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FINAL REPORT

CONSULTING SERVICES BY ENVIRONMENTAL RESOURCES MANAGEMENT

Mass Transit Railway Corporation

Tseung Kwan O Extension Phase II: *Environmental Impact Assessment*

December 1997

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ERM

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Reference C1365/73891

For and on behalf of ERM-Hong Kong, Ltd

Approved by: FREEMAN CHEUNG

Signed:

Position: Technical Director

Date: 31 December 1997

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1 INTRODUCTION

1.1 Background To The Study

1.1.1 Maunsell Consultants Asia Ltd, in association with MVA, Parsons Brinckerhoff, Urbis, Dennis Lau & Ng Chun Man, Design Research Unit and ERM Hong Kong, were commissioned by the Mass Transit Railway Corporation (MTRC) to undertake the Feasibility Study and Preliminary Design for the Tseung Kwan O Extension (TKE). During the final stages of the Study, ERM Hong Kong produced the *Tseung Kwan O Extension Detailed Environmental Impact Assessment Report, Maunsell Consultants (Asia) Ltd, July 1997* (TKE Phase I DEIA) to determine the environmental impacts which could arise from the construction and operation of the railway and to identify suitable mitigation measures to control any adverse impacts. This Report was endorsed by the Advisory Council on the Environment in August 1997.

1.1.2 The TKE Phase I DEIA established the environmental performance criteria to be applied during the construction and operation of the TKE and for inclusion in the Tender requirements for the Detailed Design and Construct (DDC) Contract. The successful Tenderer will be required to demonstrate that his preferred construction methodology will meet the performance criteria established in this Report regardless of the similarities or differences between the two methodologies.

1.1.3 It is now proposed that the depot for the Mass Transit Railway Corporation's Tseung Kwan O Extension be located in Area 86 Tseung Kwan O (TKO). This will require the construction of a spur line to the depot and a station in Area 86 (TKE Phase II). The spur line will leave the main line just east of TKO Station, running below ground in cut and cover tunnel as far as the boundaries of Areas 47 and 108, running in rock tunnel below Areas 47, 50, 108, 78 and 106, finally emerging at ground level in the north-east corner of Area 86.

1.1.4 The depot, station and associated track will be covered by a podium structure, the development above the podium and over the rest of Area 86 has been broadly dealt with under the *Tseung Kwan O Area 86 Planning Study, Maunsell et al, 1997.*

1.1.5 The TKE Phase II will be constructed using methods already assessed in the Phase I DEIA and will have the same operational characteristics for the railway, depot and station as those considered in the Phase I DEIA. This Study, the TKE Phase II DEIA will, therefore, be based on the original EIA Study Brief and utilise the assessment methodologies established for the previous Phase I DEIA, to identify potentially adverse impacts and to determine suitable mitigation measures.

1.1.6 As the timing of the Phase I and Phase II works is expected to be the same, this Study will also consider the cumulative effects of the works for both phases where appropriate. The main area of overlap will be in the Tseung Kwan O to Hang Hau section where the cut and cover tunnel works for the Phase II alignment are in close proximity to the Phase I cut and cover tunnels and station

works.

1.2 The MTRC Tseung Kwan O Extension

1.2.1 The Government's *Railway Development Strategy Report* of December 1994, identified the need for a line to serve the Tseung Kwan O Development Area which is expected to develop a population of 250,000 by 2001 and 450,000 by 2011. MTRC are proposing to build a new railway line, principally to serve the new town of Tseung Kwan O to the east of Kowloon and to provide improved public transport in the area. Phase I of the TKE will provide links from the existing Kwun Tong Line at Lam Tin Station and the Hong Kong Island Line at Quarry Bay and North Point. The new line will run eastward via Yau Tong, Tiu Keng Leng, Tseung Kwan O and Hang Hau to Po Lam.

1.2.2 Phase II of the TKE is proposed to consist of a spur line which will leave the main line just east of TKO Station, run below ground in cut and cover tunnel as far as the boundaries of Areas 47 and 108, in rock tunnel below Areas 47, 50, 108, 78 and 106 and finally emerge at ground level in the north-east corner of Area 86 where it will run under a podium to the depot and station.

1.2.3 The construction programme for the TKE Phase II is planned to commence in early 1999 with a completion date of late 2002. The construction sites will follow the alignment with:

- Site A covering the cut and cover section from TKO station to the southern spur portal;
- Site B covering the section to the northern spur portal;
- Site C providing an access adit to the northern section of rock tunnel;
- Site D an access adit for a ventilation building (the exact location has yet to be determined);
- Site E an access adit for the southern section of rock tunnel; and
- the main depot and station site.

1.2.4 The potential for landfill gas and leachate impacts upon the proposed station and depot and podium in Area 86 has been identified. A landfill gas and leachate hazards assessment is being undertaken in parallel to this DEIA and the findings will be presented after gas and leachate sampling are completed in early 1998. Any requirements for monitoring of landfill gas and/or leachate will be fully implemented as part of the overall environmental monitoring and audit programme for the Project and any protective engineering measures that are identified in the hazard assessment will be incorporated into the design of the railway structures.

1.2.5 The TKE Phase II alignment and the work site locations are shown in *Figure 1.2a*.

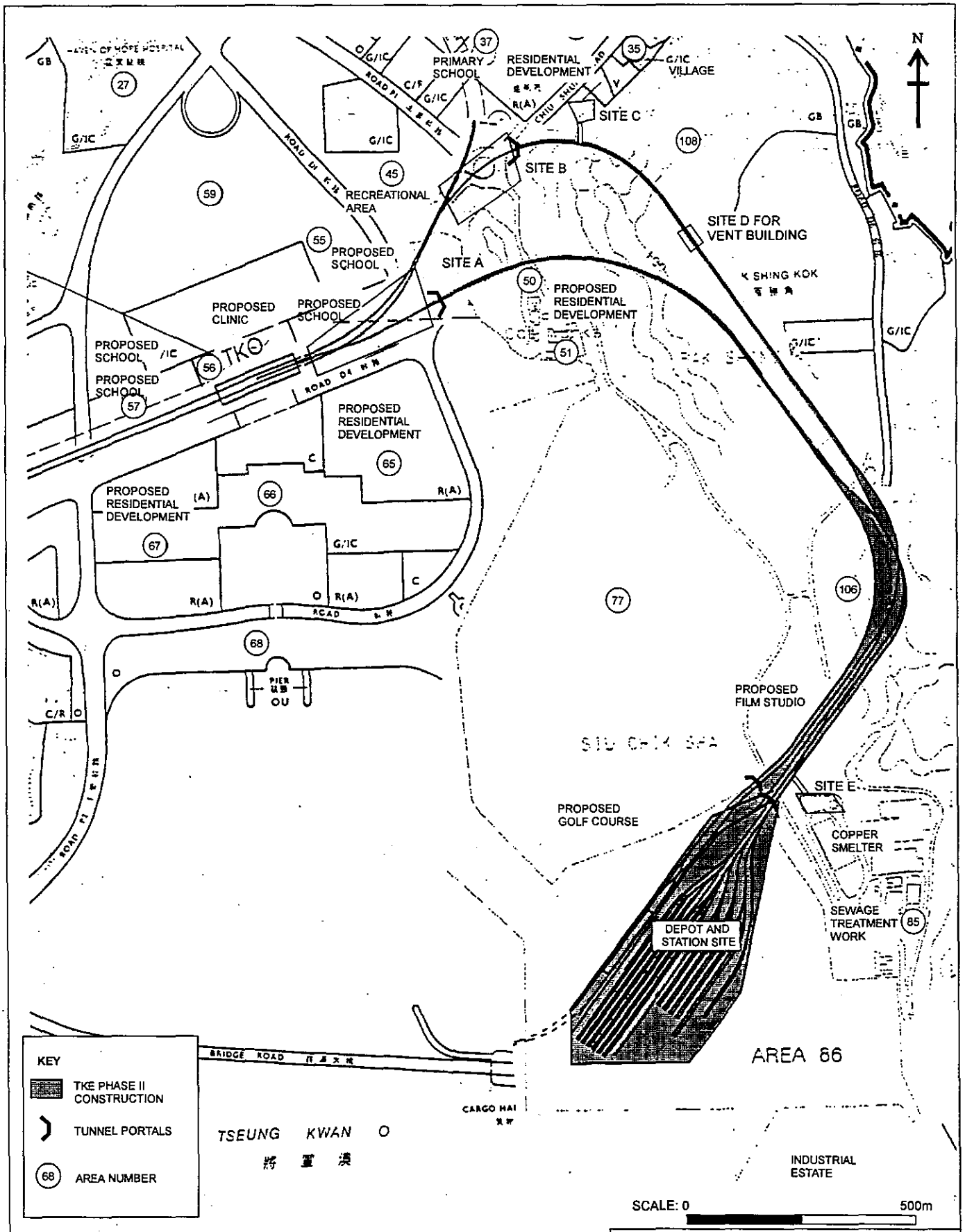

FIGURE 1.2a - TSUENG KWAN O EXTENSION PHASE II

Environmental Resources Management

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1.3 Objectives of the Detailed Environmental Impact Assessment

1.3.1 The specific objectives for the DEIA are to fulfil the requirements of the EPD Environmental Impact Assessment Study Brief, which are:

i) to describe the proposed railway and associated facilities including railway stations and the requirements for their development;

ii) to identify and describe the elements of the existing and planned community and environment likely to be affected by the proposed railway;

iii) to identity and quantify environmental polluting sources and determine the significance of impacts on sensitive receivers and potential affected uses;

iv) to minimize potential pollution and environmental disturbance arising from the development and its operation and during construction of the railway;

v) to identify, predict and evaluate the residual (ie. after practicable mitigation) environmental impacts and cumulative effects from other pollution emitters expected to arise during the construction, operation phases of the proposed railway in relation to the sensitive receivers and potential affected uses;

vi) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction, operation of the railway which are necessary to mitigate these impacts and reduce them to acceptable levels;

vii) to design and specify the environmental monitoring and audit requirements necessary to ensure the implementation and the effectiveness of the environmental performance and pollution control measures adopted;

viii) to investigate the extent of side-effects of proposed mitigation measures that may lead to other forms of impacts;

ix) to identify constraints associated with the mitigation measures recommended in the study; and

x) to identify any additional studies necessary to fulfil the objectives to the requirements of this Environmental Impact Assessment Study.

1.4 Layout of the Report

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

- *Section 2* identifies the air quality impacts, assesses their magnitude and puts forward recommendations for appropriate mitigation measures;
- *Section 3* identifies the noise and vibration impacts and puts forward effective mitigation measures;

- *Section 4* identifies and reviews the water quality impacts and puts forward effective mitigation measures;
- *Section 5* addresses the solid waste management implications, considers waste reduction and disposal options and identifies control and mitigation measures;
- *Section 6* reviews the land use and visual impacts and puts forward proposals for necessary mitigation;
- *Section 7* identifies the ecological impacts and provides recommendations for suitable mitigation measures;
- *Section 8* identifies the environmental monitoring and audit requirements and provides recommendations for their application; and
- *Section 9* discusses the overall conclusions arising from the DEIA.

2 AIR QUALITY

2.1 Introduction

2.1.1 This *Section* addresses the air quality impacts associated with the construction and operational activities of the TKE Phase II and is concerned with identifying the likely dust impacts during the construction of the alignment, depot and tunnels. Activities including ground excavation, drill and blast tunnelling and spoil handling will be assessed. As the entire alignment will be either below ground, or covered, sources of operational impacts will be limited to the railway and depot ventilation systems.

2.1.2 During the construction phase, there will be dust impacts from materials handling and earth moving activities and gaseous emissions from trucks and powered mechanical equipment which may affect the nearby sensitive uses of the area. The extent of the impacts depends on the distances between the work sites and the sensitive receivers (buffer distance), the mode of construction employed and the numbers of plant and vehicles used.

2.1.3 Impacts from the exhaust emissions of construction plant should be limited due to the relatively small numbers of plant involved within the construction sites and need not be addressed in this Study.

2.2 Government Legislation and Standards

2.2.1 The principal legislation for the management of air quality is the *Air Pollution Control Ordinance* (APCO) (Cap 311). The whole of the Hong Kong Special Administrative Region (SAR) is covered by the Hong Kong *Air Quality Objectives* (AQOs) which stipulate the statutory limits of air pollutants and the maximum allowable numbers of exceedances over specific periods, these are shown in *Table 2.2a*. A limit value for 1-hour total suspended particulates (TSP) of 500 $\mu g\ m^{-3}$, which should not be exceeded at ASRs, is stated in the *Technical Memorandum on Environmental Impact Assessment Process* and will also be used in this study.

2.2.2 The *Air Pollution Control (Open Burning) Regulation*, made under the APCO, prohibits open burning for the purposes *inter alia* of the disposal of construction waste or the clearance of a site in preparation for construction works.

2.3 Existing and Future Baseline Conditions

2.3.1 The majority of land uses close to the TKE Phase II alignment are designated for residential, educational and industrial purposes.

Table 2.2a Hong Kong Air Quality Objectives ($\mu g\ m^{-3}$)(i)

	Averaging Time				
	1 hr(ii)	8 hr(iii)	24 hr(iii)	3 Months(iv)	1 Year(iv)
Sulphur Dioxide	800	-	350	-	80
Total Suspended Particulate	-	-	260	-	80
Respirable(v) Suspended Particulate	-	-	180	-	55
Nitrogen Dioxide	300	-	150	-	80
Carbon Monoxide	30000	10000	-	-	-
Photochemical Oxidants as Ozone(vi)	240	-	-	-	-
Lead	-	-	-	1.5	-

(i) Measured at 298K (25°C) and 101.325 kPa (one atmosphere)
(ii) Not to be exceeded more than three times per year.
(iii) Not to be exceeded more than once per year.
(iv) Arithmetic means.
(v) Respirable suspended particulate means suspended particles in air with a nominal aerodynamic diameter of 10 μm and smaller.
(vi) Photochemical oxidants are determined by measurement of ozone only.

2.3.2 TKO is a newly developed district and many of the housing estates and associated facilities are still under construction. Developments are currently located mainly in the north of TKO, whilst reclamation for the southern part of the town is still in progress.

2.3.3 Fugitive dust from the current and proposed construction works is likely to be the major source of air quality impacts. However, large number of diesel powered lorries pass through the area to service the ongoing reclamation works to the south and to deliver waste to the South East New Territories (SENT) landfill. The background air quality is, therefore, currently influenced by both vehicle exhaust and construction works. In the future, with the gradual completion of the reclamation and developments in the new town, the impacts from construction dust will diminish.

2.3.4 The development of the TKO Industrial Estate which is located in Area 87 south-east of the new town means that emissions from industrial premises within the estate will contribute to the background air quality in the nearby area. Therefore, the future background air quality in the vicinity of the dépot and station will be affected by construction dust, traffic and industrial emissions.

2.3.5 Monitoring results at the nearest air monitoring station located in Tseung Kwan O are referenced. The annual averaged TSP level of 77 $\mu g\ m^{-3}$ in the Tseung Kwan O area recorded in 1993 is the only available data and is used in the TKE Phase II study.

2.4 Air Sensitive Receivers

2.4.1 Representative sensitive receivers including residential uses, clinics, schools and academic institutions, and active and passive recreational uses have been identified in accordance with the Hong Kong Planning Standards and Guidelines

(HKPSG). Representative receivers are those that will be the worst affected amongst a group of receivers, where the application of effective mitigation measures for the representative receiver will be sufficient to protect the whole group. The representative potential air sensitive receivers (ASRs) in the vicinity of the proposed TKE Phase II worksites are summarized in *Table 2.4a* below, with their locations shown in *Figure 2.4a*.

2.4.2 The TKE Phase II depot and station are located on newly reclaimed land in Area 86 and the surrounding area has not yet been developed. There will be six proposed worksites (sites A-E and Area 86) and their locations are shown in *Figure 2.4a*.

2.4.2 Representative ASRs have been identified, based on the TKO Outline Zoning Plan (dated 16 July, 1996), four schools and a clinic are proposed to the north, approximately 150 m away from worksites A & B. To the south of sites A & B, in Areas 65 and 67, Private Sector Participation Scheme (PSPS), Home Ownership Scheme (HOS), or Sandwich Class housing will be developed, the PSPS in Area 65 is due for completion in 2000. A residential development is also proposed at Areas 50 and 51. The recreational use of Tseung Kwan O Park is also identified as ASR according to HKPSG. A proposed film studio in Area 106, recreational open space (including a golf driving range, grass pitches and a model car racing track) in Area 77 and the TKO industrial estate in Area 87 are located in the proximity of the proposed worksites. The completion date of all of the above developments are not available, however, these planned developments have been identified to be ASRs in this assessment.

2.4.3 Existing ASRs include a primary school and residential buildings at Area 37, village houses in the southern part of Area 35 and offices at the copper smelter and sewage treatment plant in Area 87 are also identified as ASRs.

2.4.4 The residential and educational uses planned for Area 86 have not been included as ASRs in this Study as they will not be in use until after the construction works are completed and the MTR depot and station facilities will be designed to ensure that no adverse impacts arise during the operation of the railway.

Table 2.4a Identified ASRs in Tseung Kwan O

ASR	Air Sensitive Receivers	Distance from Work Site (m)					
		Site A	Site B	Site C	Site D	Site E	Station & Depot Site
A1	Proposed School, southern part of Area 55	100	300	900	850	1600	1400
A2	Proposed School, eastern part of Area 56	100	400	1000	950	1650	1500
A3	Proposed Clinic, Area 56	150	500	1050	1050	1700	1500
A4	Proposed School, western part of Area 56	200	600	1150	1150	1800	1500
A5	Proposed School, eastern part of Area 57	250	650	1200	1200	1850	1550
A6	Proposed Sandwich Class Housing, Area 67	500	900	1500	1400	1700	1300
A7	Proposed PSPS/HOS, Area 65	100	500	900	800	1300	1100
A8	Proposed TKO Recreational Area, Area 45	300	100	500	550	1750	1650
A9	Primary School, Area 37	500	200	300	600	1900	1850
A10	Residential Development, Yuk Ming Court, Area 37	600	150	100	450	1850	1800
A11	Village Houses, southern part of Area 35	700	350	50	350	1800	1750
A12	Proposed Residential Development, Area 50 & 51	250	400	600	350	1200	1200
A13	Proposed Film Studio, Area 106*	1300	1450	1550	1150	200	200
A14	Copper Smelter, Area 85	1600	1700	1850	1500	30	50
A15	Sewage Treatment Work, Area 85	1650	1750	1900	1500	20	100
A16	Industrial Estate, Area 87	2000	2250	2500	2200	800	100
A17	Recreational Open Space, Area 77	1000	1400	1700	1300	300	50

Note: * Receptor is at an elevation of 40 m above source

2.5 Construction Impacts

Potential Sources of Impact

2.5.1 The principal source of potential air quality impacts during the construction of the TKE Phase II will be dust. Since the surfaces areas of the works are recently reclaimed land, dust from haul roads can be expected to be a major source of impact. Other construction dust sources include site clearance, drill and blast tunnelling, ground excavation, materials handling and transfer off-site and vehicle movement on paved roads from depot, tunnel and alignment construction.

2.5.2 Cut and cover tunnelling will be employed on Sites A and B with 60,000 m^3 of sand excavated at the two sites. Sites C and E will generate about 20,000 m^3 of sand and 170,000 m^3 of rock from bored tunnels. Heavy construction plant will

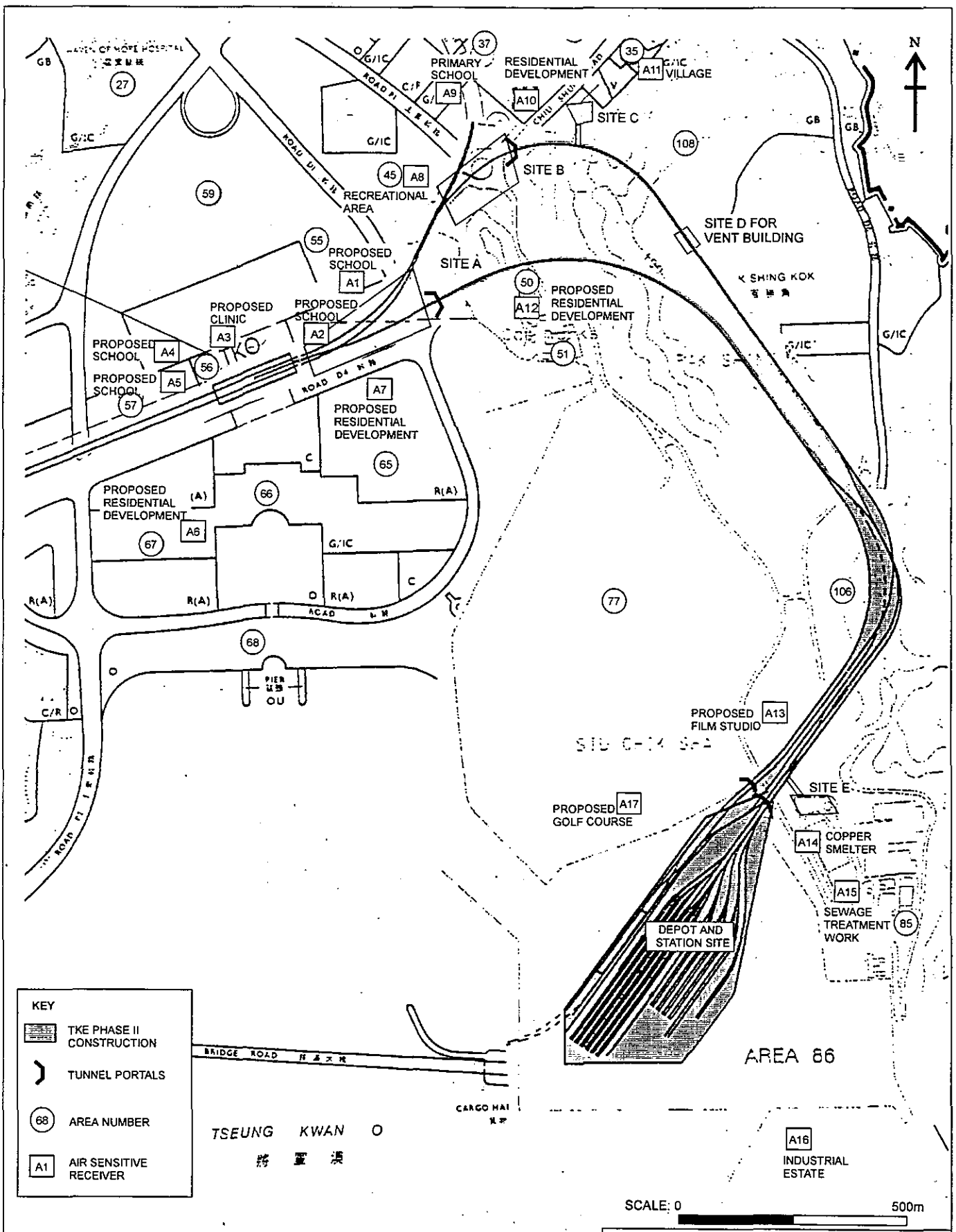

FIGURE 2.4a - TSUENG KWAN O EXTENSION PHASE II
AIR SENSITIVE RECEIVERS

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be operated on Site D and the station and depot site.

Table 2.5a Worksite Spoil Generation and Vehicle Numbers

Worksite Location	Spoil Quantity (m^3)	Number of Vehicles on site[1] (vehicles hr^{-1})
Site A	30,000 soft material from cut & cover	0.9
Site B	30,000 soft material from cut & cover	0.9
Site C	10,000 soft material & 85,000 rock from bored tunnel	1.7
Site E	10,000 soft material & 85,000 rock from bored tunnel	1.7

(1) Number of lorries required estimated assuming a 12 hours working day and a lorry capacity of 8 m^3, this excludes two concrete mixer lorries per hour.

2.6 Assessment Methodology

2.6.1 The assessment will focus on the potential dust impacts from the construction of the railway, tunnels and depot for the TKE Phase II. The tunnels associated with sites A and B will be constructed by means of cut and cover. Drill and blast method will be employed for the rock tunnels (a tunnel boring machine may be used once the tunnel portals are cleared) and the spoil will be handled at Sites C and E.. Excavation, drilling, blasting and materials handling will be the major dusty construction activities. It is assumed that concrete will be delivered by concrete trucks and no concrete batching plants will be required.

2.6.2 The maximum 1-hour and 24-hour TSP concentrations were modelled to assess the likely dust impacts at the identified ASRs, with the assumption of concurrent construction activities taking place at all worksites.

2.6.3 The impact of fugitive dust sources depends on the quantity, as well as the drift potential, of the dust particles injected into the atmosphere. Large dust particles will settle out near the source and particles that are 30-100 μm in diameter are likely to undergo impeded settling. These particles, depending on the extent of atmospheric turbulence, would probably settle within a distance of 100 m from the source. The main dust impact will arise from fine particles, less than 30 μm in diameter, dispersed over greater distance from the sources and identified as Total Suspended Particulate (TSP).

2.6.4 A background TSP level of 77 μg m^{-3} taken from the EPD's Junk Bay Monitoring Station in 1993 was included to estimate the cumulative impacts of the construction dust impacts from the TKE Phase II.

Dispersion Model

2.6.5 The Fugitive Dust Model (FDM) is an air quality model specifically designed for computing concentration and deposition impacts from fugitive dust sources including point, line and area sources. The model was used to predict the extent of impacts from the construction of the alignments, tunnels and depot. Five

categories of dust size were assumed in the model, particle size multipliers for these five categories are established in the Compilation of Air Pollutant Emission Factors, 5th Edition, US Environmental Protection Agency, 1995 (AP-42). The proportion of the emission rate for each dust size established in Section 13.2.2-4, AP-42 was adopted in the model, these are summarised in *Table 2.6a*. The gravitational settling velocity for each dust category was calculated by the FDM.

Table 2.6a Dust size and the Portion of Emission Rate

Dust Size (μm)	Portion of Emission Rate
0 - 2.5	0.095
2.5 - 5.0	0.105
5.0 - 10	0.16
10 - 15	0.14
15 - 30	0.3
30 - 100	0.2

Assessment Parameters

1-Hour TSP Levels

2.6.6 The normal construction hours in Hong Kong are 07.00-19.00, Monday to Saturday and a maximum working period of twelve hours was used with the corresponding meteorological records included in the input data for the FDM. The model predictions were made on an hourly basis for different activities and the predicted TSP levels compared to the recommended hourly target level of 500 $\mu g\ m^{-3}$.

24-hour TSP Levels

2.6.7 Variation of dust emissions with time is not considered in the FDM, therefore, the daily TSP impact was modelled with the default option of a 24-hour averaging period and the meterological data for the period 07.00-19.00. The 24-hour TSP impact was then estimated by multiplying the modelled results by a conversion factor considering the 12 hour construction period which gives about 50% of the 24-hour TSP concentrations from the model. The predicted 24-hour TSP levels were then compared against with the AQO of 260 $\mu g\ m^{-3}$.

Meteorological Input

2.6.8 Sequential 1994 meterological data from the Royal Observatory, for Tseung Kwan O Meterological Station, were used to assess the impacts from general construction works. Meterological data for the corresponding 12-hour working period was selected for modelling. The input data included temperature, wind speed direction, mixing heights and stability classes.

2.6.9 It is anticipated that blasting will take place during the daytime and the stability class D is assumed. Strong winds may give rise to fugitive dust, however, high

wind speed will also enhance dispersion and reduce the extent of dust impact. Wind speeds of 1 m s^{-1}, 2 m s^{-1} and 3 m s^{-1} were used in the model to assess the worst case impacts from blasting.

TSP Emission Rates

2.6.10 This assessment focuses on dust emissions from general construction activities for depot, station and alignment including materials handling, heavy construction (building or road construction) and vehicle movement outside the worksites. Estimations of emission factors have been made in accordance with AP-42. The emission factors used in the modelling assessment are presented in *Table 2.6b* below.

2.6.11 Soft spoil and hard materials in Hong Kong are generally wet, with moisture contents in the order of 10% (referenced to the recent geological study for the *Feasibility Study for Kennedy Town Extension, Working Paper EC2, Initial Geotechnical Interpretation Report, 22 March 1996, MTRC*. The AP-42 equation for the derivation of the emission rate for material handling is based upon a moisture content in the range of 0.25 - 4.8%. The assessment is based, therefore, on material which is more friable than the spoil which will be generated by the works for a worst case scenario, i.e. 4.8%. Typical densities of 2500 kg m^{-3} for rock and 1800 kg m^{-3} for soil were also assumed in the model.

2.6.12 A dust emission rate is established for blasting activity in Table 11.9-1 of Section 11.9-5 of AP-42, this has been applied with an assumed blasting area of 25 m^2 and one blast in any one hour. The highest dust impacts can be expected during the initial excavation stage when blasting takes place at the portal, impacts will diminish as works move inside the tunnel. Dust impacts will also be reduced by the adoption of current best practice for blasting works, including the erection of blasting nets and coverage of the blasting opening by canvas, as required by the Mines and Quarries Division (M&Q) of the Civil Engineering Department (CED).

2.7 Prediction Of Impacts

2.7.1 Dust impacts arising from blasting operations are considered as discrete events, as during blasting, construction works in the vicinity of the blast area will be halted temporarily for safety reasons. The 1-hour TSP levels have been predicted at downwind distances of 5-200 m from the blasting site under wind speeds of 1 m s^{-1}, 2 m s^{-1} and 3 m s^{-1} and the worst case condition is noted to be a wind speed of 1 m s^{-1}. The predicted 1-hour TSP levels are presented in *Table 2.7a.*

Table 2.6b Emission Factors for Construction Activities at Proposed Worksites

Activities	Emission Factor	Remarks
Handling of excavated spoil	0.12 g Mg^{-1}	Based on USEPA AP-42 Vol. 1 5th Edition, Section 13.2.4-4. Emission factor is a function of wind speed and the wind dependent factor is input in the model. Assume moisture content of 4.8%.
Wind erosion	0.85 Mg ha^{-1} yr^{-1}	USEPA AP-42 Vol. 1, 5th Edition, Section 11.19.12.
Heavy construction	2.69 Mg ha^{-1} $Month^{-1}$	USEPA AP-42 Vol. 1, 5th Edition, Section 13.2.3-1. Assume only 30% of activities are operating at a time.
Truck movements on paved haul roads	2.18 g veh^{-1} m^{-1}	USEPA AP-42 Vol. 1, 5th Edition, Section 13.2.2-1. Assume typical silt content of road surface to be 10 %; vehicle speed of 20 kph; vehicle weight of 25 tonnes and 10 wheels per vehicle. 85% reduction for paved haul roads
Blasting	27.5 g $blast^{-1}$	USEPA AP-42 Vol. 1, 5th Edition, Section 11.9-5. Assume blast area with dimension of 5 m x 5 m

Table 2.7a Predicted Blast Dust Concentration ($\mu g\ m^{-3}$)(1)

Down Wind Distance from Blasting site (m)	1-hour TSP levels $\mu g\ m^{-3}$
5	660
10	363
15	234
20	175
25	144
30	126
35	114
40	106
45	101
50	96
100	83
200	79

Note: (1) the background TSP level of 77 $\mu g\ m^{-3}$ is included.

2.7.2 The predicted 1-hour and 24-hour TSP levels arising from the construction work for the TKE Phase II at the identified ASRs, including the background levels of 77 $\mu g\ m^{-3}$, at the ASRs under the worst-case meterological conditions are shown in *Table 2.7b* below.

Table 2.7b Predicted Averaged TSP Concentrations (μg m^{-3})(1)

ASRs	Description	1-hour TSP levels	24-hour TSP levels
A1	Proposed School, southern part of Area 55	157	117
A2	Proposed School, eastern part of Area 56	153	115
A3	Proposed Clinic, Area 56	149	113
A4	Proposed School, western part of Area 56	147	112
A5	Proposed School, eastern part of Area 57	145	111
A6	Proposed Sandwich Class Housing, Area 67	156	117
A7	Proposed PSPS/HOS, Area 65	173	125
A8	Proposed TKO Recreational Area, Area 45	186	131
A9	Primary School, Area 37	173	125
A10	Residential Development, Yuk Ming Court, Area 37	194	136
A11	Village Houses, southern part of Area 35	159	118
A12	Proposed Residential Development, Area 50 & 51	290	183
A13	Proposed Film Studio, Area 106	127	102
A14	Copper Smelter Offices, Area 85	601	339
A15	Sewage Treatment Works Offices, Area 85	405	241
A16	Industrial Estate Offices, Area 87	400	238
A17	Recreational Open Space, Area 77	461	269

Note: (1) the background TSP level of 77 μg m^{-3} is included.

2.8 Evaluation Of Impacts

2.8.1 As shown in *Table 2.7a*, 1-hour TSP levels from blasting at the tunnel portals are predicted to exceeding the recommended 1-hour criteria of 500 μg m^{-3} for a distance of 5-10 m from the blast site. However, the nearest identified ASR (A10 - Yuk Ming Court in Area 37) is located at least 150 m from the tunnel portal where the contribution of dust from blasting towards the total TSP level will be only 4 μg m^{-3}. In addition, the extent of dust impact depends on the blasting area and techniques used. Best practice for the blasting works, required by M&Q, including the erection of blasting nets and coverage of the blasting area with canvas can be expected to be implemented, further reducing TSP levels.

2.8.2 The predicted 1-hour and 24-hour TSP levels arising from the construction activities within the depot, station and alignment worksites are presented in *Table 2.7b*. The modelling results show that the dust levels only exceed the 1-hour or 24-hour criteria at the copper smelter offices in Area 85 (A14) and the 24-hour criterion at the proposed recreational open space in Area 77. Levels approaching the criteria are also predicted at other ASRs close to the depot and station site (A13, A15 and A16).

2.9 Mitigation Measures

2.9.1 Unmitigated construction work has been predicted to cause dust impacts exceeding the established criteria at the two ASRs closest to the depot and station site with high levels at other ASRs in the immediate area. No adverse dust impacts have been predicted in along the rest of the alignment.

2.9.2 The following dust control measures are recommended and should be incorporated in the contract specification to minimise dust emission from the sites:

Drilling and Blasting

- where breaking of rock/concrete is required, watering should be implemented to control dust, water sprays should be used during the handling of excavated material at the site and at active cuts, excavation and fill sites where dust is likely to be generated;
- where drilling of rock is required, dust controls, including watering prior to drilling to wet down the rock face, should be implemented to control fugitive dust; and
- blasting operations should be well arranged and take appropriate precautions to minimize dust generation, such as the use of blast nets, canvas covers and the area within 30 m from the blasting area shall be wetted with water prior to blasting;

Materials Handling

- the heights from which excavated materials are dropped should be controlled to a minimum practical height to limit the fugitive dust generation from unloading;
- all stockpiles of aggregate or spoil of more than 50 m^3 should be enclosed or covered entirely by impervious sheeting or sprayed with water or dust suppression chemical so as to maintain the entire surface wet;

Vehicle Dust

- effective water sprays should be used on the site to dampen potential dust emission sources such as unpaved areas used by site traffic and active construction areas;
- vehicles transporting materials that have the potential to generate dust should have properly fitting side and tail boards;
- materials transported by vehicles should be covered entirely by clean impervious sheeting, with the cover properly secured and extended over the edges of the side and tail boards to ensure that the materials do not leak from the vehicle;

- materials should also be dampened, if necessary, before transportation;
- on-site vehicle speeds should be controlled to reduce dust re-suspension and dispersion by traffic within the sites;
- wheel washing facilities should be provided at the exit of the site to prevent dusty material from being carried off-site on vehicles and deposited on public roads;

Excavation

- the working area of any excavation or earth moving operation should be sprayed with water before and after the operation so as to maintain the entire surface wet;
- the amount of soil exposed and the dust generation potential should be kept as low as possible, this can be accomplished by surface compaction, temporary fabric covers, minimising the extent of exposed soil and the prompt re-vegetation of completed earthworks; and

Site Clearance

- the working area for the uprooting of trees, shrubs, or vegetation or for the removal of boulders, poles, pillars or temporary or permanent structures should be sprayed with water before and after the operation so as to maintain the entire surface wet.

2.9.3 In predicting the likely amount of dust suppression effected by the recommended measures, it has been assumed that there will be a 50% reduction in dust generated by materials handling heavy construction, and a 50% reduction of dust generated by vehicle movements.

2.9.4 The predicted TSP levels were revised on the basis of the recommended dust suppression measures and the results are shown in *Table 2.9a*. These show that the ambient dust levels arising from general construction activities can be reduced to within the criteria at all ASRs. The resulting 1 hour and 24 hour TSP for the copper smelter offices (A14) will then be 345 $\mu g\ m^{-3}$ and 211 $\mu g\ m^{-3}$ respectively, and the 24 hour TSP for the recreational open space (A17) will be 176 $\mu g\ m^{-3}$, which are all within the AQO requirement.

Table 2.9a Mitigated Predicted Averaged TSP Concentrations (μg m^{-3})(1)

Air Sensitive Receivers		1-hour TSP levels	24-hour TSP levels
A1	Proposed School, southern part of Area 55	118	98
A2	Proposed School, eastern part of Area 56	116	97
A3	Proposed Clinic, Area 56	114	96
A4	Proposed School, western part of Area 56	113	95
A5	Proposed School, eastern part of Area 57	112	95
A6	Proposed Sandwich Class Housing, Area 67	118	97
A7	Proposed PSPS/HOS, Area 65	126	102
A8	Proposed TKO Recreational Area, Area 45	132	105
A9	Primary School, Area 37	126	101
A10	Residential Development, Yuk Ming Court, Area 37	137	107
A11	Village Houses, southern part of Area 35	119	98
A12	Proposed Residential Development, Areas 50 & 51	185	131
A13	Proposed Film Studio, Area 106	108	92
A14	Copper Smelter Offices, Area 85	345	211
A15	Sewage Treatment Works Offices, Area 85	245	161
A16	Industrial Estate Offices, Area 87	243	160
A17	Recreational Open Space, Area 77	275	176

Note: (1) the background TSP level of 77 μg m^{-3} is included.

2.10 Cumulative Impacts

2.10.1 The TKE Phase I DEIA also identified potentially adverse dust impacts in the area between Tseung Kwan O town centre and Hang Hau during the construction of the railway and stations. This Study has identified that several ASRs will be affected by both the TKE Phase I and Phase II works, it is also likely that these works will occur at the same time.

2.10.2 Three ASRs, the proposed school in the western part of Area 56 (A4), the primary school in Area 37 (A9) and Yuk Ming Court (A10) could be affected by cumulative impacts which would exceed the established criteria. However, by applying the same additional mitigation measures as those recommended in the TKE Phase I DEIA, 3 m hoardings along the boundary of the works, dust levels can be reduced to within both the 1-hour and 24-hour criteria as shown in *Table 2.10a* below.

Table 2.10a Mitigated Cumulative Dust Levels(1)

ASR	TKE Phase I Level		TKE Phase II Level		Cumulative Level	
	1-Hour	24-Hour	1-Hour	24-Hour	1-Hour	24-Hour
Unmitigated levels						
A4	1232	342	147	112	1302	377
A9	3054	927	173	125	3150	975
A10	1210	240	194	136	1327	299
Levels with all mitigation measures implemented						
A4	431	172	113	95	467	190
A9	449	204	126	101	498	228
A10	390	126	137	107	450	156

Note: (1) All figures include the background level of 77 $\mu g\ m^{-3}$.

2.11 Operational Impacts

2.11.1 No potential air quality impacts during the normal operation of the TKE Phase II have been identified since electric trains will be used and R134a will be used for air conditioning in compliance with the Montreal Protocol.

2.11.2 Ventilation shafts will provide air exchange and air-conditioning for the proposed TKE Phase II and no major air pollutants are expected during normal operations. Nevertheless, the locations and directions of ventilation exhausts should not face directly onto any sensitive receptor. Where possible, inlet and exhaust vents should be directed away from ASRs. This is particularly important as the general air conditioning system within the section would be used for emergency smoke extraction in the event of fire.

2.12 Conclusions

2.12.1 The proposed construction works will be undertaken in partially and fully developed areas, and the majority of land uses close to the construction sites are identified to be ASRs. Unmitigated dust has been identified as the only air quality impact arising during the construction phase of the proposed TKE Phase II. In the absence of any mitigation measures, high dust impacts are predicted at a limited number of the identified ASRs. Excavation works and vehicles moving on haul roads have been identified as the main sources of dust.

2.12.2 Construction methods should be selected to minimise potential impacts and to this end, mitigation measures have been identified and should be incorporated in at the detailed design stage to reduce the likely dust impact of the ASRs to within the identified criteria. Mitigation measures, particularly the wetting of dusty areas and limiting the speeds of trucks on unpaved haul roads should be implemented to control the dust impacts to acceptable levels.

2.12.3 The mitigation measures identified in this *Section* have been recommended, based on the assumption that all sensitive receivers will be occupied during the construction works, to ensure that sufficient protective measures have been identified. However, the measures proposed for specific receivers may not be necessary if the ASR is unoccupied during part or all of the works and any suggested restrictions on site activities should be confirmed at the appropriate stage of the construction programme.

2.12.4 Air quality impacts during operation of the TKE Phase II are not considered to be of concern, however, consideration must be given to the design and orientation of the ventilation shafts which should also be directed away from ASRs to avoid the possibility of potential nuisance.

3 NOISE AND VIBRATION

3.1 Introduction

3.1.1 This *Section* addresses the potential noise impacts associated with the construction and operation of the proposed TKE Phase II. The construction activities associated with the TKE Phase II will occur at a total of six fixed construction sites as well along the actual railway alignment. Potential noise impacts are assessed for each of these sites for all existing and planned noise sensitive receivers in the vicinity. Operational impacts are considered from fixed sources, specifically ventilation systems, and train movements.

3.2 Government Legislation and Standards

3.2.1 It is anticipated that the majority of the construction works will be undertaken during normal working hours (Monday to Saturday 07.00 -19.00), excepting Public Holidays. There are currently no legislative standards in Hong Kong for the control of construction activities during normal working hours. However, a limit of $L_{Aeq,\ 30min}$ 75 dB for dwellings and 70 dB for educational institutions (65 dB during examination periods), have been proposed in *Noise from Construction Activities - Non-Statutory Controls, EPD Practice Note for Professional Persons, May 1993* (ProPECC PN2/93). This target has been applied on major construction projects, and is now generally accepted in Hong Kong. These limits have therefore been adopted in this assessment in order to protect NSRs to an appropriate extent.

3.2.2 The control of construction work other than percussive piling during restricted hours (19.00-07.00 and all day on Sundays and Public Holidays) is governed by the *Noise Control Ordinance* (NCO) and the subsidiary *Technical Memoranda* on *Noise From Construction Work Other Than Percussive Piling* (TM1)

3.2.3 A subsidiary technical memorandum, *Technical Memorandum on Noise from Construction Work in Designated Areas* (TM2), applies to Construction Works during restricted hours, within designated areas as defined by the *Noise Control (Construction Work Designated Areas) Notice, Legal Supplement No 2 to Gazette No. 2/1996, 12 January 1996.*

3.2.4 TM2 covers the use of the following specified powered mechanical equipment: hand-held breaker; bulldozer; concrete lorry mixer; dump truck; and hand-held poker vibrator. The prescribed construction works are: erection or dismantling formwork or scaffolding; loading, unloading or handling of rubble, wooden boards, steel bars, wood or scaffolding material; and hammering.

3.2.5 Construction activities should be planned and controlled in accordance with the NCO. Works requiring the use of powered mechanical equipment (PME) during restricted hours will require a Construction Noise Permit (CNP) and will need to achieve the applicable ANL. The ANL is derived from the Basic Noise Levels (BNL) determined in TM1 by applying corrections for the duration of the works and the effect of any other nearby sites operating under a CNP.

Noise Criteria

3.2.6 Noise from percussive piling and general construction activities which take place during restricted hours are controlled by a CNP system under the NCO. The issue of these permits is at the discretion of Noise Control Authority using the guidance of the appropriate TM and potential noise impacts arising from these activities are considered outside the scope of this study. This assessment therefore relates to general construction activities during normal working hours, the criteria for which have been established using the guidance given in ProPECC PN2/93. These are shown below in *Table 3.2a.*

Table 3.2a Daytime Noise Criteria ProPECC PN2/93 ($L_{Aeq,\,30\,min}$ dB)

Noise Sensitive Receiver	Criteria (0700-2300)
Dwelling	75
School	70 (65 during examinations)

Noise Sensitive Receivers

3.2.7 In accordance with the HKPSG and TM1, the most affected sensitive receivers including residential uses, hospitals, schools and academic institutions, have been identified. Potential representative noise sensitive receivers (NSRs) in the vicinity of the proposed TKE Phase II worksites are summarised in *Table 3.2b* below with their locations shown in *Figure 3.2a.* Representative NSRs are those that will be the worst affected amongst a group of receivers, where the application of effective mitigation measures for the representative receiver will be sufficient to protect the whole group.

3.2.8 The TKE Phase II depot and station are located on newly reclaimed land and the surrounding area has not yet been developed. There will be six proposed worksites (sites A-E and Area 86) and their locations are shown in *Figure 3.2a.*

3.2.9 Representative NSRs for the proposed developments have been identified based on the TKO Outline Zoning Plan (dated 16 July, 1996). These are:

- four schools and a clinic proposed to the north, approximately 150 m away from worksites A & B;
- to the south of sites A & B, in Areas 65 and 67, Private Sector Participation Scheme (PSPS) Home Ownership Scheme (HOS) and Sandwich Class housing will be developed, the PSPS in Area 65 is due for completion in late 2000;
- a residential development is also proposed in Areas 50 and 51.

The completion date of all of the above developments are not available, however, these planned developments have been identified to be representative NSRs in this assessment.

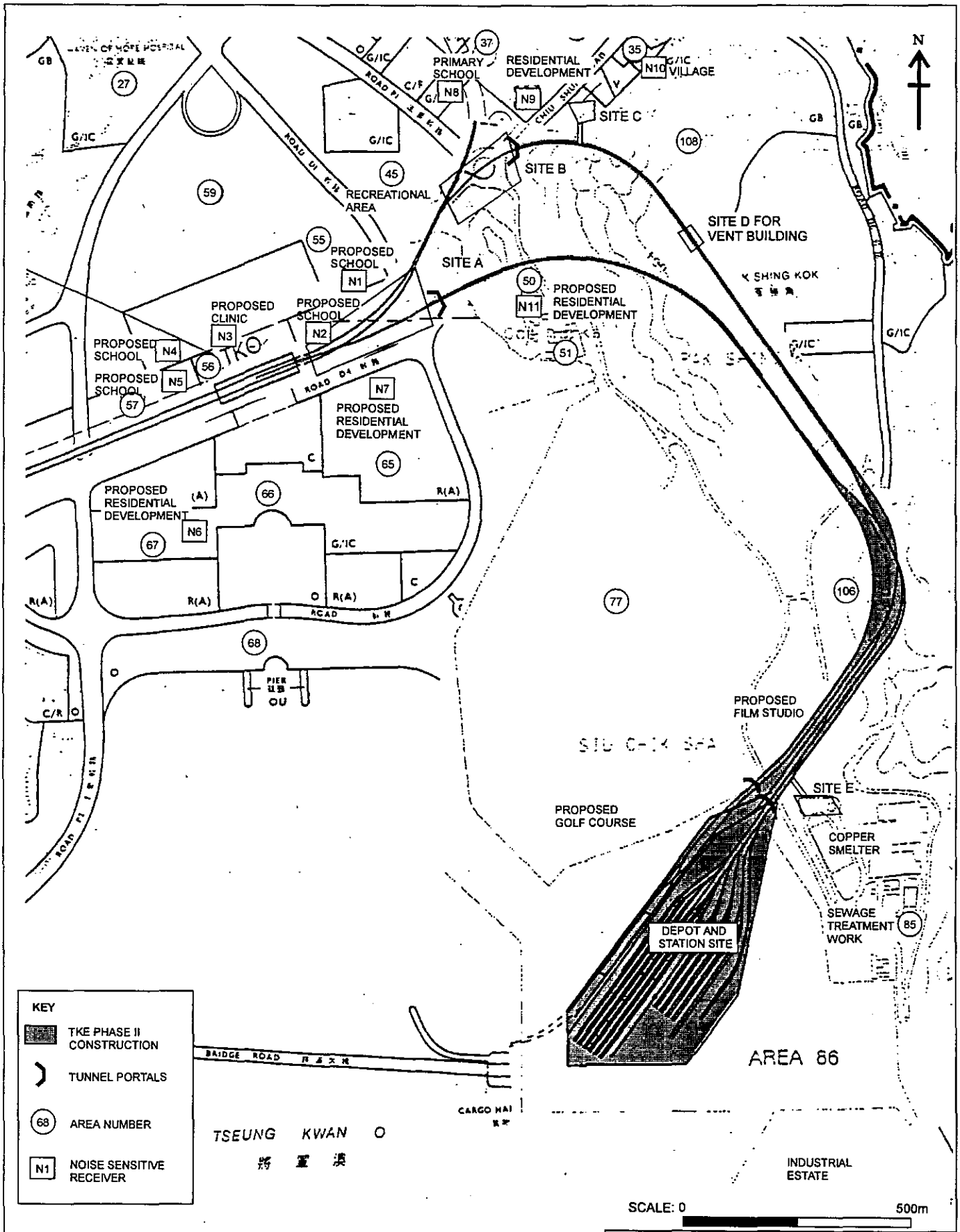

FIGURE 3.2a - TSUENG KWAN O EXTENSION PHASE II
NOISE SENSITIVE RECEIVERS

Environmental Resources Management
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong
ERM

3.2.10 Existing representative NSRs include a primary school and residential buildings in Area 37, as well as village housing in the southern part of Area 35. The distances of the NSRs from the proposed worksites (sites A - E and depot/station) are listed in *Table 3.2b*, with their locations shown in *Figure 3.2a*. The village housing in Area 35 will act as the representative receiver for the planned hospital in Area 32.

3.2.11 The residential and educational uses planned for Area 86 have not been included as NSRs in this Study as they will not be in use until after the construction works are completed. The MTR depot and station facilities will be designed to ensure that no adverse noise impacts are generated at any NSRs during the operation of the railway.

Table 3.2b Noise Sensitive Receivers

	Noise Sensitive Receivers	Distance from Work Site (m)					
		Site A	Site B	Site C	Site D	Site E	Area 86
N1	Proposed School, southern part of Area 55	100	300	900	850	1600	1400
N2	Proposed School, eastern part of Area 56	100	400	1000	950	1650	1500
N3	Proposed Clinic, Area 56	150	500	1050	1050	1700	1500
N4	Proposed School, western part of Area 56	200	600	1150	1150	1800	1500
N5	Proposed School, eastern part of Area 57	250	650	1200	1200	1850	1550
N6	Proposed Sandwich Class Housing, Area 67	500	900	1500	1400	1700	1300
N7	Proposed PSPS/HOS, Area 65	100	500	900	800	1300	1100
N8	Primary School, Area 37	500	200	300	600	1900	1850
N9	Residential Development, Yuk Ming Court, Area 37	600	150	100	450	1850	1800
N10	Village housing, Area 35	700	350	50	350	1800	1750
N11	Proposed Residential Development, Area 50 & 51	250	400	600	350	1200	1200

3.3 Potential Noise Impacts

3.3.1 Each of the separate construction sites has the potential to cause noise impacts at neighbouring noise sensitive receivers. Each is discussed in the following paragraphs.

3.3.2 The construction of the station and depot will take place within TKO Area 86. This is bounded to the south and east by industrial areas and to the north by a proposed recreational open space. The only non-industrial receiver that has been identified within an 1 km radius of this site is a proposed film studio some 500 m to the north of Area 86. Since the proposed film studio is considered a commercial premises and that commercial and industrial premises are not

considered as noise sensitive receivers (NSRs) under the HKPSG, no impacts are likely to arise from general construction work at this site. General construction at this site is not, therefore, considered further in this assessment.

3.3.3 Construction Sites A and B will be used for the construction of cut and cover tunnels and are located at the roundabouts on Chui Shun Road. Each is located in close proximity to a number of proposed noise-sensitive developments, including; schools, a clinic and residential developments.

3.3.4 Construction Site C is a temporary works site for the construction of the bored tunnel. It is located to the north west of Sites A and B and is close to several existing and planned schools and residential dwellings.

3.3.5 Construction Site D will be used for the construction of a mid-tunnel vent building and a magazine for the storage of industrial explosives and is located some 400 m to the south west of Wo Tong Kong village. This site is a considerable distance from all NSRs in the surrounding area and is also screened by the topography of the intervening land. This will provide sufficient attenuation to prevent any adverse noise impacts from this construction site, therefore, this site has not been considered any further in this assessment.

3.3.6 Construction Site E will be for the rock tunnels. It is located north-east of the depot and station site. Since there are no NSRs within 1 km, this site is not considered any further in this assessment.

Rock Tunnelling Works

3.3.7 The entire alignment of the TKE Phase II will be contained within tunnel, the greatest part of which will be within rock tunnel and constructed using specialised tunnelling equipment. No noise impacts are anticipated from these below ground activities. Noise breakout from tunnel ventilation shafts may be adequately controlled by installing silencers to the vents and ensuring that all vents are directed away from the most noise sensitive receivers in the vicinity of the shafts. The SWL of ventilation fans should be limited to avoid potential impacts during the night-time period. The maximum permissible SWLs, based on the nearest NSRs, assuming an ASR rating of B are as follows:

• Site A	95 dB(A)
• Site B	99 dB(A)
• Site C	89 dB(A); and
• station and depot site and Sites D & E	no NSRs, therefore, no SWL limit required.

3.3.8 Noise impacts from below ground tunnelling activities are therefore not considered any further in this assessment.

Blasting

3.3.9 Blasting will be required at all sites during the construction of the tunnel and access adit portals. The control of all blasting operations in Hong Kong is vested

in the Mines and Quarries (M&Q) Division of the Civil Engineering Department (CED). Permits for the storage and use of explosives must be obtained from the M&Q Division which also stipulates particular restrictions on blasting procedures.

3.3.10 The M&Q Division requires an assessment of blasting vibration and its effects on nearby structures to be carried out by qualified blasting specialists, and submitted to them for approval. This assessment will be carried out by the specialist contractor prior to commencement of the works at each site. Hence a detailed assessment of blasting vibration is outside the scope of this study. It should however, be noted that the controls on blasting likely to be required to safeguard nearby structures will provide a degree of noise mitigation of the possible impacts on nearby sensitive landuses.

3.4 Assessment Methodology

3.4.1 A methodology for assessing construction noise other than percussive piling has been developed based on TM1. In general, the methodology is as follows:

- locate NSRs that may be affected by the works;
- calculate distance attenuation to NSRs from notional noise source point;
- predict construction noise levels at NSRs in the absence of any mitigation measures; and
- calculate the maximum total site sound power level (SWL) for construction activities such that noise levels at NSRs comply with appropriate noise criteria.

3.4.2 The distance correction for each NSR with respect to each construction activity is calculated from the distance between the NSR and the worksite notional point. The notional point is established in accordance with TM1.

3.4.3 The noise predictions consider the noise contribution from the various activities that may occur simultaneously in the working areas or in adjacent working areas. Mitigation measures have been considered where noise criteria exceedances are likely. These measures include the use of silenced PME and movable barriers, scheduling of construction activities and reducing the number of noisy plant working simultaneously.

3.5 Prediction of Noise Impacts

3.5.1 Details of the likely construction activities and the appropriate construction plant teams have been estimated and are presented in *Annex A*. These have enabled an inventory of SWLs to be identified for each component of the various plant teams, from which the total SWL for each plant team has been calculated. Construction noise levels have been predicted using the methodology set out in the TM, the results are presented in *Table 3.5a*. All noise levels have been predicted at 1 m from the most exposed facade of each of the NSRs in the vicinity of the individual site. Where a noise sensitive use is planed but the exact layout

unknown, the nearest facade has been assumed to be at the site boundary.

Table 3.5a Predicted Construction Noise Levels, dB $L_{Aeq(30mins)}$

Site/NSR	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Site A											
Vibratory Sheet Piling	**76**	**76**	**73**	**70**	68	62	**76**	62	61	60	68
Bulk Excavation	**77**	**77**	**73**	**71**	69	63	**77**	63	61	60	69
Concreting tunnel	**80**	**80**	**76**	**74**	**72**	66	**80**	66	64	63	72
Shotcreting Tunnel	**80**	**80**	**76**	**74**	**72**	66	**80**	66	64	63	72
Site B											
Vibratory Sheet Piling	67	64	62	61	60	57	62	70	73	66	64
Bulk Excavation	67	65	63	61	61	58	63	**71**	73	66	65
Concreting tunnel	70	68	66	64	63	61	66	**74**	**76**	69	68
Shotcreting Tunnel	70	68	66	64	63	61	66	**74**	**76**	69	68
Site C											
Tunnelling	55	55	54	53	53	51	55	65	75	**81**	59

Note
(1) Criterion is 75 dB(A) for residential developments; N6-N7 and N9-N11.
(2) Criterion is 70 dB(A) for schools (65 dB(A) during examination periods); N1-N2, N4-N5 and N8.
(3) Criteria exceedances are indicated in **bold** type face.
(4) Piling and excavation at Sites A and B will last about 18 months, with tunnel concreting and shotcreting also taking about 18 months. Tunnelling works at Site C will last for approximately 30-36 months.

3.6 Evaluation of Impacts

3.6.1 Construction noise levels are predicted to exceed the recommended day time noise criteria by up to 10 dB(A) at NSRs N1-N2, N4-N5 and N7 as a result of cut-and-cover tunnel construction activities at Site A. Criteria exceedances of up to 4 dB(A) at N8 and N9 are anticipated as a result of construction activities within Site B. Tunnelling activities at Site C are likely to generate criteria exceedances of 6 dB(A) at N10.

3.6.2 It should be noted that the noise levels shown in *Table 3.5a* represent the worst case scenario by assuming that all the available plant items for each phase of works are in use for 100% of the time. In practice this is unlikely to occur as a number of items of plant will operate sequentially and within the constraints of available space within the worksite.

3.7 Recommended Mitigation

3.7.1 Noise emissions from construction sites can be minimised through good site practice, selecting quiet plant and quiet working methods and through the use of temporary barriers. These methods are discussed in the following paragraphs and the results are shown in *Table 3.7a*.

Good Site Practice

3.7.2 Good site practice and noise management can considerably reduce the impact of construction site activities on nearby NSRs. The following package of 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 works;
- machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from NSRs;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction works;
- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

Selecting Quieter Plant and Working Methods

3.7.3 The Contractor may be able to obtain particular models of plant that are quieter than standard types given in the TM. The benefits achievable in this way will depend on the details of the Contractor's chosen methods of working, and it is considered too restrictive to specify that a Contractor has to use specific items of plant for the construction operations. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total sound power level of all plant on the site so that the Contractor is allowed some flexibility to select plant to suit his needs.

3.7.4 It should be noted that various types of silenced equipment can be found in Hong Kong. However, the Noise Control Authority, when processing a CNP application, will apply the noise levels contained in the relevant statutory TM unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration.

Temporary Noise Barriers

3.7.5 In general, noise barriers located between noisy construction activities and NSRs can provide 5 dB(A) reduction from screening (estimated in accordance with TM). It would be possible for the Contractor to provide Movable vertical barriers that can be located close to noisy plant to achieve this level of reduction. Certain types of PME, such as generators and compressors, can be completely enclosed giving a total noise reduction of 10 dB(A) or more.

Scheduling of Construction Activities

3.7.6 Activities may be scheduled to minimise noise generated at certain areas during periods which may be particularly sensitive to noise. For example, noisy construction activities, in close proximity to schools, could be scheduled to avoid examination periods or even to take place during school holidays.

3.7.7 By considering the above methods of mitigation it is possible to develop a mitigation package, which can be adopted to minimise potential noise impacts.

Mitigation Option 1

3.7.8 Mitigation Option 1 utilises quiet plant, where appropriate, and temporary noise barriers. The revised inventory of plant noise data and the corresponding noise calculations are presented in *Tables A2* and *A7-9* in *Annex A*.

3.7.9 The results indicate that Mitigation Option 1 can be successfully used to reduce the number of noise impacts generated by construction activities. However, residual impacts of up to 6 dB(A) are likely at NSRs N1, N2 and N7.

Table 3.7a Mitigated Construction Noise Levels, dB $L_{Aeq(30mins)}$

Site/ NSR	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Site A											
Vibratory Sheet Piling	**76/76/75**	**76/76/75**	**73/73/72**	- / - / -	- / - /-	- / - /-	**76/76/75**	- / - /-	- / - /-	- / - /-	- / - /-
Bulk Excavation	**77/65/-**	**77/65/-**	**73/61/61**	**71/59/-**	- / - /-	- / - /-	**77/65/ -**	- / - /-	- / - /-	- / - /-	- / - /-
Concreting tunnel	**80/71/70**[5]	**80/71/70**[5]	**76/67/ -**	**74/65/-**	**72/63/-**	- / - /-	**80/71/-**	- / - /-	- / - /-	- / - /-	- / - /-
Shotcreting Tunnel	**80/71/70**	**80/71/70**	**76/67/ -**	**74/65/-**	**72/63/-**	- / - /-	**80/71/-**	- / - /-	- / - /-	- / - /-	- / - /-
Site B											
Vibratory Sheet Piling	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-
Bulk Excavation	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	**71/ 59 /-**	- / - /-	- / - /-	- / - /-
Concreting tunnel	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	**74 / 65 /-**	**76 /67 /-**	- / - /-	- / - /-
Shotcreting Tunnel	-/ - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	**74 / 65 /-**	**76 / 67 /-**	- / - /-	- / - /-
Site C											
Tunnelling	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	- / - /-	-/ - /-	**81 / 71 /-**	- / - /-

Notes:
(1) Criterion is 75 dB(A) for residential developments; N6-N7, N9-N11.
(2) Criterion is 70 dB(A) for schools (65 dB(A) during examination periods); N1-N2, N4-N5 and N8.
(3) Noise levels presented represent the following; Unmitigated/Mitigation Option 1/Mitigation Option 2.
(4) Criteria exceedances are indicated in **bold** type face.
(5) Includes specific mitigation measures to control cumulative impacts from Sites A and B.

Mitigation Option 2

3.7.10 Mitigation option 2 will require restrictions on plant operating schedules and percentage on-time for individual items of plant operating within Site A. The plant inventory and noise calculations are presented in *Annex A Tables A3* and *A10* to *A12*, respectively. The results indicate that noise criteria could be met at almost all NSRs during the majority of activities if the percentage on-times of specific plant were limited as follows (see *Annex A Tables A13 - A15*);

- vibratory piling rigs - 80%;
- mixer lorries - 90%; and
- poker vibrator - 80%.

Blasting

3.7.11 Blasting for the construction of the tunnel portals should be controlled within the appropriate guidance provided by the M&Q Division. Whilst it is unlikely that noise impacts from blasting can be prevented altogether, it is possible to minimise potential impacts by adopting good blasting techniques, including providing advance warning of blasts and through the implementation of a public relations programme.

Cumulative Impacts

3.7.12 Construction activities may occur at all three sites simultaneously. Therefore, the potential for cumulative impacts exists. In order to determine possible cumulative impacts it has been assumed that the timing of the construction processes at the cut and cover tunnel sites A and B will coincide, during which time tunnelling will occur at site C. The noise levels from each of the three sites has been combined and the cumulative noise predicted. The results are presented in *Table 3.7b* and assume that Mitigation Option 2 is adopted. Cumulative noise impacts are likely at NSRs N1, N2, N3 and N8 during piling and at N1 and N2 during the concreting and shotcreting phases. Criteria exceedances of up to 4 dB(A) are anticipated.

Table 3.7b ***Cumulative Noise Impacts from TKE Phase II Construction, dB(A)***

NSR	N1	N2	N3	N4	N5	N7	N8	N9	N10
Vibratory Sheet Piling	74	74	72	-	-	-	71	-	-
Bulk Excavation	-	-	-	-	-	-	-	-	-
Concreting Tunnel	71	71	-	-	-	-	-	-	-
Shotcreting Tunnel	71	71	-	-	-	-	-	-	-

Notes:
(1) Criterion is 75 dB(A) for residential developments; N6-N7 and N9-N11.
(2) Criterion is 70 dB(A) for schools (65 dB(A) during examination periods); N1-N2, N4-N5 and N8.
(3) Criteria exceedances are indicated in **bold** type face.

3.7.13 Cumulative impacts at N8 may be prevented by restricting the on-time of the vibratory piling rigs at Site B to 90 %. (see *Annex A Tables A13-15*).

3.7.14 Cumulative impacts during concreting and shotcreting of the tunnel may be avoided by restricting the on-time of the poker vibrators at Site A to 55 % (see *Annex A Tables A13-15*).

3.7.15 Cumulative impacts during the piling phase may be avoided either by significantly restricting the on-time of the piling rigs at both sites A and B, or restricting operations to one site at a time. In order to pile at both locations the on-time of each of the piling rigs would need to be reduced to 23 %. (see *Annex A Tables A13-15*)

3.8 Residual Impacts

3.8.1 Residual impacts are likely at three proposed schools (NSRs N1, N2 and N8) during the piling phase and at N1 and N2 during tunnel concreting and shotcreting. If the schools are in use during the construction works, these residual impacts could be avoided by one of the following options;

- schedule piling phases to coincide with school holidays;
- limit the on-time of the vibratory piling rigs to 23 %;
- restrict piling operations to one site at a time, limiting the on-time of piling rigs within Site A to 25 %; or
- provide noise insulation to the schools and clinic likely to be exposed to noise impacts.

3.8.2 It is considered likely that the proposed restrictions in on-time that have identified above to deal with the residual impacts could act as a major constraint upon the construction programme. It is, therefore, recommended that noise insulation be provided for the affected facades of the schools (N1 and N2) and clinic, unless the contractors can demonstrate clearly that the noise criteria can be achieved without adversely affecting the construction programme.

3.9 Cumulative Noise Impacts

3.9.1 Cumulative noise impacts may arise as a result of simultaneous works on TKE Phase I and Phase II in the Area between Tseung Kwan O and Hang Hau. Cumulative impacts are likely to arise:

- at five NSRs in the vicinity of Tseung Kwan O if the construction of this station coincides with the Phase II construction works at Sites A or B; and

- at two NSRs in Area 37 if the construction of the cut and cover tunnel at Hang Hau coincides with construction activities within Phase II sites, B and C.

3.9.2 The mitigated noise levels predicted in the TKE Phase I DEIA have been reviewed in relation to the predicted mitigated noise levels for TKE Phase II shown in *Table 3.7a* above, to determine the likelihood of cumulative impacts at each of the seven NSRs identified.

3.9.3 The noise contributions from each of the construction activities in Phase I and Phase II which are likely coincide, as well as the predicted cumulative noise level at each NSR is presented in the following *Table 3.9a*.

Table 3.9a Cumulative Construction Noise Impacts, dB $L_{Aeq(30min)}$

NSR	Description	Activity	Phase I	Phase II	Phase II	Total
Tseung Kwan O			TKO Station	Site A	Site B	
N1 NTKO1	Proposed School, southern part of Area 55	Piling	67	**75**	67	**76**
		Excavation	67	65	55	69
		Structures	70	70(4)	61	**73**
N2 NTK02	Proposed School, eastern part of Area 56	Piling	68	**75**	64	**76**
		Excavation	67	65	53	69
		Structures	70	70(4)	59	**73**
N3(3) NTK02	Proposed Clinic, part of Area 56	Piling	68	**72**	62	**74**
		Excavation	67	61	51	69
		Structures	70	67	57	**72**
N5 NTKO3	Proposed School, eastern part of Area 57	Piling	67	67	60	70
		Excavation	67	57	49	67
		Structures	70	63	55	**71**
N6 NTKO5	Proposed Sandwich Class Housing, Area 67	Piling	72	61	57	72
		Excavation	75	51	46	75
		Structures	73	57	52	73
N7 NTK04	Proposed PSPS/HOS, Area 65	Piling	74	75	62	**78**
		Excavation	73	65	51	74
		Structures	71	71	57	74
Hang Hau			Hang Hau	Site B	Site C(3)	
N8 NHAH8	Primary School, Area 37	Piling	66	70	55	**72**
		Excavation	69	59	55	70
		Structures	70	65	55	**71**
N9 NHAH7	Residential Development, Yuk Ming Court, Area 37	Piling	71	72(4)	65	75
		Excavation	74	61	65	75
		Structures	75	67	65	**76**

Note:
(1) Noise criteria exceedances are indicated in **bold** type face.
(2) This NSR was not included in the TKE Phase I DEIA. The levels used in this assessment are equal to those predicted at N2 in the TKE Phase I DEIA which is a similar distance from the construction activities.
(3) The predicted noise level is constant throughout the construction programme at this site.
(4) Includes Mitigation Option 2 plus specific mitigation measures as described in *Section 3.7.13 - 3.7.14*.

3.9.4 The results indicate that cumulative impacts may arise at seven of the eight NSRs identified. Impacts are likely to occur:

- at NSRs N1, N2, N3 and N7 during piling activities at TKO and Site A;
- at N1, N2, N3 and N5 if structures works coincide at TKO and Site A; and
- at N8 during the piling phase and N8 and N9 during the structure phase if construction at the HAH site coincides with construction at Site B.

3.9.5 Four of the seven NSRs which are likely to experience cumulative noise impacts are schools. The impacts at these schools can be avoided if noisy activities are scheduled to take place during school holidays, or by imposing restrictions on the number of plant operating simultaneously at each site. Similarly, further noise reductions could be achieved at the clinic through additional restrictions on active plant numbers.

3.9.6 Cumulative impacts at N5 could be avoided if the on-time of the poker vibrators at site A was limited to 40% when the structure construction coincides with construction of TKO Station.

3.9.7 Similarly, cumulative impacts at NSRs N7, N8 and N9 can be avoided by:

- scheduling piling at Sites A and B so it does not coincide with piling operations for Phase I construction; and
- restricting the on-time of the poker vibrators at Site B to 60%.

3.9.8 As the construction of the cut and cover tunnels for Phase I and Phase II will be let as a single contract, it should be possible to schedule construction works so that noisy activities for Phase I do not coincide with noisy Phase II activities.

3.9.9 It is likely that the restrictions on piling operations which would be necessary to avoid impacts at N1, N2 and N3, would be too restrictive. It is, therefore, recommended that noise insulation be provided for the affected facades of the schools and clinic, unless the contractors can demonstrate clearly that the required noise levels can be achieved without adversely affecting the construction programme.

3.10 Operational Impacts

Potential Sources of Impacts

3.10.1 The entire TKE Phase II alignment will be enclosed, either in tunnel, or within a substantial concrete podium structure over the depot and station. In addition to the podium structure, requirements for additional noise mitigation measures such as noise barriers, podium boundary walls etc, will be determined during the detail design stage to protect any noise sensitive developments affected by the operation of the trains in the depot. Therefore, no adverse impacts from operational train noise are expected.

3.10.2 Vibration measurements undertaken on the existing Island Line at Tai Koo Shing, for the assessment of proposed station related developments above the new Airport Railway, have indicated that tangible (feelable) vibration is unlikely to exceed the acceptable vibration limits defined by *BS6472: 1992 Guidance to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*. Vibration re-radiated as noise (perceived as rumbling) within adjacent structures may exceed acceptable limits, defined in BS6472: 1992 as NR35 and NR45 for residential and hotel buildings respectively. However, experience on the existing MTR lines shows that, with appropriate mitigation in the form of floating or

isolated track, all vibration related impacts can be effectively ameliorated to acceptable levels. The requirement for vibration mitigation measures will be determined at the detailed design stage of the Project.

3.10.3 Fixed plant noise will arise from the ventilation systems of which there are two main types: station and depot ventilation; and trackway and tunnel ventilation.

3.10.4 The MTRC will require that the Detailed Design Consultancies for the depot and station include the design of effective noise control equipment which will be included in the station and depot ventilation systems to ensure that there will be no adverse impacts from the vents upon the Area 86 development.

3.10.5 Although mechanical tunnel ventilation systems will not be used routinely, fans will be fitted into the ventilation shafts for use during congested or emergency situations where trains are not moving through the tunnel or when it is necessary to exhaust smoke in the event of fire. These fans would also need to be tested periodically. Tunnel ventilation will normally occur through the piston effect of the moving train pushing stale air out in front of the train and drawing fresh air in behind.

3.10.6 It is understood that a residential development has been proposed for Area 78. It is likely therefore that the tunnel vent building which will be located at the Area 78 boundary will be in close proximity to a number of residential dwellings. No details of the exact locations of either source or receiver are available at this stage. Notwithstanding this, appropriate noise mitigation measures, as discussed in Section 3.10.7 below, will be provided if details of the proposed residential development are available before the construction of the tunnel ventilation building.

3.10.7 The MTRC will require the design of the ventilation systems for the station, depot and tunnels in Areas 86 and 108, which will be developed during the detailed design stage, to meet the HKPSG noise criteria. Suitable noise control measures could include, *inter alia*:

- the location of vents as far as possible from NSRs;
- the orientation of vents to direct noise away from NSRs;
- the selection of low noise fans; and
- the incorporation of appropriate noise insulation into fan rooms, vent ducts and vent louvres.

3.11 Conclusions

Construction Phase

3.11.1 The results of this assessment indicate that potential noise impacts at the majority of NSR neighbouring the TKE worksites can be adequately controlled through the use of typical mitigation measures including; the use of quiet plant, temporary noise barriers and restrictions on the operating schedule and on-time of specific items of plant.

3.11.2 The mitigation measures identified in this *Section* have been recommended, based on the assumption that all sensitive receivers will be occupied during the construction works, to ensure that sufficient protective measures have been identified. However, the measures proposed for specific receivers may not be necessary if the NSR is unoccupied during part or all of the works and any suggested restrictions on site activities should be confirmed at the appropriate stage of the construction programme.

3.11.3 In the case of N1, N2 and N3, it is likely that the restrictions necessary to avoid adverse cumulative impacts during the piling phase may be too restrictive. Therefore, appropriate noise insulation (and air conditioning) should be provided for the affected facades of the schools and clinic, unless the contractor can demonstrate clearly that the required noise levels can be achieved without adversely affecting the construction programme.

3.11.4 Cumulative impacts at N5, N7, N8 and N9 can be prevented through further restrictions on the on-time of individual items of plant and by careful scheduling of construction activities between sites.

3.11.5 Before construction works commence, the MTRC will require the contractor to demonstrate, through the production of an environmental management plan that his preferred method of construction can achieve the established criteria at all NSRs. This will include a full review of the status of all proposed developments to identify completion dates and ensure that mitigation measures are scheduled to provide effective protection for the occupants.

Operational Phase

3.11.6 Potential adverse noise impacts during the operational phase of the railway could arise from train movements and the ventilation systems for the station, depot and tunnels.

3.11.7 The MTRC will require that the detailed design of the railway, station and depot includes the provision of effective measures to control any impacts to within the established criteria. This will ensure that all NSRs are properly protected.

4 WATER QUALITY

4.1 Introduction

4.1.1 This Section presents an assessment of construction and operational phase water quality impacts of TKE Phase II and outlines potential mitigation requirements. Key issues addressed in this section are the construction and operation of the TKE Phase II railway station and depot which will generate waste water that may cause adverse water quality impacts if not properly controlled.

4.2 Legislation

4.2.1 Under the Water Pollution Control Ordinance (WPCO), Hong Kong waters are subdivided into 10 Water Control Zones (WCZs), each of which has a designated set of statutory Water Quality Objectives (WQOs). The marine waters of Junk Bay will be the receiving water body for the TKE Phase II, see *Figure 1.2a*. The WQOs for Junk Bay were declared in August 1989. The WQOs of most relevance during the construction phase will be those for suspended solids (SS) and dissolved oxygen (DO), as listed below.

- The level of DO should not fall below 4 mg l^{-1} for 90% of the sampling occasions during the whole year; values should be calculated as the annual water column average. In addition, the DO concentration should not be less than 2 mg l^{-1} within 2 m of the seabed for 90% of the sampling occasions during the whole year.

- Human activity should not cause the SS concentration to be raised more than 30% nor give rise to accumulation of SS which may adversely affect aquatic communities.

4.2.2 In addition, all discharges during both the construction and operational phases of the TKE Phase II will be required to comply with the *Technical Memorandum for Effluents discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TM) issued under Section 21 of the WPCO, which defines acceptable discharge limits to different types of receiving waters. Under the TM, effluents discharged into the sewerage system and the inshore and marine waters of the WCZ are subject to standards for particular volumes of discharge. These are defined by the EPD and are specified in licence conditions for any new discharge within a WCZ. For this assessment, the TM standards for effluents discharged into the sewerage system and the inshore waters of Junk Bay WCZ will apply to the construction and operation of the TKE Phase II. These discharge standards are presented in *Tables 4.2a* and *4.2b*, respectively.

4.2.3 The Water Supplies Department (WSD) has its own WQOs for salt water used for flushing, in which: the SS concentration should be less than 10 mg l^{-1}. Other WSD standards of the flushing water intakes include ammoniacal nitrogen (less than 1 mg l^{-1}), DO (more than 2 mg l^{-1}), 5-day biochemical oxygen demand (less than 10 mg l^{-1}) and *Escherichia coli* (*E. coli*) (less than 20,000 per 100 ml).

4.3 Sensitive Receivers and Baseline Conditions

4.3.1 The water sensitive receivers, and the associated baseline water quality and sediment conditions, are detailed below in accordance with the HKPSG.

4.3.2 Junk Bay is the nearest receiving water body and comprises the only identified water sensitive receiver of WSD salt water intake that is located at the south-west corner of Area 86 (*Figure 4.3a*). The intake may be impacted by the construction of the depot and railway, and their subsequent operation. The nearest biological sensitive receiver is Tung Lung Chau Fish Culture Zone. However, it is approximately 4 km from the depot site and is considered to be sufficiently far away from any potential water quality impact from the proposed railway. No other sensitive receivers such as shell fisheries, or recreational areas have been identified in the vicinity of the works.

4.3.3 Water quality in the vicinity of the alignment is well documented by the EPD routine marine water quality monitoring programme. The nearest water quality monitoring station is JM3 in Junk Bay (*Figure 4.3a)*. In general the data from the station indicates that water quality was not too satisfactory in the past, with relatively high turbidity, inorganic nutrient contents (total nitrogen and phosphorus) and *E. coli* and faecal coliform contents. According to the recent EPD routine monitoring data (*Marine Water Quality in Hong Kong for 1996*), the levels of total inorganic nitrogen and unionised ammonia fully complied with the WQOs in 1996 and 83.3% compliance was achieved for depth averaged DO at JM3.

4.3.4 Concentrations of SS at JM3, a parameter of key concern with regard to water quality, ranged between 2.0 mg l^{-1} to 18.0 mg l^{-1} with a mean of 6.9 mg l^{-1}. However, as the monitoring station is located over 300 m from the coast, it is considered that the SS concentrations further inshore may be locally elevated as a result of polluted discharges in the area. DO at JM3 varied from 4.8 mg l^{-1} to 7.9 mg l^{-1}. *Table 4.3a* summarises the water quality of JM3 in Junk Bay.

4.3.5 The water quality within the Junk Bay is only fair with depth-average DO objective only partially met for 1996 at JM3 and it is important to ensure that neither construction or operation of the project lead to further deteriorations in water quality.

4.3.6 There are two surface water courses which could be affected by the railway construction, the first is a small stream draining the northern slopes of Area 108. The source of the stream lies close to Site D.

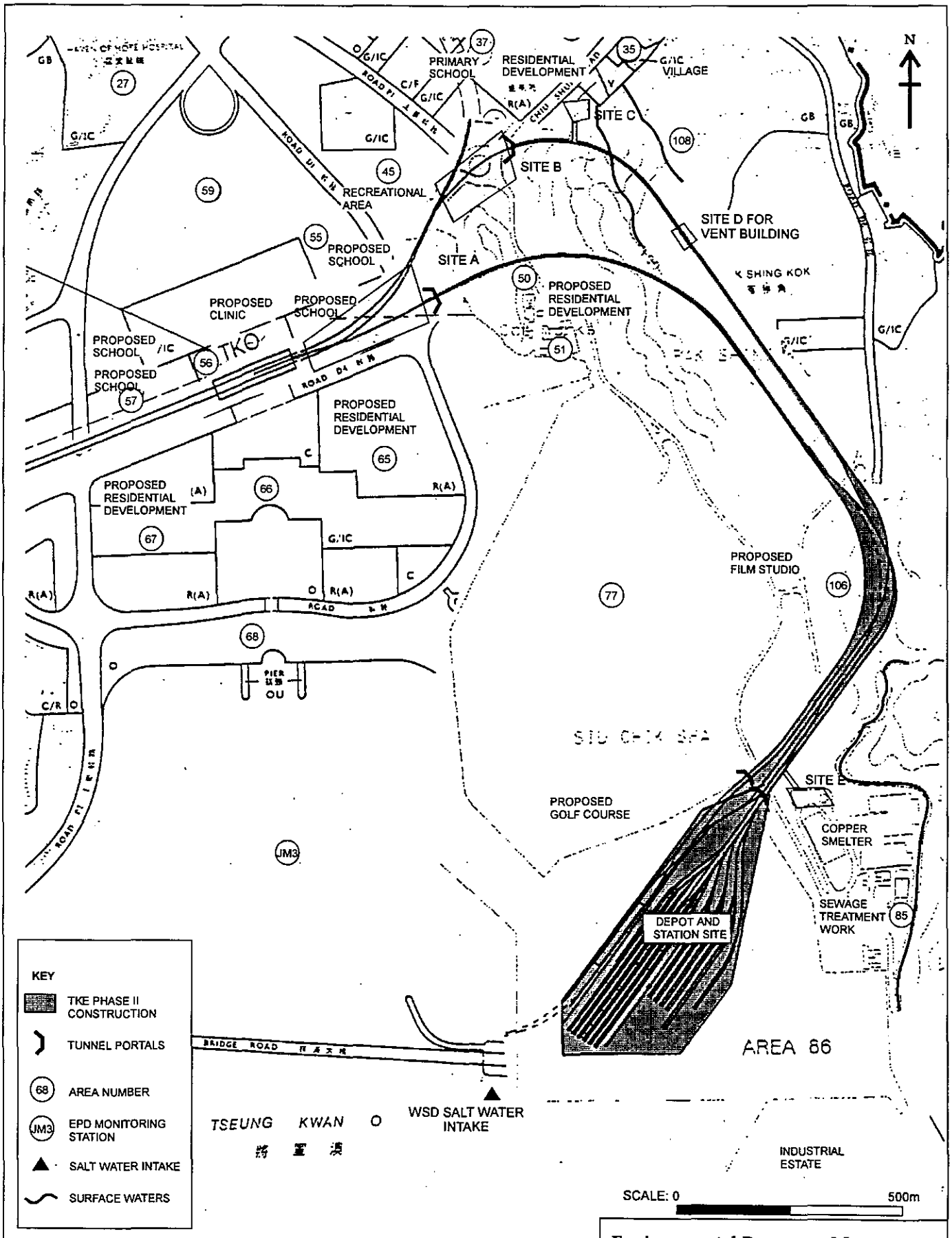

FIGURE 4.3a - WATER SENSITIVE RECEIVERS

Environmental Resources Management

6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

Table 4.2a Standards for Effluents Discharged into Foul Sewers Leading into Government Sewage Treatment Plants

Flow Rate (m^3 day^{-1})	≤10	>10 & ≤100	>10 & ≤200	>200 & ≤400	>400 & ≤600	>600 & ≤800	>800 & ≤1000	>1000 & ≤1500	>1500 & ≤2000	>2000 & ≤3000	>3000 & ≤4000	>4000 & ≤5000	>5000 & ≤6000
Determinant													
pH	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temp (°C)	43	43	43	43	43	43	43	43	43	43	43	43	43
SS	1200	1000	900	800	800	800	800	800	800	800	800	800	800
Settleable Solids	100	100	100	100	100	100	100	100	100	100	100	100	100
BOD	1200	1000	900	800	800	800	800	800	800	800	800	800	800
COD	3000	2500	2200	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Oil & Grease	100	100	50	50	50	40	30	20	20	20	20	20	20
Iron	30	25	25	25	15	12.5	10	7.5	5	3.5	2.5	2	1.5
Boron	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Barium	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Mercury	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Copper	4	4	4	3	1.5	1.5	1	1	1	1	1	1	1
Nickel	4	3	3	2	1.5	1	1	0.8	0.7	0.7	0.6	0.6	0.6
Chromium	2	2	2	2	1	0.7	0.6	0.4	0.3	0.2	0.1	0.1	0.1
Zinc	5	5	4	3	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Silver	4	3	3	2	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Other toxic metals individually	2.5	2.2	2	1.5	1	0.7	0.6	0.4	0.3	0.2	0.15	0.12	0.1
Toxic metals total	10	10	8	7	3	2	2	1.6	1.4	1.2	1.2	1.2	1
Cyanide	2	2	2	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.08	0.06
Phenols	1	1	1	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.1	0.1
Sulphide	10	10	10	10	5	5	4	2	2	2	1	1	1
Sulphate	1000	1000	1000	1000	1000	1000	1000	900	800	600	600	600	600
Total nitrogen	200	200	200	200	200	200	200	100	100	100	100	100	100
Total phosphorus	50	50	50	50	50	50	50	25	25	25	25	25	25
Surfactants (total)	200	150	50	40	30	25	25	25	25	25	25	25	25

Note: All units in mg l^{-1} unless otherwise stated; all figures are upper limits unless otherwise stated.

Table 4.2b Standards for Effluents Discharged into the Inshore Waters of Junk Bay Water Control Zone

Flow Rate (m^3 day^{-1})	**≤10**	**>10 & ≤200**	**>200 & ≤400**	**>400 & ≤600**	**>600 & ≤800**	**>800 & ≤1000**	**>1000 & ≤1500**	**>1500 & ≤2000**	**>2000 & ≤3000**	**>3000 & ≤4000**	**>4000 & ≤5000**	**>5000 & ≤6000**
[illegible]												
pH	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
Temp (°C)	40	40	40	40	40	40	40	40	40	40	40	40
Colour	1	1	1	1	1	1	1	1	1	1	1	1
Suspended solids	50	30	30	30	30	30	30	30	30	30	30	30
BOD	50	20	20	20	20	20	20	20	20	20	20	20
COD	100	80	80	80	80	80	80	80	80	80	80	80
Oil & Grease	30	20	20	20	20	20	20	20	20	20	20	10
Iron	15	10	10	7	5	4	3	2	1	1	0.8	0.6
Boron	5	4	3	2	2	1.5	1.1	0.8	0.5	0.4	0.3	0.2
Barium	5	4	3	2	2	1.5	1.1	0.8	0.5	0.4	0.3	0.2
Mercury	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	1	1	0.8	0.7	0.5	0.4	0.3	0.2	0.15	0.1	0.1	0.1
Total toxic metals	2	2	1.6	1.4	1	0.8	0.6	0.4	0.3	0.2	0.1	0.1
Cyanide	0.2	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.03	0.02	0.02	0.01
Phenols	0.5	0.5	0.5	0.3	0.25	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual chlorine	1	1	1	1	1	1	1	1	1	1	1	1
Total nitrogen	100	100	80	80	80	80	50	50	50	50	50	50
Total phosphorus	10	10	8	8	8	8	5	5	5	5	5	5
Surfactants (total)	20	15	15	15	15	15	10	10	10	10	10	10
E. coli (count per 100 ml)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Note: All units in mg l^{-1} unless otherwise stated; all figures are upper limits unless otherwise stated.

Table 4.3a Summary Statistics of 1995 Water Quality at Junk Bay

Determinant		Inner Junk Bay (JM3)
Temperature (°C)	Surface	22.4 (15.3 - 27.9)
	Bottom	21.8 (15.1 - 27.2)
Salinity (ppt)	Surface	32.1 (30.2 - 33.5)
	Bottom	33.0 (31.6 - 34.2)
DO (mg l^{-1})		6.1 (4.8 - 7.9)
pH value		8.0 (7.9 - 8.3)
Secchi Disc (m)		2.1 (1.0 - 3.1)
Turbidity (NTU)		4.2 (2.2 - 9.8)
Suspended Solids (mg l^{-1})		6.9 (2.0 - 18.0)
BOD (mg l^{-1})		0.7 (0.3 - 1.1)
Ammoniacal nitrogen (mg l^{-1})		0.17 (0.08 - 0.23)
Total Inorganic Nitrogen (mg l^{-1})		0.23 (0.13 - 0.33)
Total Nitrogen (mg l^{-1})		0.49 (0.21 - 0.91)
Ortho-phosphate (mg l^{-1})		0.04 (0.03 - 0.05)
Total phosphorus (mg l^{-1})		0.08 (0.05 - 0.14)
Chlorophyll - *a* (μg l^{-1})		2.45 (0.47 - 6.97)
E. coli (per 100 ml)		395 (23 - 4,200)
Faecal Coliform (per 100 ml)		572 (37 - 8,333)

Notes:
1. Except as specified, data presented are depth-average data.
2. Data presented are annual arithmetic means except for *E. coli* data which are annual geometric means.
3. Data enclosed in brackets indicate the ranges.

Source: *Marine Water Quality in Hong Kong for 1995*, Environmental Protection Department, September 1996.

4.3.7 The second stream flows from Area 106 and passes close to the eastern edge of Site E. This stream descends from the high ground to the north -east into a pool just to the north of Area 85. Below the pool, the stream runs in culvert behind the industrial developments in Area 85. The stream drains the western slopes of the Clearwater Bay Country Park and water quality can be expected to be good.

4.3.8 The rest of the alignment is either in cut and cover tunnel in reclamation or below ground in rock tunnel and will not affect any surface waters.

4.4 Construction Impacts

Potential Sources of Impact

4.4.1 Potential sources of water quality impacts during construction of TKE Phase II will comprise construction runoff and drainage, general construction activities, sewage from the on-site construction work force, and marine disposal of any excavated material.

4.4.2 Construction runoff and drainage includes runoff and erosion from site surfaces, tunnels, drainage channels, earth working, and stockpiles that may contain increased loads of sediments, other SS and contaminants. Potential contaminants include:

- silt and contaminated runoff from earthworks, tunnels and on-site stockpiles;
- bentonite slurries and other grouting and cement materials; and
- fuel, oil and lubricants from construction vehicles and equipment.

4.4.3 Bentonite, grouting and cement materials may be used during the construction of the TKE Phase II. As these materials will be delivered to the site by trucks, it is considered the water pollution will only result if the materials are allowed to enter into marine waters as surface runoff or underground storm water discharge.

4.4.4 General construction activities will have the potential to cause water pollution from rubbish such as food packaging and debris including used construction materials entering the water column, resulting in floating refuse in the vicinity of the site. Spillages of liquids such as oil, diesel and solvents are also likely to affect water quality if they enter surrounding water bodies.

4.4.5 Sewage effluents arising from the on-site construction work force and the canteen facilities have the potential to cause water pollution. Sewage is characterised by high levels of biochemical oxygen demand (BOD), ammonia and *E. coli*.

Evaluation of Impacts

4.4.6 Runoff and drainage may include varying amounts of SS, fuel, oil, lubricants and other contaminants such as silt from the release of bentonite, grouting or cement materials. Water quality impacts will become significant only if the runoff and drainage are allowed to discharge directly into the receiving water body without treatment. Thus, provided the surface runoff and drainage are effectively managed and controlled over the site, adverse water quality impact is not anticipated.

4.4.7 The impacts of used construction materials, debris, rubbish, liquid fuels and solvents allowed to dispose into receiving water body are likely to be minimal, provided that site boundaries are well maintained and good construction practices are observed to ensure that litter, fuels and solvents are managed, stored and handled properly.

4.4.8 Owing to the lack of established guidelines for sewage generation rates for construction sites, the recommended design rate for offices, specified in the *Guidelines for the Design of Small Sewage Treatment Plants, EPD Solid Waste Control Group, March 1990*, has been used for this assessment. It is considered that a volume of 33.0 m^3 domestic sewage per day could be generated by a maximum of about 600 workers along the alignment during the construction works. Discharge from on-site canteens serving the construction workers could also produce substantial amounts of sewage. Significant water quality impacts will occur only if the sewage is discharged directly into the receiving water body without any treatment.

4.4.9 It is anticipated that any material excavated during construction of the TKE Phase II will essentially comprise virgin rock and uncontaminated fill material, these

materials can be disposed of at public filling sites (see *Section 5*). However, if marine mud left on the site during reclamation works is excavated, it should be classified according to the *Technical Circular No. 1-1-92 on the Classification of Dredged Sediments for Marine Disposal, EPD, November 1992* (TC 1-1-92) and specific handling and disposal methods should be identified.

Mitigation Measures

4.4.10 Construction phase mitigation measures, in accordance with the *Practice Note for Professional Persons on Construction Site Drainage, Professional Persons Environmental Protection Department, 1994* (ProPECC PN 1/94) include the use of sediment traps, wheel washing facilities for vehicles leaving the site, adequate maintenance of drainage systems to prevent flooding and overflow, sewage collection and treatment, and comprehensive waste management (collection, handling, transportation, disposal) procedures.

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

4.4.12 Ideally, construction works should be programmed to minimise surface excavation works during the rainy season (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.

4.4.13 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.

4.4.14 Sediment tanks of sufficient capacity, constructed from pre-formed individual cells of approximately 6 to 8 m^3 capacity, are recommended as a general mitigation measure which can be used for settling waste water prior to disposal. The system capacity is flexible and able to handle multiple inputs from a variety of sources and particularly suited to applications where the influent is pumped.

4.4.15 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.

4.4.16 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.

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

4.4.18 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.

4.4.19 Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecast, 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 storms events, especially for areas located near steep slopes.

4.4.20 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 bay should be provided at every site exits and 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.

4.4.21 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 5.3* of this Report.

4.4.22 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.

4.4.23 Construction work force sewage should be controlled by the use of portable chemical toilets or sewage holding tanks with the sewage regularly collected by a reputable sewage collector for disposal at TKO Sewage Treatment Works (STW). Sewage from on-site canteen facilities should be diverted to and stored within sewage holding tanks for later disposal.

4.4.24 Any marine sediments excavated during the construction will be disposed of off-site. Although information about the extent of site excavation works is not yet available, it is likely that the quantities of marine sediment to be excavated will be small. Based on TC 1-1-92, disposal of marine sediment should be as follows:

- open water disposal site at east of Ninepins or south of Cheung Chau (for Class A uncontaminated mud only); or marine borrow areas (MBAs), e.g. North Lantau and South Tsing Yi MBAs (for Class A and Class B mud only); and

- contaminated mud pits (CMPs), e.g. East Sha Chau CMPs (generally for Class C seriously contaminated mud only).

4.4.25 Hopper barges will be used to transport excavated marine sediment to the designated dumping area.

4.4.26 In all cases, EPD will advise on the most appropriate disposal method for the excavated marine sediment. Any environmental conditions to be imposed with the dumping licence and special disposal arrangements will be specified at this time. The Fill Management Committee will finalise and stipulate of the disposal allocation of any volume of contaminated sediment. Any further conditions relating to the management of the disposal area will also be specified at this time.

4.4.27 For seriously contaminated sediments (Class C), special disposal arrangements comprising contained disposal in designated marine pits will be necessary. The only disposal site at present designated for the disposal of contaminated muds comprises the East Sha Chau CMPs. The Contractor should ensure that all excavation and disposal methods are in compliance with the environmental conditions imposed under the terms and conditions of EPD's marine dumping permit. Specific excavation procedures which are required to minimise any potential water quality impacts, including the use of closed grabs for contaminated marine sediment during excavation, should be included in contract documentation.

Residual Impacts

4.4.28 The construction activities associated with the TKE Phase II could lead to site runoff containing elevated concentration of SS and associated contaminants that may enter inner Junk Bay, those from the depot and station works could impact the WSD salt water intake. However, implementation of the mitigation measures recommended above will be sufficient to ensure that no unacceptable residual water quality impact will result from the construction of the TKE Phase II.

4.4.29 Specific mitigation measures to protect the WSD salt water intake are not considered necessary.

4.5 Operational Impacts

Potential Sources of Impact

4.5.1 Potential sources of impact on water quality from the operation of the TKE Depot include the following:

- operational runoff, particularly from contaminated surfaces;
- waste water from train cleaning, and heavy cleaning and maintenance facilities; and
- domestic sewage generation from the lavatories, showers and kitchen areas of the TKE Depot.

4.5.2 All sewage will be collected by sewerage systems and will be diverted to the TKO STW.

Evaluation of Impacts

4.5.3 Water quality impacts could result from tunnel seepage which could be contaminated with oil and grease from passing trains. However, such impacts can be readily controlled by the provision of oil/grease interceptors at the station.

4.5.4 Maintenance activities will be undertaken within the depot, which could result in unacceptable water quality impacts if waste water discharges are unmitigated. Liquid effluent will be generated by the acid wash and detergent washing plants used for the daily external washing of trains. In addition, heavy cleaning using scrubbers with water extraction will be undertaken on two trains, twice per week. A further 100 l of water containing detergent will be generated each day from by hand cleaning cab fronts and windscreens. Domestic sewage will be generated by the on-site work force of approximately 200-300. These effluents could result in physical, chemical and biochemical impacts within any receiving water body if appropriate collection and treatment to TM standards are not provided.

4.5.5 Effluent produced from maintenance works has the potential to be heavily contaminated with oils, grease and other hydrocarbon-based products. In addition, the washing of batteries during the maintenance process can produce an effluent contaminated with heavy metals, such as lead and nickel. All of these effluents should be regarded as chemical wastes. Special handling, storage and treatment methods have been specified in *Section 5.4* of this Report.

4.5.6 Lavatories, showers and kitchen areas will be located within the depot and effluents will arise from their use by the work force. A total of about 200-300 staff will be working at the Depot at different shifts during a working day. Using the approach described above, it can be assumed that about 33-50 m^3 per day of domestic sewage will be generated from the toilets at the depot.

Mitigation Measures

4.5.7 The design of the TKE Depot should take into account the guidelines published in *Drainage Plans subject to Comment by the EPD, Practice Note for Professional Persons, Environmental Protection Department* (ProPECC PN 5/93) and should incorporate the following specific measures to minimise the potential for adverse environmental impacts:

- the depot drainage design should focus on the areas where effluent contaminated with hydrocarbons, heavy metals or other potentially hazardous chemicals may be generated and a clear segregation of clean and contaminated effluent streams should be provided;

- waste water to be discharged into foul sewers leading to the TKO STW should be treated by the on-site treatment facilities, including silt traps and oil interceptors, to meet the TM standards (*Table 4.2a*) prior to discharge; and

- an emergency spillage action plan should be developed for the TKE Depot to ensure that any accidental spillage event is treated immediately and does not impact on any water bodies.

4.5.8 The following measures should be adopted, where appropriate, for the control of oil spills and leaks during operation of the depot:

- all plant maintenance areas should be bunded and constructed on a hard standing, and provided with sediment traps and oil interceptors;

- traps and interceptors should be regularly cleaned and maintained, especially after any accidental spillages; and

- layers of sawdust, sand or equivalent material should be laid underneath and around any plant and equipment that may possibly leak oil.

4.5.9 It should also be noted that the disposal of waste oil and other chemicals is controlled by the *Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354)*. Waste oil and other chemicals must be disposed of at the Government Chemical Waste Treatment Centre at Tsing Yi.

4.5.10 The following measures should be adopted, where appropriate, to minimise impacts from waste water discharges:

- the acid washing facilities should be designed to achieve effective neutralisation of acid to TM requirements prior to discharge;

- prudent management practice should be adopted to minimise the amount of acid used;

- opportunities for the recycling of water within the automatic washing facilities should be sought to minimise discharge requirements;

- the use of bio-degradable detergents should be considered as a preferred option.

Residual Impacts

4.5.11 Assuming all recommended mitigation measures are followed and guidelines of sewerage design are observed, the operational discharges from the TKE Depot can be expected to comply with the TM.

4.6 Conclusions

Construction Stage

4.6.1 Construction activities associated with construction of the TKE Phase II could lead to site runoff containing elevated concentration of SS and associated contaminants. Detailed mitigation measures have been described which should effectively control all potential impacts. Insurmountable residual (that is, after adoption of the recommended mitigation measures) construction stage water quality impacts are not predicted.

Operational Stage

4.6.2 Appropriate drainage collection facilities have been recommended to be incorporated into the design of the TKE Phase II to collect contaminated effluent during operation. Mitigation measures, including on-site sewage treatment facilities, are recommended to achieve WPCO discharge standards and prevent associated residual water quality impacts. It is considered that, with the adoption of the recommended mitigation measures, no insurmountable water quality impacts will result from the operational phase of the TKE Phase II.

5 SOLID WASTE MANAGEMENT

5.1 Introduction

5.1.1 This *Section* identifies the potential waste arisings from the construction works for the TKE Phase II and assesses the potential environmental impacts resulting from these wastes.

5.1.2 The options for the minimisation, treatment, storage, collection, transport and disposal of waste arisings from the proposed site have been examined. Procedures for waste reduction and management are considered and mitigation measures for minimising the impacts of the wastes are recommended.

5.2 Legislation

5.2.1 The following legislation covers, or has some bearing upon, the handling, treatment and disposal of wastes in Hong Kong:

- Waste Disposal Ordinance (Cap 354);
- Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);
- Crown Land Ordinance (Cap 28); and
- Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws.

Waste Disposal Ordinance

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

5.2.3 Under the WDO, wastes can only be disposed of at a licensed site. A breach of these regulations can lead to the imposition of a fine and/or a prison sentence. The WDO also provides for the issuing of licences for the collection and transport of wastes. Licences are not, however, currently required to be issued for the collection and transport of construction and/or trade waste.

Waste Disposal (Chemical Waste) (General) Regulation

5.2.4 Chemical wastes as defined under the *Waste Disposal (Chemical Waste) (General) Regulation* includes any substance being scrap material, or unwanted substances specified under Schedule 1 of the Regulations, if such substance or chemical occurs in such a form, quantity or concentration so as to cause pollution or constitute a danger to health or risk of pollution to the environment.

5.2.5 A person should not produce, or cause to be produced, chemical wastes unless he is registered with the EPD. Any person who contravenes this requirement commits an offence and is liable upon conviction, for a first offence, to a fine of up to HK$200,000 and to imprisonment for up to 6 months. The current fee for registration is HK$240.

5.2.6 Producers of chemical wastes must treat their wastes, utilising on-site plant licensed by the EPD, or have a licensed collector take 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 transfer of wastes from cradle to grave can, therefore, be traced.

5.2.7 The Regulations prescribe the storage facilities to be provided on site including labelling and warning signs. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written procedures to be observed in the case of emergencies due to spillage, leakage or accidents arising from the storage of chemical wastes. He must also provide employees training in such procedures.

Crown Land Ordinance

5.2.8 Construction wastes which are wholly inert may be taken to public dumps. Public dumps usually form part of land reclamation schemes and are operated by the CED. The *Crown Land Ordinance* requires that dumping licences are obtained by individuals or companies who deliver suitable construction wastes to public dumps. The licences are issued by the CED under delegated powers from the Director of Lands.

5.2.9 Individual licences and windscreen stickers are issued for each vehicle involved. Under the licence conditions public dumps 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 other suitable material is permissible. The material should, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical waste, animal and vegetable matter and any other material considered unsuitable by the dump supervisor.

Public Cleansing and Prevention of Nuisances

5.2.10 These Regulations provide a further control on the illegal tipping of wastes on unauthorised (unlicensed) sites. The illegal dumping of wastes can lead to fines of up to HK$10,000 and imprisonment for up to 6 months.

5.3 Sensitive Receivers and Baseline Conditions

5.3.1 Sensitive receivers in the direct vicinity of the work site affected by:

- windblown dust and debris and vehicle exhaust are addressed in *Section 2*;
- noise from excavation, construction and transport activities and mechanical plant are addressed in *Section 3*; and
- contaminated or sediment-laden runoff from site surfaces are addressed in *Section 4*.

5.3.2 Thus, the sensitive receivers with respect to waste management, have been identified in *Sections 2, 3 and 4*. These receivers may be affected by the storage, handling, collection, transport and disposal of waste generated by the construction works. Baseline conditions have also been described in the previous sections.

5.3.3 In addition, as a health and safety consideration, construction site personnel, and waste handling and transport personnel (other than specialist chemical waste/contaminated materials personnel), should be protected with respect to chemical wastes and contaminated materials, as they do not possess the training, expertise and specialist equipment to deal with contaminated materials according to proper procedures.

5.3.4 The landfill or public fill site at which waste is disposed, and its surrounding area, may be affected by waste disposal. For routine wastes, being general refuse, construction and demolition waste, and excavated inert materials, such disposal sites are not relevant to this study. This is because all are covered by their own EIA, EM&A and mitigation procedures; and appropriate disposal of the above routine waste types at these facilities is routine and legal. As such, neither the Contractor, nor the MTRC, have any responsibility for analysis or mitigation of impacts occurring at these disposal sites as a result of disposal of wastes generated at the proposed site.

5.3.5 The proposed alignment is on recently reclaimed land or will run through virgin rock and land contamination is not anticipated. However, it should be noted that public fill sites will not accept chemical wastes or contaminated wastes, and none of the Strategic Landfills accept such wastes on a routine basis. In the case of chemical wastes and contaminated materials arising from the site, any handling, transportation and disposal require specialist procedures. The procedures for the transportation and disposal of chemical wastes or excavated contaminated materials, should be agreed in writing with the EPD prior to the removal of these materials from site.

5.4 Potential Sources of Impacts

5.4.1 Construction activities will result in the generation of a variety of wastes which can be divided into distinct categories based on their constituents, as follows:

- excavated inert material;
- construction and demolition waste;
- chemical wastes; and
- general refuse

5.4.2 The definitions for each of these categories, and the nature of their arisings and potential impacts are discussed in detail below. The definitions of each waste type are provided for the purposes of this report, with the exception of chemical waste which is defined in the *Waste Disposal (Chemical Waste)(General) Regulation*.

Excavated Inert Material

5.4.3 Excavated inert material is defined as inert virgin material removed from the ground and sub-surface excluding any wastes or fill which may have been placed there previously. Excavated material will be generated from excavation of the ground and sub-surface of the proposed site and from the tunnel construction. Material from rock excavation will comprise volcanics or granite, with those portions from the surface and shallow sub-surface being partially or completely decomposed.

5.4.4 It is anticipated that 250,000 m^3 of inert excavated material will be removed from the proposed work site, comprising 80,000 m^3 of material from the existing reclamations and 170,000 m^3 of rock.

Construction and Demolition Waste

5.4.5 Construction waste is defined as any unwanted materials generated during construction, including rejected structures and materials and materials used and discarded. Construction waste will arise from a number of different activities carried out by the Contractor during construction and maintenance activities; and may include:

- wood from formwork;
- equipment and vehicle maintenance parts, including materials used in tunnelling;
- materials and equipment wrappings;
- unusable cement/grouting mixes; and
- damaged or contaminated construction materials.

5.4.6 The volume of construction waste generated at the work site will be dependent on the operating procedure and site practices. At this stage, it is not possible to predict accurately the amount of construction waste that will be generated. The proposed alignment is on new reclamation and the volume of demolition waste will be low. A preliminary estimate can be made based upon previous projects, on a site employing about 600 workers, 120 m^3 per month of construction waste can be expected,

Chemical Waste

5.4.7 Chemical Waste as defined under the *Waste Disposal (Chemical Waste)(General) Regulation* includes any substance being scrap material, or unwanted substances specified under Schedule 1 of the Regulation. A complete list of such substances is provided under the Regulation, however substances likely to be generated by construction activities will for the most part arise from the maintenance of equipment. These may include, but need not be limited to the following:

- scrap batteries or spent acid/alkali from their maintenance;
- used engine oils and hydraulic fluids, waste fuel;
- mechanical machining producing spent mineral oils/cleaning fluids including materials used in tunnelling; and
- equipment cleaning activities producing spent solvents/solutions which may

be halogenated.

5.4.8 At this stage, it is not possible to predict accurately the amount of chemical waste that will be generated. However, based upon similar projects, it is estimated that the TKE Phase II works will probably produce about 5400 l of waste fuel, oils and other liquid wastes each month.

General Refuse

5.4.9 General refuse will include any waste that does not fit into any of the categories previously described. The presence of a construction site will result in the generation of a variety of general refuse materials requiring disposal. General refuse may include food wastes and packaging, waste paper, etc. To quantify the amount of general refuse that will be generated, EPD's figure for domestic waste generation (1994) is used, being 1.04 kg per person per day. As the site personnel are only present for a working day of eight hours, a scale factor of 0.35 is used. Thus, the proposed site will likely produce approximately 210 kg of general refuse per day.

5.5 Assessment Methodology

5.5.1 The assessment of environmental impacts from waste generation is based on three factors:

- the type of waste generated;
- the amount of principal waste types generated; and
- the proposed reuse, storage, transport, treatment and disposal methods, and the impacts of these methods.

5.6 Prediction and Evaluation of Impacts

Excavated Inert Materials

5.6.1 There will be considerable volumes of excavated material generated by the TKE Phase II construction works. Due to the nature of the works, the reuse of excavated materials on site will be minimal and therefore the majority of these materials will have to be disposed off-site. It is likely that the materials will be used as reclamation fill because of their suitability and the availability of reclamation fill sites. As explained in *Section 5.3*, potential impacts from excavated materials are covered in *Sections 2, 3 and 4*.

Construction and Demolition Waste

5.6.2 The storage, handling, transport and disposal of construction and demolition wastes have the potential to create similar visual, water, dust and associated traffic impacts as the storage and disposal of excavated materials.

5.6.3 The disposal of construction and demolition wastes is unlikely to raise any long term concerns because of the inert nature of most construction wastes. To conserve void space at landfill sites, construction waste must not be disposed of at a landfill site if it contains more than 20% inert material by volume. It is therefore good practice to segregate wastes at construction sites before disposing of inert materials at public fill sites for reclamation works and putrescible materials at a controlled landfill site. However, constraints on available space at the work sites may prevent effective sorting.

Chemical Waste

5.6.4 Chemical wastes may pose serious environmental and health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the *Chemical Waste Regulations* and the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. These hazards include:

- toxic effects to workers;
- adverse effects on air, water and land from spills;
- fire hazards; and
- disruption of sewage treatment works where waste enters the sewage system.

5.6.5 Chemical wastes will arise principally as a result of maintenance activities. It is difficult to quantify the amount of chemical waste which will arise from the construction activities since it will be highly dependent on the Contractor's on-site maintenance requirements and the numbers of plant and vehicles utilised.

General Refuse

5.6.6 The storage of general refuse has the potential to give rise to adverse environmental impacts. These include odour if waste is not collected frequently (eg. daily), windblown litter, water quality impacts if waste enters water bodies, and visual impact. The sites may also attract pests and vermin if the waste storage area is not well maintained and cleaned regularly. In addition, disposal of wastes, at sites other than approved landfills, can also lead to similar adverse impacts at those sites. The environmental impacts from the various waste types are summarised in *Table 5.6a*.

Table 5.6a Summary of Impacts from Waste Arisings

Waste Type	General Evaluation
Excavated Inert Materials	An estimated 250,000 m^3 will be generated. The materials are not considered likely to generate adverse disposal related environmental impact because they will be used as reclamation fill. Significant air, water and noise impacts may occur as detailed in *Sections 2, 3 and 4.*
Construction and Demolition Waste	Estimated generation is 2160 m^3 of construction waste. Due to the inert nature of most construction waste and the availability of public dump sites, disposal not likely to raise long term environmental concerns.
Chemical Waste	An estimated 97200 l of maintenance materials such as used lubricating oils will be produced. Storage, handling, transport and disposal must be in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.* Provided that this occurs, and chemical wastes are disposed of at a licensed facility, the contractor and the MTRC should be in compliance with all relevant regulations.
General Refuse	Estimated generation is 99 te. If good practice is adhered to and all feasible avoidance and reuse opportunities are taken, non-compliances with the relevant regulations should not occur.

5.7 Mitigation Measures

5.7.1 Storage, transportation and disposal measures to avoid or minimise potential adverse impacts associated with waste arisings from the construction of the facility are recommended as below.

Waste Management Hierarchy

5.7.2 Various options within waste management can be categorised in terms of preference from an environmental viewpoint. The options considered to be more preferable have the least impacts and are more sustainable in a long term context. Hence, the hierarchy is as follows:

- avoidance, ie not generating waste through changing or improving processes;
- reuse of materials, thus avoiding disposal; and
- disposal, according to relevant laws, guidelines and good practice. The Waste Disposal Authority should be consulted by the Contractor on the final disposal of wastes.

5.7.3 This hierarchy should be used to evaluate waste management options, thus allowing maximum waste reduction and often reducing costs. For example, by reducing or eliminating over-ordering of construction materials, waste is avoided, eliminating the need for other, more complex management options, and purchasing costs are reduced.

Excavated Inert Materials

5.7.4 Excavated materials are not considered likely to cause adverse impacts, since they will be used as reclamation fill, which is considered a useful reuse of the material. As such, mitigation measures are not considered necessary. There are potentially significant impacts relating to air, water and noise which could result from the generation of excavated materials. As explained in *Section 5.3*, potential impacts due to excavated materials are covered in *Sections 2, 3 and 4.*

5.7.5 Any uncontaminated inert materials may be delivered to public fill sites. Those public fill sites which will be in operation concurrently with the works, and their capacities, are listed in *Table 5.7a.*

Table 5.7a Public Fill Sites Operating Concurrently with the TKE Phase II Works

Fill Site Project Name	Start Date	End Date	Volume (m^3)
Yuen Long (SW) Extension Site Formation Rd & Drain Work	01/10/97	01/10/00	600000
Lantau Port Development	01/01/98	31/12/11	16390000
Total Capacity			**19600000**

Projected Total Rock and Soft Arisings from TKE Phase II (m^3) is 250,000.

5.7.6 From *Table 5.7a*, it can be seen that the public fill sites have a combined capacity of approximately 19.6 million m^3, greatly in excess of the inert material arisings. As such, it is anticipated that no disposal difficulties will occur. The majority of the inert materials will most likely go to fill sites, with public dumps receiving materials in the event that fill sites are not available or the materials do not meet the requirements for fill sites.

Construction and Demolition Waste

5.7.7 It is not possible to predict accurately the likely generation rates at this time, although the volumes are estimated to be relatively low. Due to the inert nature of most construction waste and the availability of public fill sites, disposal is not likely to raise long term environmental concerns. However, minimisation measures should be taken, as described below.

5.7.8 Careful planning and good site management can minimise over ordering and waste of materials such as concrete, mortars and cement grouts. If feasible, the noise enclosure should be designed so that the materials are reusable after it has been dismantled and removed, thereby not generating demolition waste. The design of formwork could maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing could be considered to increase the potential for reuse.

5.7.9 In accordance with the *New Disposal Arrangements for Construction Waste, Environmental Protection Department and Civil Engineering Department, 1992*, disposal of construction waste can either be at a specified landfill, or a public dump, with the latter being the preferred option. Construction and demolition

wastes currently occupy approximately 60-70% of the void in active landfills, and to extend landfill life, Government policy prohibits the disposal of construction waste at landfill if it contains more than 20% inert material by volume. Such inert wastes are directed to reclamation areas, where they have the added benefit of offsetting the need for removal of materials from terrestrial borrow areas.

5.7.10 If landfill disposal has to be used, the wastes will most likely be delivered to the SENT Landfill.

5.7.11 The requirements for the handling and disposal of bentonite slurries should follow the *Practice Note For Professional Persons - Construction Site Drainage, Professional Persons Consultative Committee, 1994* (ProPECC PN 1/94).

5.7.12 At the present time, Government is developing a charging policy for the disposal of waste to landfill, which will provide an additional incentive to reduce waste when implemented.

Chemical Waste

5.7.13 For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.

5.7.14 Chemical waste that is produced, as defined by *Schedule 1* of the *Waste Regulations (Chemical) 1992,* should be handled as follows.

5.7.15 Containers used for the storage of chemical wastes should:

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

5.7.16 The storage area for chemical wastes should:

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

- be arranged such as to separate incompatible materials.

5.7.17 Disposal of chemical waste should:

- use a licensed waste collector; and
- be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility (which offers both a chemical waste collection service and supply the necessary storage containers); or
- be to a reuser of the waste, under approval from the EPD, the Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers.

General Refuse

5.7.18 General refuse generated on-site should be stored in enclosed bins or compaction units separate from construction and chemical wastes. A reputable waste haulier should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily or every second day basis to minimise odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

5.7.19 General refuse is generated largely by food service activities on site, so reusable rather than disposable dishware should be used if feasible. Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated or easily accessible, so separate, labelled bins should be provided if feasible.

Summary

5.7.20 This section describes waste management requirements and provides practical actions which can be taken to minimise the impacts arising as a result of the generation, storage, handling, transport and disposal of wastes. Waste reduction is best achieved at the planning and design stage, as well as by ensuring that processes are run in the most efficient way. For unavoidable wastes, reuse, and optimal disposal are most practical when segregation occurs on the construction site, as follows:

- excavated material (inert) suitable for reclamation or fill;
- construction waste (inert) for disposal at public dump;
- construction waste (non-inert) for landfill;
- chemical waste; and
- general refuse.

5.7.21 The criteria for sorting solid waste is described in the *New Disposal Arrangements for Construction Waste*. Waste containing in excess of 20% by volume of inerts should be segregated from waste with a larger proportion of putrescible material.

5.7.22 Proper storage and site practices will minimise the damage or contamination of construction materials. If space permits, on site measures may be implemented which promote the proper disposal of wastes once off-site. For example having separate skips for inert (rubble, sand, stone, etc) and non-inert (wood, organics, etc) wastes would help ensure that the former are taken to public fill sites, while the latter are properly disposed of at controlled landfills. Since waste brought to public fill sites will not be charged, while those brought to landfill may be charged, separating waste may also help to reduce waste disposal costs.

5.7.23 Specifically, it is recommended that:

- wastes should be handled and stored in a manner which ensures that they are held securely without loss or leakage thereby minimising the potential for pollution;
- only reputable waste hauliers authorised to collect the specific category of waste concerned should be employed;
- removal of demolition wastes should coincide with the demolition work;
- appropriate measures should be employed to minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers;
- the necessary waste disposal permits should be obtained from the appropriate authorities, if they are required, in accordance with the *Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)* and the *Crown Land Ordinance*;
- collection of general refuse should be carried out frequently, preferably daily;
- waste should only be disposed of at licensed sites and site staff and the civil engineering Contractor should develop procedures to ensure that illegal disposal of wastes does not occur;
- waste storage areas should be well maintained and cleaned regularly.

Training

5.7.24 Training and instruction of construction staff should be given at the site to increase awareness and draw attention to waste management issues and the need to minimise waste generation.

5.8 Operational Impacts

General

5.8.1 This *Section* describes the likely waste streams arising from the operation of the depot and station associated with the TKE Phase II and details the waste

management mitigation measures which are recommended.

5.8.2 TKE Phase II comprises the railway itself, the tunnels, associated electrical, communications, ventilation and drainage systems, stations, and a maintenance depot. The station and maintenance depot will be located in TKO Area 86.

5.8.3 Background information from a number of audits of MTRC sites, which were undertaken by ERM in 1995, have been included in this report, as it is considered to give a good indication of the likely waste arisings and management procedures which could occur in the TKE Phase II station.

Potential Sources of Impact

General

5.8.4 During the operation of TKE Phase II, waste will be generated by:

- the public and MTRC staff;
- the maintenance of building services in the station and depot, such as ventilation and lifts;
- railway maintenance activities in the depot; and
- any renovation or modification to the station, depot or tunnels.

5.8.5 Waste arisings which will be generated typically consist of general refuse, industrial waste and chemical waste. The volumes and nature of each of these wastes types are described below.

5.8.6 The waste arisings may vary depending upon passenger usage, number and proximity of retail outlets, numbers of MTRC staff and maintenance requirements.

General Refuse

5.8.7 General refuse will be generated by the public, commercial operators within stations and the MTRC itself. Based on previous investigations of MTRC operations, the general refuse that will arise at the stations will be composed of food waste, aluminum cans, wood, plastic, office wastes, tins/containers, cleaning materials and miscellaneous other wastes produced during daily activities.

5.8.8 The depot will generate less than 10 m^3 of general refuse per day, primarily consisting of litter from trains, cotton waste from workshops, and paper towels.

Industrial Waste

5.8.9 Industrial waste will be generated from maintenance activities in the depot and the maintenance and upkeep of the TKE Phase II station. The depot will be used for heavy cleaning and maintenance activities and, therefore, the waste arisings will be comparable with those of the existing MTRC depots. Railway and station maintenance and renovation may also generate significant amounts of waste, although these arising are likely to be irregular, depending on particular needs and projects.

5.8.10 It is anticipated that the depot could generate up to 50 m^3 of ferrous and non-ferrous scrap per month. Other industrial waste arisings will normally be limited to cleaning wastes, including sediment sludge settled out from external train detergent washing water. These cleaning wastes will be removed periodically by a "sludge gulper".

5.8.11 Carriage maintenance will not be undertaken within the station. Railway and station maintenance or renovation may generate more significant amounts of waste, on an irregular basis, depending on particular needs and projects.

Chemical Waste

5.8.12 Chemical waste may be generated from station building services and railway maintenance, and could include chemicals such as R134a (used in air conditioners and other cooling equipment), lubricants and solvents.

5.8.13 The depot will have two types of chemical waste arisings:

- waste oils and solvents generated from train maintenance; and
- waste batteries and other equipment containing chemicals.

5.8.14 The total annual volumes of chemical waste arisings from the operation of the TKE are expected to be in the order of:

- 16,000 l of oil;
- 2,000 l of solvents;
- 4,500 l of alkaline solutions; and
- 120 l of spent nitric acid.

Assessment Methodology

5.8.15 The assessment of environmental impacts from waste generation is based on three factors:

- the type of waste generated;
- the amount of principal waste types generated; and
- the proposed storage, transport, treatment and disposal methods, and the impacts of these methods.

Prediction and Evaluation of Impacts

General Refuse

5.8.16 There are a variety of impacts associated with the storage and handling of waste which can largely be controlled by good practice. Litter may accumulate on or near the stations, shops or refuse collection points (RCPs) if waste is not properly collected, stored, handled, transported and disposed of in accordance with good management practice. Contaminated water or leachate may arise if the waste is not properly stored in an RCP or if it is not entirely emptied during collections. Pests and vermin may be attracted by the waste if it is not properly contained, and if the storage area is not regularly cleaned and well maintained. Odour problems

may be caused by RCPs if they are not properly cleaned and emptied frequently. Other impacts may occur if wastes other than the approved types are allowed to be deposited at the collection point (such as chemical or hazardous wastes).

Industrial Waste

5.8.17 Industrial wastes have the potential to create similar environmental impacts to general refuse as described above dependent on their composition.

Chemical Waste

5.8.18 Chemical wastes may pose serious environmental and health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the *Waste Disposal (Chemical Waste) (General) Regulation*. These hazards include:

- toxic effects to workers;
- adverse effects on air, water and land from spills;
- fire hazards; and
- biological disruption to sewage treatment works where waste enters the sewage system.

5.8.19 No unacceptable environmental impacts are likely to occur provided chemical wastes are handled in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation* and delivered to a facility licensed to receive chemical wastes.

Waste Reuse, Treatment, Storage, Transportation and Disposal Options

General

5.8.20 This Section sets out the reuse, treatment, storage, transportation and disposal options which may be implemented to avoid or minimise potential adverse impacts associated with waste arisings from the operation of the TKE Phase II under the headings of each waste type. These options should be considered and the recommendations incorporated into a comprehensive on-site waste management plan. Such waste management plans should incorporate site specific factors, such as the designation of areas for the segregation and temporary storage of reusable materials.

Waste Management Hierarchy

5.8.21 The waste management strategy for the TKE Phase II operation should follow the waste management hierarchy as discussed below:

- *Waste Avoidance and Minimisation:* To mitigate the generation of solid waste, waste reduction measures should be used where feasible, particularly if this will lead to reduced costs and increased efficiency for the corporation. Such measures may include eliminating unnecessary waste from maintenance processes, eliminating or reducing transport packaging where the MTRC has direct control and working to reduce the generation of solid waste by the public and retailers associated with the stations.

- *Reuse:* For the remaining solid waste, reusable portions should be separated out where practical.

- *Treatment and Disposal:* All wastes which cannot feasibly be reused, should be disposed of to landfill, or if chemical or other dangerous wastes, to the CWTF, as follows:

  - general refuse and industrial waste should be transported by a reputable private waste collection company and disposed of at solid waste transfer stations or landfill; and

  - chemical waste as defined by *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation*, should be stored in accordance with approved methods defined in the Regulations and the chemical waste, transported by a party licensed to transport chemical wastes by the EPD and disposed of at a facility licensed to receive chemical wastes by EPD.

5.8.22 Based on the above principles, mitigation measures for the three operational waste types are given below.

General Refuse

5.8.23 General refuse should be collected from small bins and delivered to a dedicated station/depot RCP. The guidelines for the design of RCPs are given in the HKPSG. Commercial and industrial enterprises are prohibited from depositing waste at public RCP's. Such enterprises are required to retain the services of a reputable private contractor for the collection and delivery of waste to a transfer station or landfill.

5.8.24 General refuse from the TKE Phase II would most likely be delivered directly to the SENT Landfill by a private waste collector.

Industrial Waste

5.8.25 Industrial waste should be handled, transported, collected and disposed in the same manner as that for general refuse, as described above.

Chemical Waste

5.8.26 Under the *Waste Disposal (Chemical Waste) (General) Regulation*, chemical waste producers should register with EPD. Chemical wastes should be transported by a licensed chemical wastes haulier to a facility licensed to receive chemical wastes.

5.8.27 Chemical waste should be stored in appropriately safe and resistant containers, labelled, and in an appropriate store area, in accordance with the *Waste Disposal (Chemical Waste)(General) Regulation*, as discussed in detail in *Section 5.4.5*. Enviropace, the operator of the CWTF, supplies approved containers for chemical waste which can be replaced with each collection.

5.8.28 Specifically, the chemical waste streams should be handled as follows:

- the maintenance berths in the depot should utilise effective means of capturing waste oils and lubricants during maintenance, such materials should be handled as chemical waste and delivered to a licensed facility for disposal;
- the drainage systems for the maintenance berths should be equipped with oil traps, when emptied and maintained, the contents of these oil traps should be treated as chemical waste; and
- waste batteries and other components containing or contaminated with chemical should be taken by a registered chemical waste collector for disposal at the CWTF.

5.9 Conclusions

5.9.1 Provided that the recommendations put forward in this report are conscientiously acted upon, there will be no unacceptable waste related environmental impacts as a result of the storage, handling, collection, transport, and disposal of wastes arising from the TKE Phase II construction and operation.

5.9.2 The largest construction waste arising will be excavated materials. These materials are not considered to have adverse environmental impacts associated with their disposal because the materials will be reused on site or used as reclamation fill. However, there may be potential impacts associated with the excavation, storage and transport of these materials with respect to dust and vehicle exhaust emissions, noise from plant and vehicles and water contamination from site run-off, as described in *Sections 2, 3 and 4.*

5.9.3 Construction and demolition waste will be limited, nevertheless construction wastes should be minimised and demolition wastes reused wherever practicable to reduce the waste volumes requiring disposal at landfill. Chemical waste and general refuse arising from the TKE Phase II construction should be managed in accordance with the recommendations made within this *Section* in order to avoid health risks to workers or the public and nuisances from dust and odour. Each of these wastes should be kept segregated to avoid cross-contamination allowing inert construction and demolition wastes to be reused or disposed of at public dumps thereby minimising the need for disposal by landfill.

5.9.4 The level of general refuse produced by the TKE operation is not expected to be unduly high, but all feasible measures should be taken to minimise waste generation and reuse wastes. Quantities of industrial and chemical waste arisings will be relatively small as they will be removed from the depot on a regular basis to avoid the accumulation of potentially hazardous materials.

6 LANDUSE AND VISUAL IMPACT

6.1 Introduction

6.1.1 This *Section* focuses on the land use and visual impacts that may arise from the construction and operation of TKE Phase II. Most of the TKE Phase II alignment is within rock tunnel and will not generate landuse or visual impacts, the surface areas which will be affected by the railway are all on recently reclaimed land which is in the process of development.

6.2 Government Legislation and Guidelines

6.2.1 There is no legislation in Hong Kong that relates directly to the assessment of the landscape or visual impacts of construction sites. A degree of control is achieved through the requirement to address visual issues as part of an environmental review and assessment process. The EPD advice note 2/90 Application of the EIA Process to Major Private Sector Projects, identifies visual impact as being an issue of concern to be addressed. In addition, HKPSG (Chapter 10-Landscape and Conservation), outlines those criteria which should be considered when planning in an urban environment.

6.2.2 Government legislation restricts developers from making changes to existing land levels and from felling trees. Government restrictions on the preservation and felling of trees in Hong Kong are detailed in *Government General Regulation 740*.

6.3 Sensitive Receivers and Baseline Conditions

6.3.1 The proposed work sites for TKE Phase II are all sited on recently completed reclamation which is either under development or planned for development. The landuses in the vicinity of the northern section of the alignment site are mainly high-rise residential and schools, some areas are already occupied, whilst the remaining areas will be developed during the same time period as the railway. The central section of the alignment is within rock tunnel and other than the proposed vent building, will not present any landuse or visual impacts. The southern section of the alignment, in Area 86, is located within an area of primarily industrial development, with a proposed recreational area above the landfill to the north which is currently under restoration.

6.4 Potential Sources of Impact

6.4.1 The construction works are likely to generate land-use, landscape and visual impacts in those areas where developments are occupied concurrently with the railway works. Land use impacts would primarily be visual and noise disturbance to nearby uses, there may also be some disruption to existing pedestrian linkages and vehicular routes.

6.4.2 The elements of the proposed construction work that would have a visual impact on the surrounding areas and their population include storage of materials and machinery, fencing for site security and temporary huts. In addition, there would be vehicular traffic associated with these construction works. Potential impacts on the physical landscape will be permanent changes to the landform. All the above land-use, visual and landscape impacts may be reduced to some extent during the construction stage by the introduction of appropriate mitigation measures.

6.5 Prediction Of Impacts

6.5.1 Stored materials and machinery, structures under construction, excavation works, temporary huts and security fencing may all be elements that would be visible outside the site during the construction process. As the construction works progress and the tunnels are completed, the degree of disturbance will slowly subside. Permanent structures will be created for the vent building in Area 108 and the station and depot in Area 86 will be covered by a podium which will provide the base for a major property development. The development above the podium and over the rest of Area 86 is being dealt with separately under the ongoing *Tseung Kwan O Area 86 Planning Study, Maunsell et al, 1997*. All the above features would create visual impacts on residents, users of surrounding properties and pedestrians.

6.6 Evaluation of Impacts

6.6.1 The railway will be constructed in areas which are already undergoing major physical changes as marine areas are reclaimed and developed for, *inter alia*, residential, educational and industrial uses. Thus the railway construction will be only one element of a much larger series of construction activities and not the only source of impact in the area.

6.6.2 Visual impact would be due to the generally unsightly appearance of any construction activities including, earthworks, the movements of machinery, storage of materials, structural works and drainage alterations. However, limited visual impacts are predicted given the other extensive works in the vicinity.

6.6.3 After the construction works are completed, the only above ground elements of the railway will be the vent building in Area 108 and the station and the depot in Area 86. The station and depot will be covered by a podium and fully enclosed within the Area 86 development. Thus only the vent building will be permanently visible.

6.7 Mitigation Measures

6.7.1 The construction areas should be effectively cordoned off, with hoardings on site boundaries and access to the site restricted. Site offices and stockpiles should, where practicable, be use to screen the works from elevated receivers.

6.7.2 Consideration should be given to management of traffic within the area during works when there would be frequent movement of trucks and heavy vehicles into and out of the sites.

6.7.3 The vent building design should be such that the permanent structure is integrated into the overall appearance of the area as much as possible. Where practicable, any vegetation lost during site clearance works for the vent building should be replanted.

6.8 Conclusions

6.8.1 The construction of the railway will be carried out in an area already undergoing extensive development works. The land use impacts associated with the construction and operation of the railway will, therefore, be generally limited due to the existing nature of the area around and to the south of the TKO new town. Nevertheless, mitigation measures should be introduced where practicable to minimise impacts.

6.8.2 Upon completion of the railway works, the construction sites will be developed for property or infrastructural uses and virtually no MTR structures will be visible. Apart from the presence of the vent building, the impacts are, therefore, considered to be temporary.

7 TERRESTRIAL ECOLOGY

7.1 Introduction

7.1.1 This *Section* assesses the potential ecological impacts associated with the TKE Phase II and recommends mitigation measures, where appropriate, to minimize adverse impacts.

Government Legislation and Guidelines

7.1.2 There are a number of international and local regulations, legislations and guidelines which provide the framework for the protection of species and habitats of ecological importance, those related to the current project are:

- *Forests and Countryside Ordinance (Cap 96) of the Revised Edition 1994*;
- *Wild Animals Protection Ordinance (Cap 170) of the Revised Edition 1994*;
- *Town Planning Ordinance (Cap 131)*;
- *Hong Kong Planning Standards and Guidelines* (Chapter 10);
- *Technical Memorandum on EIA Process;*
- *Guidelines for Implementing the Policy on Off-site Ecological Mitigation Measures*; and
- *United Nations Convention on Biodiversity.*

7.1.3 The *Forests and Countryside Ordinance (Cap 96)* prohibits felling, cutting, burning or destroying of trees and growing plants in forests and plantations on government land. Its subsidiary Regulations prohibit the picking, felling or possession of listed rare and protected plant species. The list of protected species in Hong Kong which comes under the Forestry Regulations was last amended on 11 June 1993 under the Forestry (Amendment) Regulation 1993 made under section 3 of the *Forests and Countryside Ordinance (Cap 96).*

7.1.4 Under the *Wild Animals Protection Ordinance (Cap 170)*, designated wild animals are protected from hunting, whilst their nests and eggs are protected from injury, destruction and removal. All birds and most mammals are protected under this Ordinance. As there will be potential loss of woodland habitat, as well as indirect impact to the associated species, the above Ordinances are relevant.

7.1.5 The recently amended *Town Planning Ordinance* provides for the designation of coastal protection areas, Sites of Special Scientific Interest (SSSIs), Green Belt or other specified uses that promote conservation or protection of the environment, eg conservation areas. The authority responsible for administering the Town Planning Ordinance is the Town Planning Board (Planning Department).

7.1.6 The revised chapter 10 of the *Hong Kong Planning Standards and Guidelines (HKPSG)* covers "Conservation". This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and

government departments involved in conservation.

7.1.7 Guidance for the assessment is provided in Annex 16 of the *Technical Memorandum on EIA Process* (TM) which sets out the general approach and methodology for assessment of ecological impact arising from a project or proposal to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts. Annex 8 recommends the criteria that can be used for evaluating ecological impact.

7.1.8 The Guidelines for Implementing the Policy on Off-site Ecological Mitigation Measures, PELB TC No. 1/97 - WBTC No. 4/97 (TC) sets out the government's policy in implementation of off-site ecological mitigation measures which, in brief, requires that where such a measure is required, it would, after full justification, be provided to the extent that it is practicable on a "like for like" basis and within the boundaries of Hong Kong. The evaluation criteria recommended in the Technical Circular Annex A was adopted in the current study.

7.1.9 The PRC is a Contracting Party to the *United Nations Convention on Biological Diversity* of 1992. The Convention requires signatories to make active efforts to protect and manage their biodiversity resources. Hong Kong Government has stated that it will be "committed to meeting the environmental objectives" of the Convention.

7.2 Baseline Conditions

7.2.1 Site visits to the area have identified that the TKE Phase II worksites are all located on either:

- recently reclaimed land, which has been colonised by only occasional scrub vegetation; or
- the vent building (Site D) located on heavily disturbed grassland; and
- the southern portal access adit work site (Site E) which is located on hardstanding, adjacent to a wooded slope on the edge of Area 85.

7.2.2 The ecological value of the areas which will be affected by the railway construction to wildlife of recognized ecological importance is considered to be limited because of the following reasons:

- the highly fragmented nature of the existing habitats limit the potential and capacity of the study area as important to wildlife; and

- the poor habitat quality from frequent human activities within the study area give rise to simple community structure and hence little micro-habitats for wildlife.

7.2.3 The habitat types within the study area are either established on a heavily disturbed areas, suffering from severe and frequent disturbance or fragmented in nature, with only simple structural complexity and species diversity and the ecological value of the study area is considered to be poor.

7.3 Potential Impacts

7.3.1 There will be little loss of vegetation as a direct result of the construction works, although some areas of vegetation will need to be cleared around the boundaries of Sites A, B and C. There is also the possibility of adverse impacts on vegetated areas adjacent to Site D and E if the construction works are not properly controlled. However, as discussed previously in *Section 7.2*, the ecological value of the study area is considered to be poor, and the severity of the impact is, therefore, considered to be low.

7.3.2 The increased human activities in the area during construction may increase the risk of fire and threaten the surrounding habitats. However the impacts can be controlled by good practice as recommended in *Section 7.4*.

7.4 Mitigation Measures

7.4.1 Whilst the severity of impacts have been identified in *Section 7.3* to be low, the following mitigation measures are recommended:

- a tree survey should be conducted before construction works commence to fulfill the requirements of *Works Branch Technical Circular 24/94 - Tree Preservation* and *Planning Environment and Lands Branch Technical Circular 3/94 - Tree Preservation*;

- upon completion of the construction works the worksites should, where practicable, be reinstated and planted with native grass, herb, shrub or tree species that bear fruits preferred by birds and/or palatable to larval or adult butterflies.

7.4.2 The following good construction practices are recommended to avoid any adverse ecological impact to the surrounding environment due to uncontrolled construction activities:

- erect fences along the boundary of construction sites before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel into adjacent areas;

- check regularly to ensure that the work site boundaries are not exceeded and that no damage is being caused to the surrounding areas; and

- the use of fire during construction should be avoided or such use if unavoidable should be carried out under close supervision and appropriate fire fighting equipment should also be installed in the work area.

7.4.3 In addition, the design of the vent building should give consideration to maximising the opportunity to provide planting areas for trees and other vegetation to improve the quality of the local environment.

7.5 Conclusions

7.5.1 The ecological value of the areas selected for construction sites is low and loss of existing vegetation will be limited. Worksites should, where practicable, be reinstated upon completion of the works. Whilst little opportunity exists to provide additional areas for planting, the curtilage of the vent building area should be considered for this purpose.

8 ENVIRONMENTAL MONITORING AND AUDIT

8.1 Introduction

8.1.1 In this Section, recommendations for the environmental monitoring and audit (EM&A) programme are outlined, taking account of the findings of this DEIA and the environmental protection criteria requirements to be incorporated into the DDC contracts.

8.1.2 This DEIA has identified that EM&A will only be necessary for air quality and noise impacts during the construction period. No water sensitive receivers will be affected during either the construction or operation of the proposed site and any potential impacts on the local drainage system will be controlled by the requirements of the wastewater discharge licence.

8.1.3 Requirements for landfill gas and/or leachate monitoring will be determined from the findings of the Landfill Gas and Leachate Hazard Assessment which is being undertaken in parallel to this DEIA Study.

8.1.4 As identified in the TKE Phase I DEIA, the MTRC will undertake the EM&A work required during the construction of the TKE Phase I. The Corporation will extend this role to include the TKE Phase II and the recommendations of this Report should, therefore, be included in subsequent revised versions of the TKE EM&A Manual. The MTRC's and the Contractor's responsibilities will be related through the application of Event Contingency Plans (ECPs) to deal with any exceedance of the established criteria, either in the course of normal construction working or through unforseen circumstances.

8.2 Objectives of Environmental Monitoring and Audit

8.2.1 The overall objectives of the EM&A programme which will be undertaken during the TKE Phase II construction works are as follows:

- to monitor the performance of the project and to provide an early indication if any of the environmental mitigation measures, identified in this report and/or implemented by the contractors, fail to meet the established standards and guidelines, particularly the environmental protection criteria identified in this DEIA;
- to take remedial action if unexpected problems or unacceptable impacts arise;
- to provide data to enable an environmental audit to be undertaken;
- to provide a data base against which the short or long term environmental effects associated with the works may be determined; and
- to verify the environmental impacts predicted in the DEIA.

8.3 Monitoring Requirements

8.3.1 An EM&A programme is necessary for assessing the effectiveness of the recommended mitigation measures for the construction works and to ensure compliance with action and target levels in accordance with the current EPD EM&A requirements. The findings of the TKE Phase II DEIA have been used to identify that only dust and noise monitoring are required for the EM&A programme. The recommended monitoring requirements are set out below and full details of the EM&A programme, including monitoring equipment, and monitoring and audit protocols, are set out in the TKE EM&A Manual. Following agreement with the EPD, the Phase II monitoring locations should be incorporated into the TKE EM&A Manual.

Dust

8.3.2 From the findings of the DEIA, it is recommended that construction dust monitoring should be carried out at ASRs A4 (Proposed school, western part of Area 56), A9 (Primary School, Area 37) and A10 (Yuk Ming Court, Area 37) in the north and A 14 (copper smelter offices, Area 85) and A17 (Golf Course, Area 77) in the south. It should be noted that the three ASRs in the north have already been identified as monitoring locations during the TKE Phase I construction works and need not be further addressed here. Furthermore, ASR A17 should only be included in the monitoring programme if the recreational area is expected to be open to the public during the TKE Phase II construction works. The monitoring programme is summarised in *Table 8.3b* below.

Table 8.3b Dust Monitoring Requirements

Period	Location	Frequency
Baseline	A14 A17	At least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hr TSP samples. 1-hr sampling shall be carried out at least 3 times per day while the highest dust impact is expected.
Works	A14 A17	At least once in every six days for 24-hr TSP monitoring. No regular 1-hour TSP monitoring will be undertaken.

Noise

8.3.4 Noise monitoring is recommended during construction to ensure compliance with the target levels for noise recommended in ProPECC PN2/93. It is recommended that noise monitoring be carried out during the construction period at NSRs N1(proposed school, southern part of Area 55), N3 (proposed clinic, Area 56), N7 (proposed PSPS/HOS, Area 65), N8 (primary school, Area 37) and N10 (village housing, Area 35). Monitoring will only be required if the NSRs are occupied during the construction period and, in the case of the schools and clinic (N1, N3 & N8) during opening hours. N8 has already been identified for monitoring fro the Phase I works and need not be further addressed here. The monitoring frequency during construction works is summarised in *Table 8.3a* below.

Table 8.3a Noise Monitoring Requirements

Period	Location	Frequency
Baseline	N1 N3 N7 N10	Carried out daily for a period of 2 weeks. Measurements of the L_{eq}, L_{90} and L_{10} noise levels shall be made, over 30 minute periods, over the full 24 hour period for N7 and the opening hours of N1 and N3.
Works	N1 N3 N7 N10	1 set of measurements per week (6 consecutive $L_{eq\,(5\,min.)}$ results) between 07.00 - 19.00 on normal weekdays. For evening working, 1 set of measurements (3 consecutive $L_{eq\,(5\,min.)}$ results) between 19.00 - 23.00 on normal weekdays at occupied receivers only.

8.4 Event Contingency Plans

8.4.1 The purpose of the ECPs is to provide, in association with the monitoring and audit activities, procedures for ensuring that if any deterioration of environmental quality occurs as a result of the works, either accidentally or through inadequate implementation of mitigation measures on the part of the contractor, that the cause of this is quickly identified and remedied, and that the risk of a similar event re-occurring is reduced.

8.4.2 The principle upon which the ECPs are based is the prescription of procedures and actions associated with the measurement of certain defined levels of pollution by environmental monitoring, established prior to the commencement of the construction works. These are:

- *Action Level*, beyond which appropriate remedial actions may be necessary to prevent environmental quality deteriorating further; and
- *Limit Level*, the limits stipulated in the relevant Hong Kong statutes and guidelines, if these are exceeded, works should not proceed without appropriate remedial action, including a critical review of plant and working methods.

Reporting

8.4.3 The primary reporting function, undertaken within the EM&A programme will be the issuance of formal exceedance notifications, corrective actions and ongoing feedback between the EM&A Team and the Corporation. In addition, periodic reviews of the EM&A process will be prepared and circulated to relevant personnel within the Corporation's Project Team as a means of gauging site staff and contractor performance. The periodic reviews will comprise Monthly, Biannual and Annual EM&A Reports; these Reports will be copied to the EPD for comment.

8.4.3 Baseline monitoring results and proposals for the A/L level parameters will be submitted to the EPD for agreement. The Report will be supported by the baseline monitoring data in electronic format, along with information from the EM&A Manual covering monitoring locations, equipment and protocols.

8.4.4 A Monthly Report will be produced as part of the TKE EM&A programme which may include a brief account of construction activities during the month, an interpretation of the monitoring results by verifying compliance and highlighting any failure to comply with the target levels in the form of an Environmental Performance Index (similar to the LAR EM&A) and an account of any necessary remedial measures recommended by the MTRC site staff and implemented by the Contractor.

8.4.4 In addition to the Monthly Reports, Bi-annual and Annual Reports will be issued which will provide a general overview of the progress of the Project EM&A to date.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions - Construction Phase

Air Quality

9.1.1 Unmitigated dust has been identified as the only air quality impact arising during the construction phase of the proposed TKE Phase II. In the absence of any mitigation measures, high dust impacts are predicted at a limited number of the identified ASRs. Excavation works and vehicles moving on haul roads have been identified as the main sources of dust.

9.1.2 Mitigation measures have been identified to minimise the generation of dust during the construction works and these should be incorporated at the detailed design stage to reduce the likely impacts at the ASRs to within the identified criteria.

9.1.3 Mitigation measures, particularly the wetting of dusty areas and limiting the speeds of trucks on unpaved haul roads should be implemented at all times to control the dust impacts to acceptable levels.

9.1.4 The mitigation measures identified for the control of air quality impacts (see *Figure 9.1a*) have been recommended, based on the assumption that all sensitive receivers will be occupied during the construction works, to ensure that sufficient protective measures have been identified. However, the measures proposed for specific receivers may not be necessary if the ASR is unoccupied during part or all of the works and any suggested restrictions on site activities should be confirmed at the appropriate stage of the construction programme.

Noise and Vibration

9.1.5 The results of this assessment indicate that potential noise impacts at the majority of NSR neighbouring the TKE worksites can be adequately controlled through the use of typical mitigation measures including; the use of quiet plant, temporary noise barriers and restrictions on the operating schedule and on-time of specific items of plant.

9.1.6 Residual impacts at two proposed schools, immediately north of Site A (N1 and N2), can be prevented through the provision of appropriate noise insulation (and air-conditioning) or, if practicable, by further restrictions on vibratory piling operations.

9.1.7 Residual impacts at the proposed clinic (N3) to the west of Site A, may be prevented through the provision of appropriate noise insulation (and air conditioning) or, if practicable, by further restrictions on vibratory piling operations.

9.1.8 The mitigation measures identified for the control of noise impacts (see *Figure 9.1a*) have been recommended, based on the assumption that all sensitive receivers will be occupied during the construction works, to ensure that sufficient

protective measures have been identified. However, the measures proposed for specific receivers may not be necessary if the NSR is unoccupied during part or all of the works and any suggested restrictions on site activities should be confirmed at the appropriate stage of the construction programme.

Water Quality

9.1.9 Activities associated with construction of the TKE Phase II could lead to site runoff containing elevated concentrations of SS and associated contaminants. Detailed mitigation measures have been described which should effectively control all potential impacts (see *Figure 9.1a*). No residual impacts are predicted.

Waste Management

9.1.10 The largest construction waste arising will be excavated materials. These materials are not considered to have adverse environmental impacts associated with their disposal because the materials will be reused on site or used as reclamation fill.

9.1.11 Provided that the recommendations put forward in this report are incorporated at the detailed design stage, there will be no unacceptable waste related environmental impacts as a result of the storage, handling, collection, transport, and disposal of wastes arising from the TKE Phase II construction and operation.

Ecology

9.1.12 The ecological value of the areas selected for construction sites is low and loss of existing vegetation will be limited. Worksites should, where practicable, be reinstated upon completion of the works. Whilst little opportunity exists to provide additional areas for planting, the curtilage of the vent building area should be considered for this purpose.

Landuse and Visual

9.1.13 The construction of the railway will be carried out in an area already undergoing extensive development works. The land use impacts will, therefore, be generally limited due to the existing nature of the area around and to the south of the TKO new town. Nevertheless, mitigation measures should be introduced where practicable to minimise impacts.

Environmental Monitoring and Audit

9.1.14 Potential exceedances of the established dust and noise criteria have been identified during the construction works for the TKE Phase II. It is, therefore, proposed to undertake dust and noise monitoring at selected sensitive receivers to ensure that the necessary mitigation measures are applied to control impacts to within the established criteria. No other EM&A requirements have been identified, although landfill gas and/or leachate monitoring could be required, depending on the results of the Landfill Gas And Leachate Hazard Assessment which is being undertaken in parallel to this DEIA Study.

Table 9.1a Implementation of Mitigation Measures

Mitigation Measure	Sheet Piling	Bulk Excavation	Concreting Tunnels	Shotcreting Tunnels	Commissioning
Air Quality					
Site Watering & Compaction	All sites	All sites	All sites	All sites	-
Vehicle Speed Control	All sites	All sites	All sites	All sites	-
Boundary Fencing	Sites A, B & C	Sites A, B & C	Sites A, B & C	Sites A, B & C	-
Blast Suppression	-	Rock Tunnel Portals	-	-	-
Vent Orientation	-	-	-	-	Vent Building, Depot and Station
Noise					
Quiet Plant and Moveable Barriers	Sites A & B	Sites A & B	Sites A, B & C	Sites A, B & C	-
Quiet Plant, Moveable Barriers and Limited Numbers of Plant	Sites A & B	Site A	Sites A & B	Sites A & B	-
Option of Glazing for Schools and Clinic	TKO & HAH	TKO & HAH	TKO & HAH	TKO & HAH	-
Acoustic Control of Vents	-	-	-	-	Vent Building, Depot and Station
Water Quality					
Site Boundary Drainage	All sites	All sites	All sites	All sites	-
Site Runoff Control and Drainage	All sites	All sites	All sites	All sites	-
Operational Drainage Systems	-	-	-	-	Depot, Station & tunnels
Ecology					
Site Boundary Fencing	All sites	All sites	All sites	All sites	-
Vehicle Movement Controls	All sites	All sites	All sites	All sites	-
Revegetation	-	-	-	All Sites	All sites

9.2 Conclusions - Operational Phase

Air Quality

9.2.1 Air quality impacts during operation of the TKE Phase II are not considered to be of concern. However, consideration must be given to the design and orientation of the ventilation shafts, which should also be directed away from ASRs to avoid the possibility of potential nuisance.

Noise and Vibration

9.2.2 Potential adverse noise impacts during the operational phase of the railway could arise from train movements and the ventilation systems for the station, depot and tunnels. The MTRC will require that the detailed design of the railway, station and depot includes the provision of effective measures to control any impacts to within the established criteria. This will ensure that all NSRs are properly protected.

Water Quality

9.2.3 Appropriate drainage collection facilities have been recommended to be incorporated into the design of the TKE Phase II to collect contaminated effluent during operation. Mitigation measures, including on-site sewage treatment facilities, are recommended to achieve WPCO discharge standards and prevent associated residual water quality impacts. It is considered that, with the adoption of the recommended mitigation measures, no insurmountable water quality impacts will result from the operational phase of the TKE Phase II.

Waste Management

9.2.4 The level of general refuse produced by the TKE operation is not expected to be unduly high, but all feasible measures should be taken to minimise waste generation and reuse wastes. Industrial and chemical waste from maintenance activities will be limited, as only minor carriage maintenance will occur at the depot.

Ecology

9.2.5 No ecological impacts have been predicted during the operation of the railway.

Landuse And Visual Impacts

9.2.6 Upon completion of the railway works, the construction sites will be developed for property or infrastructural uses and virtually no MTR structures will be visible. Apart from the presence of the vent building, the impacts are, therefore, considered to be temporary and no adverse operational impacts are expected.

Environmental Monitoring and Audit

9.2.7 No requirements for operational EM&A have been identified.

9.2 Recommendations for Further Studies

9.3.1 Following the completion of the TKE Phase II DEIA, a number of issues remain to be determined.

9.3.2 A Landfill Gas and Leachate Hazard Assessment is currently being undertaken in parallel to this DEIA Study and the report is scheduled to be issued in the early part of 1998. This assessment will determine the potential risk from landfill gas and/or leachate migration into Area 86 and will be used in the Detailed Design Consultancy for the station and depot to determine the engineering requirements to deal with any identified potential hazard. The Consultants consider that, from previous experience under similar circumstances, any potential hazard can be fully controlled through suitable engineering treatments. The measures applied to protect the MTRC structures will also prove effective in protecting any other developments in Area 86.

9.3.3 In advance of any construction works, the MTRC will require the contractor to produce an environmental management plan to ensure that the criteria established in this DEIA will be met. The contractor will be required to review the potential impacts from his planned construction methodology, as well as any changes in the status of sensitive receivers, against the findings of the DEIA. He will be required to establish and implementation timetable and, where necessary, revise the proposed mitigation measures, to ensure compliance with the established criteria.

9.3.4 As noted above, the Detailed Design Consultancy will identify engineering requirements to deal with any potential landfill gas and/or leachate impacts. The scope of the Detailed Design Consultancy will also include the development of effective control measures to protect occupants of the proposed Area 86 development from adverse air quality, noise and vibration impacts from the operational railway. The scope of the consultancy will also cover the development of any necessary water treatment plant to deal with aqueous discharges from the depot.

Annex A

Construction Plant Lists

Table A1 Plant Inventory - No Mitigation

Section - Cut and Cover Tunnel

Activity	PME	TM ref	UNIT	SWL	sub-SWL
1 Vibratory Sheet Piling	Sheet pile vibrator	*	2	118	121
	Generator	CNP101	2	108	111
				Total SWL	121

*Reference source:- SWL is taken from BS5228:Part 4:1986 (Table 1, Ref 53)

Activity	PME	TM ref	UNIT	SWL	sub-SWL
2. Bulk Excavation	Excavator	CNP081	2	112	115
	Lorry	CNP141	6	112	120
	Loader	CNP081	2	112	115
				Total SWL	122

Activity	PME	TM ref	UNIT	SWL	sub-SWL
3.Concreting of Tunnel Slabs	Mixer lorry	CNP044	5	109	116
	Generator	CNP101	2	108	111
	Excavator	CNP081	4	112	118
	Lorry	CNP141	2	112	115
	Pump lorry	CNP047	1	109	109
	Poker vibrator	CNP170	5	113	120
	Crane	CNP048	2	112	115
	Air compressor	CNP003	3	104	109
				Total SWL	125

Activity	PME	TM ref	UNIT	SWL	sub-SWL
4. Shotcreting (spray concrete inside tunnel)	Mixer lorry	CNP044	5	109	116
	Generator	CNP101	2	108	111
	Excavator	CNP081	4	112	118
	Lorry	CNP141	2	112	115
	Pump lorry	CNP047	1	109	109
	Poker vibrator	CNP170	5	113	120
	Crane	CNP048	2	112	115
	Air compressor	CNP003	3	104	109
				Total SWL	125

Section - Tunnelling

Activity	PME	TM ref	UNIT	SWL	sub-SWL
1A. Tunnelling (day)	Generator	CNP101	1	108	108
	Excavator	CNP081	1	112	112
	Lorry	CNP141	4	112	118
	Drill	CNP183*	1	106	106
	(below ground)			Total SWL	120

*Includes 10 dB as it will be underground

Table A2 Plant Inventory - Quiet Plant and Movable Noise Barriers

Section - Cut and Cover Tunnel

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
1 Vibratory Sheet Piling	Sheet pile vibrator	*	2	118	100	121
	Generator (QP)	CNP102	2	100	100	103
				Total SWL		121

*Reference source:- SWL is taken from BS5228:Part 4:1986 (Table 1, Ref 53)

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
2. Bulk Excavation	Excavator (QP)	CNP081	2	105	100	108
	Lorry (QP)	CNP141	6	105	100	113
	Loader (QP)	CNP081	2	105	100	108
					sub-total	115
					Barrier	-5
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
3.Concreting of Tunnel Slabs	Mixer lorry	CNP044	5	109	100	116
	Generator (QP)	CNP102	2	100	100	103
	Excavator (QP)	CNP081	4	105	100	111
	Lorry (QP)	CNP141	2	105	100	108
	Pump lorry	CNP047	1	105	100	105
	Poker vibrator (QP)	CNP170	5	110	100	117
	Crane (QP)	CNP048	2	105	100	108
	Air compressor	CNP003	3	100	100	105
					sub-total	121
					barrier	-5
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
4. Shotcreting (spray concrete inside tunnel)	Mixer lorry	CNP044	5	109	100	116
	Generator (QP)	CNP102	2	100	100	103
	Excavator (QP)	CNP081	4	105	100	111
	Lorry (QP)	CNP141	2	105	100	108
	Pump lorry	CNP047	1	105	100	105
	Poker vibrator (QP)	CNP170	5	110	100	117
	Crane (QP)	CNP048	2	105	100	108
	Air compressor	CNP003	3	100	100	105
					sub-total	121
					Barrier	-5
					Total SWL	116

Bored Tunnelling

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
Tunnelling (day)	Generator (QP)	CNP102	1	100	100	100
	Excavator (QP)	CNP081	1	105	100	105
	Lorry (QP)	CNP141	4	105	100	111
					sub-total	112
					Barrier	-5
					Total (excl. drill)	107
	Drill	CNP183*	1	106	100	106
	(below ground)				Total SWL	110

*Includes 10 dB Shielding from Tunnel

Table A3 Plant Inventory and Source Data - Mitigation Option 2

Site A - Cut and Cover Tunnel

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
1a Vibratory Sheet Piling	Sheet pile vibrator	*	2	118	80	120
	Generator (QP)	CNP102	2	100	100	103
				Total SWL		120
1b Vibratory Sheet Piling	Sheet pile vibrator	*	2	118	100	121
	Generator (QP)	CNP102	2	100	100	103
				Total SWL		121

*Reference source:- SWL is taken from BS5228:Part 4:1986 (Table 1, Ref 53)

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
2. Bulk Excavation	Excavator (QP)	CNP081	2	105	100	108
	Lorry (QP)	CNP141	6	105	100	113
	Loader (QP)	CNP081	2	105	100	108
					sub-total	115
					Barrier	-5
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
3.Concreting of Tunnel Slabs	Mixer lorry	CNP044	5	109	100	116
	Generator (QP)	CNP102	2	100	100	103
	Excavator (QP)	CNP081	4	105	100	111
	Lorry (QP)	CNP141	2	105	100	108
	Pump lorry	CNP047	1	105	100	105
	Poker vibrator (QP)	CNP170	5	110	80	116
	Crane (QP)	CNP048	2	105	100	108
	Air compressor	CNP003	3	100	100	105
					sub-total	121
					barrier	-5
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
4. Shotcreting (spray concrete inside tunnel)	Mixer lorry	CNP044	5	109	90	116
	Generator (QP)	CNP102	2	100	100	103
	Excavator (QP)	CNP081	4	105	100	111
	Lorry (QP)	CNP141	2	105	100	108
	Pump lorry	CNP047	1	105	100	105
	Poker vibrator (QP)	CNP170	5	110	80	116
	Crane (QP)	CNP048	2	105	100	108
	Air compressor	CNP003	3	100	100	105
					sub-total	120
					Barrier	-5
					Total SWL	115

Table A4 Predicted Facade Noise Levels from Construction Site A - Cut and Cover Tunnelling,dB(A)

Section - Cut and Cover Tunnel		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		100	100	150	200	250	500	100	500	600	700	250
Activity	SWL											
1 Vibratory Sheet Piling	121	76	76	73	70	68	62	76	62	61	60	68
2. Bulk Excavation	122	77	77	73	71	69	63	77	63	61	60	69
3.Concreting of Tunnel	125	80	80	76	74	72	66	80	66	64	63	72
4. Shotcreting (spray concrete inside tunnel)	125	80	80	76	74	72	66	80	66	64	63	72

Table A5 Predicted Facade Noise Levels from Construction Site B - Cut and Cover Tunnelling,dB(A)

NSR		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		300	400	500	600	650	900	500	200	150	350	400
Activity	SWL											
1 Vibratory Sheet Piling	121	67	64	62	61	60	57	62	70	73	66	64
2. Bulk Excavation	122	67	65	63	61	61	58	63	71	73	66	65
3.Concreting of Tunnel	125	70	68	66	64	63	61	66	74	76	69	68
4. Shotcreting (spray concrete inside tunnel)	125	70	68	66	64	63	61	66	74	76	69	68

Table A6 Predicted Facade Noise Levels from Construction Site C - Bored Tunnelling, dB(A)

NSR		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		900	1000	1050	1150	1200	1500	900	300	100	50	600
Activity	SWL											
1. Tunnelling (day)	120	55	55	54	53	53	51	55	65	75	81	59

Table A7 Predicted Facade Noise Levels from Construction Site A - Cut and Cover Tunnelling,dB(A)

Section - Cut and Cover Tunnel		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		100	100	150	200	250	500	100	500	600	700	250
Activity	SWL											
1 Vibratory Sheet Piling	121	76	76	73	70	68	62	76	62	61	59	68
2. Bulk Excavation	110	65	65	61	59	57	51	65	51	49	48	57
3.Concreting of Tunnel	116	71	71	67	65	63	57	71	57	55	54	63
4. Shotcreting (spray concrete inside tunnel)	116	71	71	67	65	63	57	71	57	55	54	63

Table A8 Predicted Facade Noise Levels from Construction Site B - Cut and Cover Tunnelling,dB(A)

NSR		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		300	400	500	600	650	900	500	200	150	350	400
Activity	SWL											
1 Vibratory Sheet Piling	121	67	64	62	61	60	57	62	70	73	65	64
2. Bulk Excavation	110	55	53	51	49	49	46	51	59	61	54	53
3.Concreting of Tunnel	116	61	59	57	55	55	52	57	65	67	60	59
4. Shotcreting (spray concrete inside tunnel)	116	61	59	57	55	55	52	57	65	67	60	59

Table A9 Predicted Facade Noise Levels from Construction Site C - Bored Tunnelling, dB(A)

NSR		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		900	1000	1050	1150	1200	1500	900	300	100	50	600
Activity	SWL											
1. Tunnelling (day)	110	46	45	44	43	43	41	46	55	65	71	49

Table A10 Predicted Facade Noise Levels from Construction Site A - Cut and Cover Tunnelling,dB(A)

Section - Cut and Cover Tunnel		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		100	100	150	200	250	500	100	500	600	700	250
Activity	SWL											
1 Vibratory Sheet Piling	120	75	75	72	69	67	61	75	61	60	58	67
2. Bulk Excavation	110	65	65	61	59	57	51	65	51	49	48	57
3.Concreting of Tunnel	116	71	71	67	65	63	57	71	57	55	54	63
4. Shotcreting (spray concrete inside tunnel)	115	70	70	67	64	62	56	70	56	55	53	62

Table A11 Predicted Facade Noise Levels from Construction Site B - Cut and Cover Tunnelling,dB(A)

NSR		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		300	400	500	600	650	900	500	200	150	350	400
Activity	SWL											
1 Vibratory Sheet Piling	121	67	64	62	61	60	57	62	70	73	65	64
2. Bulk Excavation	110	55	53	51	49	49	46	51	59	61	54	53
3.Concreting of Tunnel	116	61	58	57	55	54	51	57	65	67	60	58
4. Shotcreting (spray concrete inside tunnel)	115	61	58	56	55	54	51	56	64	67	60	58

Table A12 Predicted Facade Noise Levels from Construction Site C - Bored Tunnelling, dB(A)

NSR		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		900	1000	1050	1150	1200	1500	900	300	100	50	600
Activity	SWL											
1. Tunnelling (day)	110	46	45	44	43	43	41	46	55	65	71	49

Table A13 Plant Inventory - Specific Mitigation

Site A - Cut and Cover Tunnel

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
1a Vibratory Sheet Piling	Sheet pile vibrator	*	2	118	80	120
	Generator (QP)	CNP102	2	100	100	103
				Total SWL		120
1b Vibratory Sheet Piling	Sheet pile vibrator	*	2	118	25	115
	Generator (QP)	CNP102	2	100	100	103
				Total SWL		121
1c Vibratory Sheet Piling	Sheet pile vibrator	*	2	118	23	115
	Generator (QP)	CNP102	2	100	100	103
				Total SWL		118

*Reference source:- SWL is taken from BS5228:Part 4:1986 (Table 1, Ref 53)

3.Concreting of Tunnel Slabs	Mixer lorry	CNP044	5	109	100	116
	Generator (QP)	CNP102	2	100	100	103
	Excavator (QP)	CNP081	4	105	100	111
	Lorry (QP)	CNP141	2	105	100	108
	Pump lorry	CNP047	1	105	100	105
	Poker vibrator (QP)	CNP170	5	110	55	114
	Crane (QP)	CNP048	2	105	100	108
	Air compressor	CNP003	3	100	100	105
					sub-total	120
					barrier	-5
					Total SWL	115
4. Shotcreting (spray concrete inside tunnel)	Mixer lorry	CNP044	5	109	90	116
	Generator (QP)	CNP102	2	100	100	103
	Excavator (QP)	CNP081	4	105	100	111
	Lorry (QP)	CNP141	2	105	100	108
	Pump lorry	CNP047	1	105	100	105
	Poker vibrator (QP)	CNP170	5	110	55	114
	Crane (QP)	CNP048	2	105	100	108
	Air compressor	CNP003	3	100	100	105
					sub-total	120
					Barrier	-5
					Total SWL	115

Site B - Cut and Cover Tunnel

Activity	PME	TM ref	UNIT	SWL	%on-time	sub-SWL
1a Vibratory Sheet Piling	Sheet pile vibrator	*	2	118	90	121
	Generator (QP)	CNP102	2	100	100	103
				Total SWL		121
1b Vibratory Sheet Piling	Sheet pile vibrator	*	2	118	90	121
	Generator (QP)	CNP102	2	100	100	103
				Total SWL		121

*Reference source:- SWL is taken from BS5228:Part 4:1986 (Table 1, Ref 53)

Table A14 Predicted Facade Noise Levels from Construction Site A - Specific Mitigation,dB(A)

Section - Cut and Cover Tunnel		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		100	100	150	200	250	500	100	500	600	700	250
Activity	SWL											
1a Vibratory Sheet Piling	120	75	75	72	69	67	61	75	61	60	58	67
1b Vibratory Sheet Piling	121	76	76	73	70	68	62	76	62	61	59	68
1c Vibratory Sheet Piling	118	73	73	69	67	65	59	73	59	57	56	65
3.Concreting of Tunnel	115	70	70	67	64	62	56	70	56	54	53	62
4. Shotcreting (spray concre	115	70	70	66	64	62	56	70	56	54	53	62

Table A15 Predicted Facade Noise Levels from Construction Site B - Specific Mitigation,dB(A)

NSR		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
Separation, m		300	400	500	600	650	900	500	200	150	350	400
Activity	SWL											
1a Vibratory Sheet Piling	121	66	64	62	60	59	57	62	70	72	65	64
1b Vibratory Sheet Piling	121	66	64	62	60	59	57	62	70	72	65	64

Annex B

Responses to Comments on the Draft DEIA

Response to Comments
Tseung Kwan O Extension Phase II
Draft Detailed Environmental Impact Assessment Report

No.	Department	Reference	Comments	Consultants' Response
1.	Highways Dept/ WW Tse/21 Nov 1997	HNT 901/SK/21	I have no comment on the above study from a highway point of view.	Noted.
2.	HK Housing Authority/ Kelvyn Hymas/28 Nov 1997	HD(P) 7/2/TK09 VIII	My comments on the captioned report are as follows: (a) Para. 3.2.8 It is currently anticipated that TKO Area 65 PSPS will be completed in late 2000. Please update your report accordingly.	The text will be amended to include the completion date.
			(b) Para 3.11.2 The first sentence applies to the public housing development at comment (a), whereas the second does not.	Noted.
3.	TDD/K M Chung/28 Nov 1997	(22) in UA 4/5/42	I have no comments on the above draft final report.	Noted.
4.	Transport Dept/H L Chan/1 Dec 1997	CT/PAD 106/160-1 III	Please be advised that I have no comments on the Draft DEIA circulated by ERM under letter Ref: C1365\74827\CONSULT dated 26.11.97.	Noted.
5.	AFD/K W Cheung/2 Dec 1997	(19) in AF DVL 01/116/2 IV	I refer to your letter of 26 Nov 1997 addressed to the EPD and copied to this Department amongst others. For clarity, it would be useful to further elaborate on Section 7.2.1. The habitat types found in each of the construction sites A to E should be specified with some descriptions of any flora and fauna found there. This would provide more information to support your assessment in the following Sections 7.2.2 and 7.2.3.	Only site D is located on a vegetated area, sites A, B and C are already construction sites, site E is hardstanding (a car park). As identified in the text, site B is heavily disturbed grassland of poor habitat quality.

No.	Department	Reference	Comments	Consultants' Response
			Section 7.2.1 mentioned that Site E is "located on hardstanding adjacent to a wooded slope". Moreover, Section 7.4.1 indicated that "there will be potential loss of woodland habitat". As such, the location of the woodland should be shown in a plan and the characters of the woodland should be described.	The potential loss of woodland at site E would only occur if the site boundaries are exceeded. Appropriate mitigation measures have been identified to prevent this occurring.
			It was stated in Section 7.3.1 that "there is the possibility of adverse impacts on vegetated areas adjacent to Site D and E". Where are these "vegetated areas" and what kinds of vegetation are being found there? Are they referring to the "disturbed grassland" and "wooded slope" mentioned in Section 7.2.1"?	The vegetated areas refereed to have, as you note, already been identified in the text. As noted above, appropriate mitigation measures have been identified to prevent any off-site impacts.
			The references to "Section 7.5", "Section 7.7" and "Section 7.6" in Sections 7.3.1, 7.3.2 and 7.4.1 respectively are incorrect. Amendment would be necessary.	Noted, the references will be amended to *Sections* 7.2, 7.4 and 7.3 respectively.
6.	CED/R P Martin/2 Dec 1997	GCP 1/10/472 XII	I refer to the memo ref. Annex (10) to EP 1/G/72 IV dated 25.11.97 from DEP distributed to this office regarding to the above project. The Geotechnical Engineering Office has no comments on the captioned draft detailed environmental impact assessment report.	Noted.
7.	Building Dept/C M Chiang/2 Dec 1997	BD P&R/83/95-3	I have no comment on the captioned document. However, you are reminded that any permanent structure proposed for mitigation measures shall comply with the requirements of the Buildings Ordinance.	Noted.
8.	Highways Dept/C L Tang/8 Dec 1997	RD 6/2/6 pt3	I refer to your letter dated 26 Nov 1997 and would comment on the TKE Phase II draft DEIA as follows: i) Figure 1.2a Locations of the proposed film studio is not correctly shown, please see the attached sketch for its proposed location Area 106.	Noted, the correct location will be used and any changes to the predicted impacts will be reported.
			ii) Para. 2.5.2 Does Site F referred to in the last sentence mean the main depot and station site in Area 86? It is not listed at paragraph 1.2.3.	Site F should be referred to as the depot and station site, the text will be amended accordingly.

No.	Department	Reference	Comments	Consultants' Response
9.	Planning Dept/Brenda Au/8 Dec 1997	(14) in SKT 4/1/91 III	I have the following comments on above report: <u>General</u> (a) It is noted that the locations of the sensitive receivers shown on the relevant figures in the report and the description of them in the text have not been revised to take account of my previous comments on the Scoping Document. I am not going to repeat those comments heres. As the distances between the various construction sites and the sensitive receivers are affected, the assessment results given in the report will need to be revised as appropriate. In addition, please include the Tseung Kwan O Hospital in Area 32 which is now under construction.	Your comments on the scoping document have been taken into account in the DEIA, however, as discussed below, it is not necessary to assess impacts at every receiver. It should also be noted that the receiver locations shown in the DEIA Report *Figures* are indicative only and that the assessment is based on the distances shown in the relevant *Tables*. The TKE Phase II DEIA has followed the same methodologies as the TKE Phase I DEIA which did not address impacts at all sensitive receivers. Specific representative receivers, which will be the worst affected of a group of receivers and whose protection will provide sufficient mitigation for the other receivers, have been identified along the alignment for detailed assessment. Area 32 is over 500 m from the nearest work site and will not be adversely affected by the TKE Phase II. As discussed above, a suitable representative receiver for the hospital will be identified in the DEIA.
			(b) The completion dates of the developments adjacent to the construction sites are mostly known. Such information should be incorporated into the report, rather than saying that is it not available without even checking with relevant government departments.	We will be pleased to include the projected completion dates for developments as advised, however, appropriate mitigation measures have been identified based on the assumed occupancy of all sites during the construction works.
			(c) Section 6 on Land Use and Visual Impact is too general and would need to be improved. Please also refer to my specific comments below.	Land use and visual impacts will, in most cases, be limited to the temporary effects of additional construction works within areas of on-going construction. These have been identified and appropriate mitigation measures identified. The potential impacts and suitable mitigation measures to be applied in the one Area where no other construction works are occurring (Area 108) have also been addressed.

No.	Department	Reference	Comments	Consultants' Response
			(d) The report has not assessed any potential environmental impacts of the depot on the proposed at-grade schools and indoor recreation centre in Area 86 during the operational stage. No detailed information on the design of the depot is given in the report. Will the depot be open on any sides between the ground and podium levels or will it be fully enclosed? If it is the former, there will possibly be adverse noise impacts on some sensitive receivers. For the latter, the visual impact of the podium structure should be covered in Section 6 of the report. The visual impacts of any parts of the ventilation systems of the station and depot above and beyond the podium structure should also be assessed.	As discussed in Section 3.10, the entire alignment will be enclosed, either in tunnel or within the podium structure at Area 86. A separate detailed design study will be undertaken to ensure that the depot and station designs, including the ventilation systems, in no way adversely affect the other occupants of Area 86.
			<u>Specific</u> (e) Paras. 2.4.2 & 3.2.8 There are a total of seven (not four) schools to the north and northwest of Site A.	These refer to representative receivers only, the text will be clarified on this point.
			(f) Table 3.5a Is this the table for unmitigated rather than mitigated case? Exceedances of the noise criteria have not been indicated in bold.	*Table 3.5a* should be entitled ***Predicted Construction Noise Impacts***, exceedances will be highlighted.
			(g) Para 3.7.12 & Table 3.7a Reference to some tables seems to be missing. Does Table 3.7a represent mitigation option 1 or 2?	References to *Table 3.7a* will be clarified.
			(h) Para 3.8 Are there any residual noise impacts on the adjacent residential developments, particularly for those in Areas 34, 37, 55 and 65 which will be most severely affected? What are the proposed mitigation measures for such residual impacts, if any? I suppose the MTRC would be responsible for providing the noise insulation recommended for the schools and clinic. This should perhaps be stated in the report.	There are no residual impacts upon the residential developments. It is normal procedure for the MTRC to provide noise insulation to protect schools and clinics during it's construction works.

No.	Department	Reference	Comments	Consultants' Response
			(i) Para 6.4 Depending on the exact extent of Sites B and C, the vegetated slopes in Areas 47 and 108 may be affected and some tree felling involved. This should be suitably addressed.	Any requirement for tree felling or the removal of other vegetation, and the provision of appropriate mitigation measures, will be addressed in Section 7.
			(j) Paras 6.5.1 & 6.7.3 The exact location of the vent building in Area 108 should be identified for more detailed assessment. The visual impact of a vent building within the 'Green Belt' zone can be very obtrusive. Without such information, it is not sure whether the vent building design can actually be integrated into the overall appearance of the area.	No detailed plans for the vent building are currently available. The criteria for the detailed design of the vent building will include requirements to address the visual appearance within the context of the surrounding landscape.
			(k) Para 6.6.3 No visual impact assessment has been undertaken for the station and depot in Area 86 as part of the Tseung Kwan O Area 86 Planning Study. The visual impact of the depot and station, including any permanent structures above and beyond the depot podium, should be assessed in detail.	The station and depot will be contained within the podium structure which will support the majority of the Area 86 development. The MTRC will require that, at the Detailed Design Stage, any visible structures associated with the operational railway are properly integrated within the overall design of the development.
			(l) Para 7.2.1 Please refer to my comment in para (i) above.	Please refer to our response to comment (i) above.
10.	Lands Dept/DLO, SK/ Ms Maggie Au/8 Dec 1997	(19) in DLO/SK 1/193/SMS/59 Pt. IV	I refer to your letter dated 26.11.1997 and have the following comments on the captioned Draft DEIA: (a) Table 2.4b It is noted that the proposed commercia/residential development in Area 55 and Area 57 have not been included as sensitive receivers. Please explain.	As discussed above, representative sensitive receivers have been used in this assessment, it is not necessary to include every potential receiver in the assessment.
			(b) Para 3.2.7 Reference to Table 3.2a should be replaced by Table 3.2b.	Noted, the reference will be revised accordingly.
			(c) Table 3.2b Please see my comment in (a) above.	Please see our previous response.

No.	Department	Reference	Comments	Consultants' Response
11.	EPD/Alex Tang/9 Dec 1997	An(10) to EP1/G/72 IV	I refer to your above referenced letter dated 26.11.97 and have the following comments on the draft final report:	
			(1) Para 1.2.4, while it is noted that the potential for landfill gas and leachate impacts upon the proposed station and depot and podium in Area 86 has been identified, but the landfill gas and leachate hazards assessment is still being undertaken. I presume it is your professional opinion that the landfill issues would not have any insurmountable problem upon the station & depot development and thus the landfill gas & leachate hazards assessment could be conducted in parallel to identify the mitigation measures and monitoring requirements that needed to be implemented. If this is the case, please make some clear statements in this EIA report. Moreover, please also make a clear statement in this EIA report that MTRC undertakes to implement any EM&A requirements in relation to the landfill gas and leachate impacts as necessary. Nevertheless, the landfill gas & leachate hazards assessment should be completed within a reasonable period of time and in any case before finalization of the detailed design of the development.	As noted in S1.2.4, a landfill gas and leachate hazard assessment is currently underway and the findings will be reported when available. However, it is the Consultant's opinion that, if necessary, engineering measures can be applied to deal with any impacts from landfill gas or leachate.
			(2) Section 2, please provide the output files of the air modelling assessment on diskettes for our verification.	The files will be provided as requested.
			(3) Para 2.2.1, the 3rd sentence, "The AQOs are shown ...." is incomplete.	Noted, the text will be amended accordingly.
			(4) Para 2.5.2, the last sentence, should it be Sites D and Area 86 Site?	The text should read "... Site D and the depot and station site.", the text will be amended accordingly.
			(5) Para. 2.6.7, the explanation is not too clear, please elaborate how daily dust concentration at sensitive receivers due to general construction works was obtained based on the 12-hour meteorological data (between 07:00 to 19:00 hours) and a conversion percentage of 50%.	Para 2.6.7 has been taken directly from the TKE Phase I DEIA, as agreed and endorsed by the EPD.

No.	Department	Reference	Comments	Consultants' Response
			(6) Para 3.2.1 & Table 3.2a, it should be clarified that PropPECC PN2/93 does not recommend construction noise assessment criterion for wards of hospitals or clinics during non-restricted hours. However, for the purpose of ascertaining construction noise impact and identifying noise mitigation measures for this particular study, I have no objection on your proposal for adopting a noise criterion of 55 dB(A) for the assessment of construction noise impact on the proposed clinic in Area 56 (ie NSR N3).	Noted, the paragraph will be revised accordingly, the figure of 55 dB(A) was included in error. The mitigation measures recommended for NSR3 will be revised accordingly.
			(7) Para 3.2.7 - should "Table 3.2a" and "Figure 3.2a" read "Table 3.2b" and Figure 3.3a" respectively? Also, should the site in Table 3.2b be read as "Area 86" instead of "Area 56"?	The text should read *Table 3.2b* and *Figure 3.2a*, the details in *Table 3.2b* are correct. The text will be amended accordingly.
			(8) Para 3.2.8 & Table 3.2b, it is understood that there are residential developments being planned in Areas 52, 55, 57 and 78. Noise impacts on these sensitive receivers should be duly addressed in the EIA, or else you should explain clearly in the EIA report why these NSRs are excluded from the impact assessment. My earlier comments on the Scoping Document on the above also apply.	As has been discussed above, impacts have been addressed at representative receivers, the DEIA text will be amended to make this clear.

No.	Department	Reference	Comments	Consultants' Response
			(9) Paras 3.2.9, 3.10.3 & 3.10.4, according to the planning Study for Area 86, it is noted that a comprehensive residential development is being proposed in the area, both adjacent to and atop the proposed depot. Potential noise impacts due to the operational noise from the MTR depot and station in Area 86 (eg. squeal noise from trains, the possible ventilation systems designated for the depot and station) could be significant if not mitigated and should be assessed in the EIA. Where required, you should identify for incorporation into the detail design of the depot/station of suitable operational noise mitigation measures such as orientation and maximum permissible SWL of ventilation outlets, provision of sidewalls along depot boundary, etc. My earlier comments on the Scoping Document on the above also apply.	The MTRC are well aware of the potential noise impacts from the operational railway and will include such requirements within the requirements of the Detailed Design Consultancy. However, it should also be noted that, the DEIA (see S3.10) has identified that the railway will be fully enclosed either within tunnel or a purpose built podium structure which will incorporate appropriate noise and vibration control measures, as will all ventilation systems.
			(10) Para 3.3.2, "TM" in the 4th sentence should read "HKPSG".	Noted, the text will be amended as advised.
			(11) Para 3.3.7, maximum permissible SWLs of ventilation fans appear to be incorrect.	The SWLs calculated should have read 100 dB(A) for sites A and C and 103 dB(A) for site B. The report will be amended accordingly.
			(12) Table 3.5a (i) noise levels shown in the table should be unmitigated noise levels;	The noise levels are unmitigated, the title of the *Table* will be revised accordingly.
			(ii) duration of construction activities should be provided for necessary reference;	An outline construction programme will be provided.
			(iii) predicted noise levels at NSR N3 due to construction activities at Site B do not match with that given in Table A4;	The levels given in the Annex *Table* are correct. *Table 3.5a* shall be amended accordingly.
			(iv) predicted noise levels at NSRs N9 and N10 due to concreting tunnel/shotcreting tunnel at Site B and tunnelling at Site C respectively would exceed the noise assessment criterion.	The *Table* shall be amended accordingly.

No.	Department	Reference	Comments	Consultants' Response
			(13) Para. 3.6.1 (i) maximum exceedance of noise criterion would be up to 21 dB(A) for NSR N3;	The noise criteria for NSR3 will be revised to 70 dB(A) -(see response to EPD Comment 6). The criterion exceedance at this NSR will therefore be reduced to 6 dB(A).
			(ii) the exact nature and the associated derivation of cumulative noise impacts for NSRs N8 and N9 are not clear, clarification is required.	Cumulative impacts will be removed from this section. Cumulative effects due to mitigated noise levels only will be addressed in the assessment. Adequate clarification of how these are derived will be presented in the text.
			(14) Section 3.7, many of the schools would subject to significant construction noise impacts during the examination period and additional noise mitigation measures should be identified.	Detailed construction programmes are not yet available and it is not possible to determine if such events will occur at this time. However, as with the previous TKE and QBR studies, the MTRC will require contractors to produce environmental management plans to demonstrate that their proposed methodology meets, *inter alia*, the established noise criteria. If their proposed programme clashes with examination periods such that adverse impacts are likely to arise, they will be required to identify the additional necessary mitigation measures.
			(15) Para 3.7.5, according to TM on Noise from Construction Work other than Percussive Piling, site hoardings are not considered as noise barriers.	Noted, the reference to hoardings will be deleted.
			(16) Para 3.7.4, "EPD" in the 2nd sentence should read "Noise Control Authority".	Noted, the text will be amended as advised.
			(17) Para 3.7.8, should "Tables A1.3a and A1.3b" in the last sentence read "Tables, A2, A6, A7 and A8"?	Noted, the text will be amended accordingly.
			(18) Para. 3.7.9, NSR N3 would also subject to residual impacts due to construction activities at Sites A and B.	See response to EPD Comment 6.
			(19) Para. 3.7.10, the exact nature and the associated derivation of cumulative noise impacts for NSRs N4 and N8 are not clear, clarification is required. Also, should the NSRs be referred to B1 and N2 (the bullet under Para. 3.7.10) or N8 and N9 (Para. 3.6.1)?	See response to EPD Comment 13(ii)
			(20) Para 3.7.11 and 3.8.1, noise calculations should be provided to substantiate the required % on-time of the plant.	An additional *Table* shall be included in the *Annex* to substantiate these calculations.

No.	Department	Reference	Comments	Consultants' Response
			(21) Para 3.7.12, should "Table 3.5a" read "Table 3.7a"?	Noted, the text will be amended accordingly.
			(22) Table 3.7a (i) predicted noise levels at NSR N3 due to construction activities at Site B do not match with that given in Tables A4 and A7;	The *Tables* will be amended.
			(ii) predicted noise levels at NSR N9 and N10 due to concreting tunnel/shotcreting tunnel at Site B and tunnelling at Site C respectively would exceed the noise assessment criterion and mitigation measures would require;	Noted, the predicted levels will be revised accordingly.
			(iii) predicted noise level at NSR N4 due to vibratory sheet piling at Site A does not match with that given in Tables A6.	The *Table* will be amended.
			(23) Paras 3.8.1 & 3.8.2, noise insulation to the schools and the clinic should only be adopted as a noise mitigation measure after exhausting other practicable mitigation measures. Where noise insulation is needed, MTRC should liaise with all the concerned parties in implementing the mitigation measure.	Noted.
			(24) Table 3.9a (i) discrepancies are found between noise levels at NSRs N6, N7, N8 and N9 under the column "TKO station" and those in the Phase I EIA report;	Noted, the *Table* will be revised accordingly.
			(ii) discrepancies are found between noise levels at NSRs N6 and N7 under the column "Site A", N8 and N9 under the column "Site B", and N8 and N9 under the column "Site C" and those in Tables A6, A7 and A8 respectively.	Noted, the *Tables* will be checked and revised accordingly.
			(25) Para 3.9.4, should be revised as per comments on Table 3.9a.	Noted, the text will be revised accordingly.

No.	Department	Reference	Comments	Consultants' Response
			(26) Para 3.10.5, it is understood that Area 78 has been zoned for residential development, and hence operation noise impact due to the proposed vent building should be addressed and suitable mitigation measures identified.	Noted. The potential impacts will be assessed and appropriate SWLs identified.
			(27) Section 3.11 & 9.1, conclusions on cumulative construction noise impacts should be provided.	Noted, the text will be amended accordingly.
			(28) Paras 3.11.5 & 9.2.2, the conclusion shall be subject to my comments on Para. 3.2.9, 3.10.3 & 3.10.4 above.	Noted, the text will be amended accordingly.
			(29) Para 4.2.3, the SS concentration should be less than 10 mg/l, please revise the text accordingly.	Noted, the text will be amended accordingly.
			(30) Para 4.3.3, please amend the 3rd sentence to "In general, the data from the station indicates that the water quality was not too satisfactory in the past, with relatively high turbidity, inorganic nutrient contents (total nitrogen and phosphorus) and *E. Coli* and faecal coliform contents. Nonetheless, according to the recent EPD routine monitoring data (*Marine Water Quality in Hong Kong for 1996*), the levels of total inorganic nitrogen and unionised ammonia within Junk Bay fully complied with their WQOs in 1996 and full compliance with WQO for DO was also achieved at JM4 and only the depth-average DO objective was partially met (83.3%) in 1996 at JM3."	The text will be amended as requested, however, as no reference is made in the Report to JM$, the final sentence will be revised as shown below. "According to the recent EPD routine monitoring data (*Marine Water Quality in Hong Kong for 1996*), the levels of total inorganic nitrogen and unionised ammonia fully complied with the WQOs in 1996 and 83.3% compliance was achieved for depth-average DO."
			(31) Para 4.3.5, please replace "water quality within Junk Bay is poor" by "water quality within Junk Bay is only fair with depth-average DO objective only partially met for 1996 at JM3."	The text will be amended as requested.
			(32) Section 8, as mentioned in comment (1) above, EM&A requirements for landfill issues should be determined in the landfill gas & leachate hazards assessment.	Noted.
			(33) Para 8.3.2 & Table 8.3b, A1, A7, A11 & A12 should be included as dust monitoring stations.	The predicted unmitigated dust impacts from the TKE Phase II at the four identified ASRs are only 50-60 % of the established air quality criteria and need not, therefore, be monitored.

No.	Department	Reference	Comments	Consultants' Response
			(34) Para 8.3.14 & Table 8.3a, N9, N10 & N11 should be included as noise monitoring stations.	The value of these locations will be checked and their inclusion reconsidered.
			(35) Para 8.4.3, brief discussions of Baseline Monitoring Repot, Bi-annual and Annual Report, & Interim Notification of Exceedances should be included.	The Report will be revised accordingly.
			(36) Tables A1 & A2, exact reference of sheet pile vibrator (ie table no. and ref no. in BS5228: Part 4: 1986) shall be clarified.	The BS5228: Part 4:1996 reference for this plant is Table 1 Ref 53. This will be included in the relevant tables
			(37) Tables A4 & A7, separation for NSR N11 does not match with that in Table 3.2b.	The distance provided in Table 3.2b is correct. Tables A4 and A7 will be amended accordingly.