canton Road Scheme is given below:

- 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 retail outlets along Canton Road would be minimised during the construction phase.
- The use of bored tunnelling along Canton Road will minimise the generation of spoil for this section of tunnels.
- The Canton Road Scheme does not require any reclamation and dredging works which would inevitably affect the marine water quality and ecology.
- The construction works for the Canton Road Scheme would not encroach onto Kowloon Park. All Champion Trees along Haiphong Road would therefore kept intact during the construction phase.
- The current construction method along Salisbury Road will ensure that the Old Fire Station Building (OFSB), a building with heritage value, in the FMPHQ site will be kept intact during the entire construction period. Temporary dismantle is not required.

Canton Road Scheme is therefore considered to be the preferred option.

### 3. CONSTRUCTION METHODOLOGIES FOR THE SELECTED ROUTE ALIGNMENT

A number of construction methodologies have been considered for tunnelling during the design process, including cut-&-cover tunnelling, bored tunnelling, and mined tunnelling. The environmental benefits and disbenefits of the construction methodologies have been addressed in the EIA report. The key construction elements along the alignment is summarised in the table below (**Figures 3-1-1 to 3-1-3**).

**Table 3.1** – Summary of key construction elements

Tunnel Section	Construction method	Reasons
Tunnels under Salisbury Road	Cut & cover	<ul style="list-style-type: none"> <li>Bored tunnelling is impracticable due to insufficient soil cover to achieve the arching effect for safe operation and space constraint imposed by the presence of existing MTR tunnels, the New World Subway near Nathan Road, and the East Rail Extension.</li> </ul>
Underground tunnel beneath the existing FMPHQ site and OFSB.	Mined Tunnelling	<ul style="list-style-type: none"> <li>Bored tunnelling is not preferred due to relatively small radius curve and the high risk of tunnel collapse due to minimal separation between tunnels.</li> <li>Mined tunnelling (drill &amp; blast) is adopted. A clear separation of 6m between the tunnels and the OFSB, and 16m from the Main Building will be maintained.</li> </ul>
Tunnel between Canton Road & WKN (with an Emergency Egress Point at the south of Canton Road)	Bored tunnelling	<ul style="list-style-type: none"> <li>Bored tunnelling is preferred as most of the construction activities will be conducted underground (except for ground treatment and construction of shafts), the associated construction noise and dust impacts will be much less than the cut &amp; cover option. Disruption to the retail outlets along Canton Road will be minimized.</li> </ul>
WKN, station entrances & associated facilities	Cut & cover	<ul style="list-style-type: none"> <li>Construction of station concourse, entrances, back-of-house areas would require cut-&amp;-cover approach regardless of the tunnelling method. Use of bored tunnelling in this section would therefore have no environmental benefits.</li> </ul>
Tunnel from WKN to Cherry Street.	Cut & cover	<ul style="list-style-type: none"> <li>Bored tunnelling is not practicable due to the width constraints to tunnelling imposed by YMT Highway Interchange foundations.</li> <li>If bored tunnelling is used for south of Cherry Street, the most appropriate location for the TBM retrieval shafts would be in the YMT Ventilation Building site. The presence of pocket track and box culverts to the north of WKN also supports the cut-&amp;-cover method. The length of bored tunnelling for the remaining tunnel section will only be as short as about 500m and its benefit is limited to a few numbers of sensitive receivers in this area.</li> <li>Use of cut-&amp;-cover would have a programme advantage of about 9 months over bored tunnelling. Bored tunnel is therefore not adopted.</li> </ul>
Tunnel underneath Cherry Street	Cut & cover	<ul style="list-style-type: none"> <li>Bored tunnelling is not practical due to the width constraints to tunnelling imposed by the foundations of the adjacent Olympic Station and Olympic City II.</li> </ul>
Underground tunnel between Cherry Street and WR Nam Cheong Station	Cut & cover	<ul style="list-style-type: none"> <li>Bored tunnelling is not practicable for the WR interface section because of insufficient soil cover and the relatively high gradient.</li> </ul>

#### 4. CONSTRUCTION DUST IMPACT ASSESSMENT

Construction dust will be potentially generated from soil excavation activities, backfilling, wind erosion of all open sites, storage of spoil on site, transportation / handling of spoil, underground blasting activities, as well as loading and unloading of excavated materials at barging facility and stockpiles.

Temporary decks will be installed along Salisbury Road, mucking out locations along Canton Road, and the WKN northern 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. For the mined and bored tunnel sections, as most of the works will be performed underground, dust will only be generated during excavation and reinstatement of the access shafts.

Dust impact assessments have been carried out in accordance with TM-EIA, on the basis of the USEPA AP-42 dust emission factor. Results indicate that the predicted 1-hour and 24-hour averaged TSP concentrations at some sensitive receivers will exceed the TM-EIA requirements of  $500\mu\text{g}/\text{m}^3$  during the construction of KSL under the “unmitigated” scenario. However, with proper watering throughout the construction phase (at least four times a day for WKN and at least twice a day for the other sections, as indicated in **Figure 4-1**), dust impact could be effectively mitigated to within the TM-EIA requirement at all ASRs. There would be no adverse dust impact caused by construction of KSL.

The cumulative impacts caused by the concurrent projects have been addressed in the EIA based on the latest available information. It has been concluded that there will be no adverse cumulative dust impact during the period of concurrent construction for the projects.

Appropriate dust suppression measures have been also recommended in the EIA report. By implementing appropriate control measures and good construction site practice, no residual dust impacts are anticipated. The Contractor should follow the procedures and requirements (key mitigation measures include proper watering, vehicle washing facilities, covering temporary stockpiles by impervious sheeting etc) given in the Air Pollution Control (Construction Dust) Regulation, and also implement an environmental audit and monitoring programme during the construction phase to ensure that the construction dust impacts are controlled to within the Hong Kong Air Quality Objectives (HKAQO).

#### 5. AIRBORNE NOISE IMPACT ASSESSMENT

##### 5.1 Construction Noise

Potential impacts on Noise Sensitive Receivers (NSRs) during the construction phase will arise mainly from Powered Mechanical Equipment (PME) to be operated. The major construction works would include site clearance and formation activities, building/ structure demolition, station construction, tunnel construction, installation of diaphragm walls or pipe pile walls, underpinning subway, piers and footbridge, diversion of box culverts, spoils removal from underground works & stockpiling, backfilling and reinstatement works, and barging activities. For cut-&-cover sections along Salisbury Road, mucking out locations along Canton Road, and WKN northern tunnel section 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 under the decks to minimise the noise impacts during construction.

Assessment results indicate that adverse construction noise impacts are predicted at most of the NSRs under “unmitigated” scenario. Suitable noise mitigation measures are therefore proposed in the EIA study to minimise the construction noise impact. These include:

- Good site practices such as orientating the noisy plants away from the nearby NSRs, intermittent uses of plants, proper fitting of silencers and mufflers on the construction equipment, etc;
- Use of site hoarding as noise barrier to screen noise at low level of NSRs;
- Use of movable barriers, enclosures and acoustic mat to screen noise from generally static noisy plants such as air compressor, generators, handheld breakers, pipe pile rigs, circular saw, drill hole machine, and grout pump, etc;
- Scheduling of construction works outside school examination periods in critical area; and
- Use of quiet plant and working methods.

With the implementation of the above recommended mitigation measures, the predicted construction noise level could be reduced by up to 10dB(A). However, the construction noise levels at Canton Road Government School, Lai Chack Middle School, Man King Building, Man Fai Building, Olympian City Phase 3 development will still exceed the criteria. Other specific mitigation measures including temporary noise barrier for particular PME and sequencing of construction activities have been considered.

All practicable noise mitigation measures have been used exhaustively in order to reduce the impacts to the maximum practicable extent (**Figure 5-1**). Nonetheless, there are still 3 sensitive receivers that will be subject to minor and short-term residual impacts. Table 5-1 summarises the durations and magnitude of residual impacts at the affected NSRs.

**Table 5-1** : Residual construction noise impacts

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

Since all the practicable direct noise mitigation measures have been exhausted, indirect technical remedies (ITR) in the form of upgraded windows and provision of air-conditioning have been considered by the Project Proponent as the last resort for mitigating residual construction noise impacts. Results indicate that none of the above NSRs would be qualified for ITR, given the following eligibility criteria:

- A residual impact of 5dB(A) or more; and
- A duration of noise exceedance of equal or more than 1 month.

Cumulative construction noise impacts caused by the concurrent projects have been assessed, based on the latest information. The cumulative impacts due to the concurrent projects are generally not significant. Hence, no additional mitigation measures are required under KSL project.

Since bored tunnelling will be carried out along Canton Road, the launching shaft at the south of WKN would need to operate for 24 hours. In order to meet the stipulated criteria, it is recommended to install a noise insulating cover at the launching shaft. This cover shall be shut during night-time to shelter the construction plant items inside.

## 5.2 Operational Airborne Noise

The majority of the tracks for this project will be underground except for a 150m section interfacing with WR Nam Cheong Station. This short section is provided within a concrete tunnel box, and hence adverse operational train noise impacts are not anticipated. However, operational noise will emanate from the tunnel ventilation fans, transformers, pumps, ventilation shaft, and fresh water cooling facilities. The EIA study has established the maximum allowable Sound Power Levels (SWL) for all above-grade louvres and ventilation plants, with regard to the separation distances and orientation from the nearest NSRs, cumulative noise impacts from other noise sources, as well as tonality, impulsiveness, and intermittency based on the relevant Technical Memorandum. These predicted maximum allowable SWLs should be implemented during the design development in order to meet the relevant legislative requirements.

In addition, the detailed design should also incorporate the following good practice in order to minimise the operational noise nuisance on the neighbouring NSRs:

- Louvres should be orientated away from adjacent NSRs;
- Adequate direct noise mitigation measures including silencers, acoustic louvers, acoustic enclosures should be adopted.
- The facade for these plant areas / ventilation shafts should have adequate sound insulation properties.

With proper implementation of the above noise control measures, adverse operational noise impacts are not anticipated.

## 6. GROUNDBORNE NOISE IMPACT ASSESSMENT

### 6.1 Construction Groundborne Noise

Potential construction groundborne noise impacts would arise mainly from rock breaking activities, tunnel boring etc. Other construction activities such as lorry movement, concreting, road paving etc are unlikely to generate significant groundborne noise. The noise impacts on neighbouring sensitive receivers (including Hong Kong Cultural Centre, Hong Kong Space Museum, hotels, residential premises and schools) 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 on the NSRs.

### 6.2 Operational Groundborne Noise

Trains operating in KSL would give rise to groundborne vibration which will be re-radiated as noise and affect the sensitive receivers (e.g. performance venues, hotels and residential premises etc). Groundborne noise assessment has been conducted based on established methodology. Results indicate that special trackforms are required to provide sufficient attenuation to meet the stipulated criteria, and there would not be any residual impacts.

## 7. WATER QUALITY IMPACT ASSESSMENT

There will be no dredging activities or marine work platform construction for the project. Potential water pollution sources during construction phase will include sources mainly from land activities, including construction runoff, runoff from tunnelling activities and underground works, sewage effluent due to workforce, drainage diversion, and groundwater from potential decontamination activities.

The Contractor is required to implement good site practices as stipulated in ProPECC Note 5/93 “Drainage Plan subject to Comment by the Environmental Protection Department”, ProPECC Note 1/94 “Construction Site Drainage” and “Recommended Pollution Control Clauses for Construction Contracts” in order to control the construction site discharges.

The groundwater analytical results for samples at WKN and the tunnel to the north indicate occasionally elevated concentrations 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. However, none of the samples exceed the calculated Risk Based Screening Level, and therefore remedial action is not considered necessary for groundwater. However, the pollution levels have exceeded the respective discharge limits. Hence, all the groundwater during the dewatering process for the excavation of WKN and the tunnels to the north of WKN should be recharged within the site areas.

During the operational phase of the project, potential water pollution sources are identified as the run-off from rail track, station runoff, discharge from fresh water cooling facility, and sewage from station operation. Run-off from rail track could be contaminated with limited amount of grease. Standard silt trap and oil interceptor will be provided to remove the oil, lubricants etc from the waste water before discharging into the stormwater drainage. The flow from the fresh water cooling facility will be discharged to the flushing system and then enter the sewerage system as flushing water. Since station runoff is not contaminated and sewage generated from station will be connected to sewer system, no residual water quality impact is anticipated.

## 8. WASTE MANAGEMENT IMPLICATIONS

The EIA study has assessed the potential environmental impacts associated with the handling and disposal of waste arising from the construction works. It is estimated that about 1,218,800m<sup>3</sup> of construction and demolition (C&D) materials will be excavated and the maximum annual generation of excavated material would be about 638,300m<sup>3</sup> during Year 2005.

Several temporary stockpile locations have been identified to maximise the opportunity of reusing excavated fill material for backfilling and reinstatement works. It is estimated that approximately 331,100m<sup>3</sup> of the inert C&D materials could be reused and the remaining 887,700m<sup>3</sup> would need to be disposed of. The C&D materials to be disposed of will be transported by lorries to the barging facility in West Kowloon Cultural Development (WKCD) site for final disposal at approved Public filling area. The peak hourly flow of lorries carrying C&D materials to the barging facilities for the entire KSL would be approximately 43 veh/hr. The disposal programme of surplus C&D materials is given in the EIA report.

Besides, it is estimated that about 94,900m<sup>3</sup> marine deposits and alluvium will be generated during the construction of KSL. A Sediment Quality Report was prepared and approved in Year 2003 as per the requirements given in the Work Bureau Technical Circular (WBTC) 34/2002 “Management of Dredged / Excavated Sediment”. A few of the samples (**Figure 8-1**) have failed the biological screening and these marine deposits should be therefore disposed of at Type 2

confined marine disposal site. The rest of the marine deposit along the proposed alignment should be assigned for Type 1 open sea disposal.

The Contractor will be requested to prepare a Waste Management Plan to summarise their specific proposal for minimising waste generation, on-site sorting, recycling inert C&D materials, handling of chemical waste etc.

During the operational phase, the station and the associated facilities will generate general refuse, industrial waste and chemical waste. It is anticipated that waste generated by the WKN alone would be approximately 500kg/day. A reputable waste collector should be employed to remove general refuse and industrial wastes from the stations on a daily basis to minimise odour, pest and litter impacts. The requirements given in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes should be followed in the handling of chemical wastes. A trip-ticket system should be operated to monitor all movements of chemical wastes, which will be collected by a licensed collector to licensed facility for final treatment and disposal. With the implementation of recommended mitigation measures, residual impacts are not anticipated for both the construction and operational phases.

## 9. LAND CONTAMINATION ASSESSMENT

The relevant historical information has been reviewed for the land contamination assessment in the EIA study. Site inspection has also been carried out to obtain more information regarding the current industrial activities and to select the sampling locations for contamination assessment. The potential land contamination areas are identified as below:

- Diesel and petrol contamination from the two underground oil storage tanks inside TST Fire Station, which is at approximately 60m to the west of the alignment;
- Contamination from the ex-dockyard site at West Kowloon Reclamation between the Canton Road Government Offices and TST Fire Station;
- Residual marine deposits contamination from the ex-government maintenance workshop located at the waterfront of the Canton Road Government Office;
- Contaminated marine deposits from the West Kowloon Reclamation Area;
- Diesel contamination from the two underground tanks for petrol filling station located at Skyway House which is at approximately 50m from the alignment;
- Contamination from past industrial activities next to Skyway House; and
- Contaminated marine deposits from ex-shipyard operation near Tung Chow Street Park.

Five drillholes were selected for soil and groundwater analysis and a total of 33 soil samples have been collected. Results indicate that a small quantity of 39m<sup>3</sup> of soil (1.0 - 2.0m below ground level) has been contaminated by Lead at one of the drillholes (**Figure 9-1**). Different 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 as a last resort, and the contaminated soil has been tested to be acceptable for landfill disposal in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) testing. Specification for the remedial works covering the disposal methodology, requirements for compliance testing, and the need for protective and safety measures has been also prepared in the EIA report.

## 10. HAZARD ASSESSMENT

According to the latest design information, there will not be overnight storage of explosive and hence there is no potential hazard impact.

## 11. LANDSCAPE AND VISUAL IMPACT ASSESSMENT

All landscape resources and landscape character areas in the vicinity of the alignment have been identified, including the Champion trees in the Kowloon Park Drive Children's Playground (KPDCP) and along Haiphong Road. All the visually sensitive receivers within the visual envelopes during the construction and operational phases have been identified and their impacts have been evaluated. All these Champion trees will be kept intact during both the construction and operational phases of the KSL.

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. A comprehensive package of landscape and visual mitigation measures has been recommended. **Figures 11-1 and 11-2** indicate the indicative appearance after 10 years of the WKN, CRPB and YMT Ventilation Building.

### 11.1 Construction Phase Landscape and Visual Impacts

This assessment is based on the following assessment 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 maximize the preservation of the trees of good 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;
- There will be no impacts on Champion Trees<sup>2</sup>;
- There will be no impacts on any trees in the site of the FMPHQ 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.

After implementation of the mitigation measures (including the use of clean and tidy hoardings, minimise soil erosion, transplanting of trees etc), there will still be some landscape and visual impacts caused by cut-&-cover construction techniques and the associated temporary noise barriers and temporary traffic arrangements, which are unavoidable for an essentially subterranean project in an urbanised district.

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<sup>2</sup> Champion Trees are trees listed in the Urban Council publication "Champion Trees in Hong Kong" (Chinese Edition, 1998) by Dr C Y Jim.

The most significant construction phase residual landscape and visual impacts would be of substantial significance for the temporary working areas at Nam Cheong Park, Salisbury Road, Canton Road (Southern section), forecourt at Olympian City 2 development, and the Public Open Space at Corner of Canton Road and Kowloon Park Drive. These impacts, although significant, are relatively temporary in nature.

## 11.2 Operation Phase Landscape and Visual Impacts

Landscape and visual impacts in the operational phase would potentially be caused by the residual impacts of trees lost during the construction phase, and by the permanent built structures including the YMT Ventilation Building, CRPB, WKN, and Emergency Egress Point.

However, with the implementation of the proposed mitigation measures and after 10 years growth of compensatory tree planting, the residual landscape and visual impacts in the operational phase would be insubstantial, 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 due to the proposed CRPB.

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 500sq.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 WKN building (at least 400sq.m.), with shade tree planting; and
- There will be no further tree impacts in addition to those affected during the construction phase.

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 ASSESSMENT

### 12.1 Archaeology

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 exist is extremely low and hence, the archaeological potential of these areas is also extremely low. Before commencement of the construction work, the Contractor shall consult Antiquities and Monuments Office (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.

## 12.2 Built Heritage

The only resources that will require mitigation measures are the buildings that are part of the FMPHQ (a Declared Monument) and the OFSB Accommodation Block (a Grade II Building), and the Old Fire Station Main Hall (a Grade III building).

The OFSB on Salisbury Road will be impacted by the tunnelling work. However, use of mined tunnelling can avoid physical contact with these heritage buildings. Structural monitoring will also be conducted throughout the construction of the tunnel underneath the FMPHQ compound, including the former headquarters building and a small outbuilding at its rear, the former stables, the former signal tower and the air-raid tunnel section to be preserved to ensure compliance with the Building Ordinance requirements. The Contractor should also monitor the structural integrity of the two OFSB on site and carry out necessary remedial actions in order to protect these buildings. Liaison with the FMPHQ developer has indicated that they will 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.

## 13. ENVIRONMENTAL MONITORING AND AUDITING REQUIREMENTS

It is recommended to implement an Environmental Monitoring and Audit (EM&A) programme throughout the entire construction period to regularly monitor the environmental impacts on the neighbouring sensitive receivers. The EM&A manual will be prepared as a standalone document to specify the monitoring requirements, time frame and responsibilities for the implementation of the environmental mitigation measures identified in the EIA process.

For construction noise, in particular, the Contractor will be requested to implement and operate a continuous noise monitoring mechanism throughout the entire construction period of the Project. In cases where exceedances are found, immediate actions should be taken to implement remediation measures following the procedures specified in the EM&A Manual. KCRC will also 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.

## 14. CONCLUSION

The proposed 3.7km long underground KSL is constructed to improve the accessibility to Tsim Sha Tsui and West Kowloon districts, connecting the new KCRC East TST Station to the West Rail Nam Cheong Station, with its alignment running under Salisbury Road, Canton Road and West Kowloon Reclamation area. It is estimated that a total population of about 763,700 planned by Year 2011 for Sham Shui Po district and Yau Tsim Mong district will be directly benefited by the operation of KSL.

A more environmental friendly construction methodology, bored tunnelling, will be adopted along Canton Road in order to minimise environmental impacts and disturbance to hotels, commercial premises, and residential buildings along both sides of the road. Whilst cut-&-cover activities are still required for the retrieval shaft and the associated ventilation buildings, temporary decking will be installed to avoid traffic disruption and minimise construction noise and dust impacts.

An EIA has been undertaken in accordance with the requirements of the TM-EIAO and the Study Brief (Ref No. ESB-097/2002). The scopes of the EIA study include the impact assessment of construction dust, airborne noise, groundborne noise, water quality, waste management, land

contamination, landscape and visual, cultural heritage, and hazard. A list of mitigation measures has been recommended to protect the potential sensitive receivers to the maximum practicable extent. Residual environmental impacts are not anticipated except for temporary construction noise impacts at some of the noise sensitive receivers, landscape and visual impacts during construction stage. However, the loss of roadside trees, the landscape and visual impacts caused by the ventilation buildings and WKN will be of insubstantial significance after implementing the recommended mitigation measures and the proposed tree planting becomes mature in the future.