香港地下鐵路公司
Mass Transit Railway Corporation

Feasibility Study and Preliminary Design for

Tseung Kwan O Extension
Quarry Bay Congestion Relief Works

Tseung Kwan O Extension
Detailed Environmental
Impact Assessment Report R9T
Volume II : Main Report

July 1997

Maunsell

in association with

MVA
Parsons Brinckerhoff
Urbis
Dennis Lau & Ng Chun Man
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Prepared by: ERM

Reviewed by: S Laister (Discipline Manager)

signed: S Laister

date: 23 July 1997

Reviewed by: R D Taylor (Team Director)

signed: R.D. Taylor

date: 23rd July '97

FINAL REPORT

Mass Transit Railway Corporation

Tseung Kwan O Extension Detailed Environmental Impact Assessment:

Volume II - Main Report

23 July 1997

Reference C1365/65408/65870

For and on behalf of ERM-Hong Kong, Ltd

Approved by: S.M. Laister

Signed: S M Laister

Position: Deputy Managing Director

Date: 23 July 1997

CONTENTS:

1 INTRODUCTION

1.1 BACKGROUND TO THE DETAILED ENVIRONMENTAL IMPACT ASSESSMENT

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 initial stages of the Study, ERM Hong Kong produced the *Tseung Kwan O Extension Environmental Feasibility Study Report (R8T), Maunsell Consultants (Asia) Ltd, February 1996* (EFS) to determine the environmental constraints which could affect the feasibility of the railway.

1.1.2 The EFS showed that, with appropriate mitigation, all identified potentially adverse impacts could be controlled to within the established standards and guidelines. These findings were used by the Study Team during the preliminary design stage of the TKE to develop effective mitigation measures for the construction and operational phases of the Project, to limit the effects of those potential adverse environmental impacts identified in the EFS.

1.1.3 Subsequently, ERM has taken the findings of the EFS, using the more developed output of the *MTRC Tseung Kwan O Extension Final Preliminary Design, Maunsell et al, May 1996* (MN9T) to produce a Detailed Environmental Impact Assessment (DEIA). The DEIA will be used to establish the environmental performance criteria to be applied during the construction and operation of the TKE, which will be included in the tender requirements for the Detailed Design Consultancy (DDC). The Ng Kwai Shan (Black Hill) tunnel contract will not be let as a DDC but as a Design and Construct (D&C) agreement.

1.1.4 This Report sets out the findings of the DEIA which ERM, with assistance from Maunsell, Urbis and other members of the Study Team, has been contracted to undertake.

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. The TKE will provide links from the existing Kwun Tong Line (KTL) at Lam Tin Station and the Hong Kong Island Line (HKIL) 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 (see *Figure 1.2a*).

1.2.2 The proposed railway will run south-east from Lam Tin to Yau Tong and north-east from the Eastern Harbour Crossing to Yau Tong, before entering a tunnel section running north-east through Ng Kwai Shan (Black Hill), to Tiu Keng Leng. The line will continue in the same general direction through Tseung Kwan O to Hang Hau in a cut-and-cover tunnel before turning north-west for the final section to Po Lam running at ground level.

1.2.3 The construction programme for TKE is planned to commence in late1998/early 1999 with a completion date of mid-2002. The construction sites will follow the alignment with the main works areas at the station sites and the tunnel vent building. The Ng Kwai Shan (Black Hill) tunnel will be the only works area without continuous surface works.

1.3 OBJECTIVES OF THE DETAILED ENVIRONMENTAL IMPACT ASSESSMENT

1.3.1 The specific objectives for the DEIA are to complete the investigations undertaken in the EFS and thus 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.

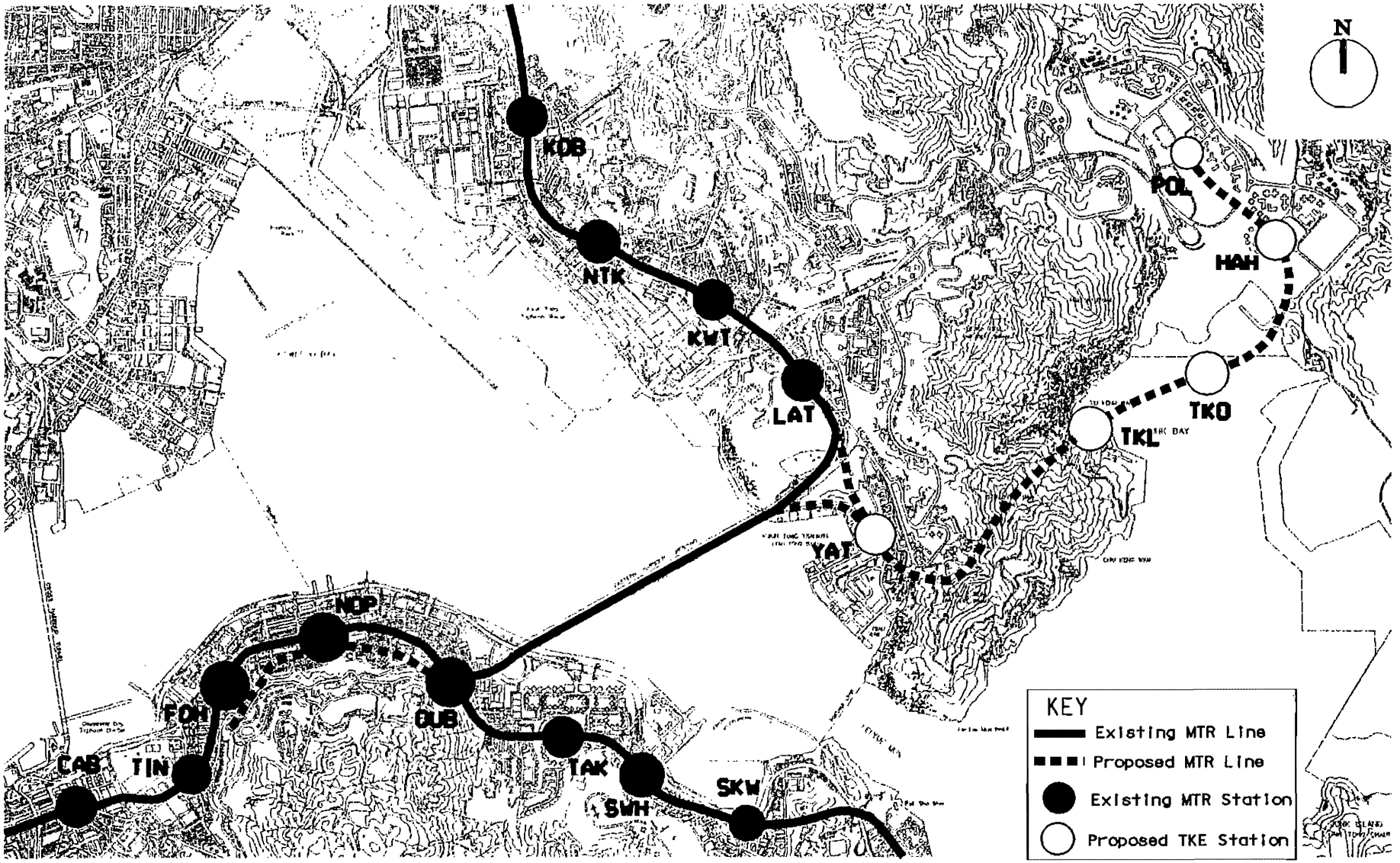

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FIGURE No. 1.2a

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TSEUNG KWAN O EXTENSION PROPOSED ALIGNMENT

1.4 *STRUCTURE OF THE DETAILED ENVIRONMENTAL IMPACT ASSESSMENT REPORT*

1.4.1 The DEIA comprises three volumes:

- *Volume I*, the Executive Summary briefly explains how the DEIA was carried out and describes the findings of the Main Report, concentrating on the potential adverse impacts and proposed mitigation measures;
- *Volume II*, the Main Report provides the findings of the DEIA: identifying the environmental performance criteria applicable to the TKE; focusing on the likely impacts of the construction and operation of TKE; and developing appropriate mitigation measures to control any adverse impacts; and
- *Volume III*, the initial version of the TKE EM&A Manual.

1.4.2 After this introductory section, the remainder of Volume II of the DEIA is arranged as follows.

- *Section 2* identifies the air quality impacts arising from the construction and operation of the TKE, assesses their magnitude and puts forward recommendations for appropriate mitigation measures.
- *Section 3* identifies the noise and vibration impacts arising from the construction and operation of the TKE, their magnitude and suitable mitigation.
- *Section 4* identifies and reviews the water quality impacts arising from the construction and operation of the TKE and puts forward effective mitigation measures.
- *Section 5* addresses the solid waste management implications arising from the construction and operation of the TKE, considers waste reduction and disposal options and identifies control and mitigation measures.
- *Section 6* identifies the ecological impacts arising from the construction and operation of the TKE and provides recommendations for suitable mitigation measures.
- *Section 7* reviews the landuse and visual impacts arising from the construction and operation of the TKE and puts forward proposals for necessary mitigation.
- *Section 8* identifies the EM&A requirements arising from the assessment of construction and operational impacts from the TKE and provides recommendations for their application.
- *Section 9* discusses the overall conclusions and recommendations arising from the DEIA and makes recommendations for further studies.
- *Annex A* contains a glossary of the terms and abbreviations used in the Report.
- *Annex B* presents the air quality construction dust contour maps.
- *Annex C* contains the construction plant lists and their sound power levels.

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 proposed TKE and is largely concerned with identifying the likely dust impacts during the construction of the alignment, stations and tunnels.

2.1.2 During the construction phase, there will be dust impacts from material 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.

2.1.4 During the operational stage, electric trains will be used and there will be no adverse air quality impacts although there might be some dust generation from abrasion and gaseous and particulate emissions from equipment used for maintenance operations. However, these pollutant sources are expected to have little or no impact and emissions will be limited to the station and tunnel ventilation systems.

2.1.5 High dust levels have been predicted from all worksites as a result of unmitigated working, however, the application of appropriate mitigation measures has reduced the predicted levels to within the established criteria at all sites except Hang Hau and Po Lam, where exceedances of the 1-hour criterion remain. In these cases, exceedances are only predicted under the worst case meteorological conditions which are only likely to occur on a few days each year, in the early morning and evening, when on site activity and consequent dust generation will be limited. Additional mitigation measures which could be applied if it is necessary to further reduce dust have been identified. It is, therefore, considered that the recommended mitigation measures will be fully effective in controlling dust levels from the TKE worksites to within the established hourly and daily criteria. No adverse impacts have been identified from the operational railway.

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 Territory 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. The AQOs are shown in *Table 2.2a*. There is no AQO for hourly total suspended particulates (TSP) but it is generally accepted that an hourly average TSP concentration of 500 $\mu g\ m^{-3}$ should not be exceeded at ASRs. Such a control limit has no statutory basis but is particularly relevant to construction work and has been applied to a number of construction projects in Hong Kong in the form of contractual clauses. Therefore, this hourly TSP criteria is also considered 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.

Table 2.2a Hong Kong Air Quality Objectives ($\mu g\ m^{-3}$)[1]

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

(i) Measured at 298°K (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 particulates 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 *EXISTING AND FUTURE BASELINE CONDITIONS*

2.3.1 The majority of land uses close to the TKE alignment are designated for residential, educational and commercial purposes. In the Yau Tong area, the main source of air quality impact is from the existing traffic on Lei Yue Mun Road and Cha Kwo Ling Road. According to Annual Traffic Census 1994, the annual averaged daily traffic flow for Lei Yue Mun Road were in range of 12,540-28,500 in Yau Tong and 67,120 in Lam Tin, Cha Kwo Ling Road averaged 12,700 vehicles per day. It is expected that the ambient NO_x and Respirable Suspended Particulate (RSP) levels will be high for sensitive receivers close to these two main roads.

2.3.2 In Lam Tin, Sai Tso Wan Landfill is located to the south of Lam Tin MTRC Station. The landfill site has been closed since 1980 and has a gas abstraction plant and flare which is located at the boundary. Landfill gases being collected at the abstraction plant are flared off on-site. The products at the flare are mostly carbon dioxide, other pollutants such as sulphur dioxide, nitrogen oxide and TSP are also produced in limited quantities. This will have a negligible impact on the background air quality.

2.3.3 Industrial emissions in the Yau Tong area also contribute to the overall background levels. However, it is understood that the future use of the industrial area in Yau Tong is the subject of an on-going study under the Central and East Kowloon Development Statement. This may lead to changes in land use and, in this case, the air quality in the future is less likely to be affected by industrial emissions and will probably be dominated by vehicle exhaust.

2.3.4 Tseung Kwan O is a newly developed district and many of the housing estates and associated facilities are still under construction. Development is now mainly located at the northern part of Tseung Kwan O, i.e. Po Lam and Hang Hau. Reclamation at the southern part of Tseung Kwan O is in progress and the Rennie's Mill area in Tiu Keng

Leng is scheduled to be demolished and redeveloped for public housing.

2.3.5 Fugitive dust from the current and proposed construction works is the major source of air quality impacts. However, large numbers 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.

2.3.6 In the future, with the gradual completion of the reclamation and developments in Tseung Kwan O new town, the impacts from construction dust will diminish. However, businesses are moving into the Tseung Kwan O Industrial Estate which is located to the west of Tseung Kwan O town. Although the industrial estate is distanced from the town, and industrial fuel consumption will be limited, operations and emissions of industrial premises within the estate will contribute to the background air quality in the nearby areas. Therefore, the future background air quality in Tseung Kwan O will be dominated by traffic emissions with minor contributions from industrial emissions.

2.3.7 As there are no existing Environmental Protection Department (EPD) air quality monitoring stations in the area of Lam Tin and Yau Tong, monitoring results at the nearest air monitoring station located in Tseung Kwan O are referenced. The annual averaged TSP levels of 77 $\mu g\ m^{-3}$ in the Tseung Kwan O area recorded in 1993 are used in the TKE study.

2.4 *AIR SENSITIVE RECEIVERS*

2.4.1 In accordance with the Hong Kong Planning Standards and Guidelines (HKPSG), sensitive receivers including residential uses, schools and academic institutions, and active and passive recreational uses have been identified. Potential air sensitive receivers (ASRs) in the vicinity of the proposed TKE Extension worksites at Lam Tin, Yau Tong, Tiu Keng Leng, Tseung Kwan O, Hang Hau and Po Lam are summarized in *Tables 2.4a-d* below with their locations shown in *Figures 2.4a-e*.

Yau Tong Section

2.4.2 Yau Tong Estate, Ko Chui Road Estate, Yau Tong Centre and Ko Chui court are the main residential uses in the Yau Tong area. Yau Tong Estate and Ko Chui road Estate will be redeveloped starting in 1996. In addition to the residential uses, there are two schools along Cha Kwo Ling Road namely Po Chiu College and St. Antonius Primary School. However, Po Chui College is expected to be resumed due to the Yau Tong Station (YAT) construction works, and therefore, is not considered in this assessment. Sam Ka Tseun Recreation Ground is located along Cha Kwo Ling Road and is identified as an ASR in according to the HKPSG. The existing and proposed developments are identified as ASRs and the shortest distances from the station and alignment sites to the ASRs are presented in *Table 2.4a*, with their locations are shown in *Figure 2.4a*.

Tiu Keng Leng Section

2.4.3 The squatter dwellings at Rennie's Mill are scheduled to be demolished and residents will be relocated. The future landuse in this area will be mainly residential and schools are also proposed. Developments in the vicinity of the proposed Tiu Keng Leng Station (TKL) will be residential in Area 72 (ATKL2), a school to the west of Area 72 (ATKL1) and a recreational centre to the east of Area 72 (ATKL3), as shown in *Figure 2.4b*. The

completion date of these developments are not available, however, the proposed school and the residential developments are located within the proposed MTRC worksite and it is assumed, therefore, that they will not be completed before the construction of the TKE. ASRs other than the planned residential uses and schools in Area 72 are located more than 200 m away from the proposed worksites and, therefore, no potentially impacted ASRs have been identified for Tiu Keng Leng Section.

Table 2.4a Identified ASRs in Yau Tong

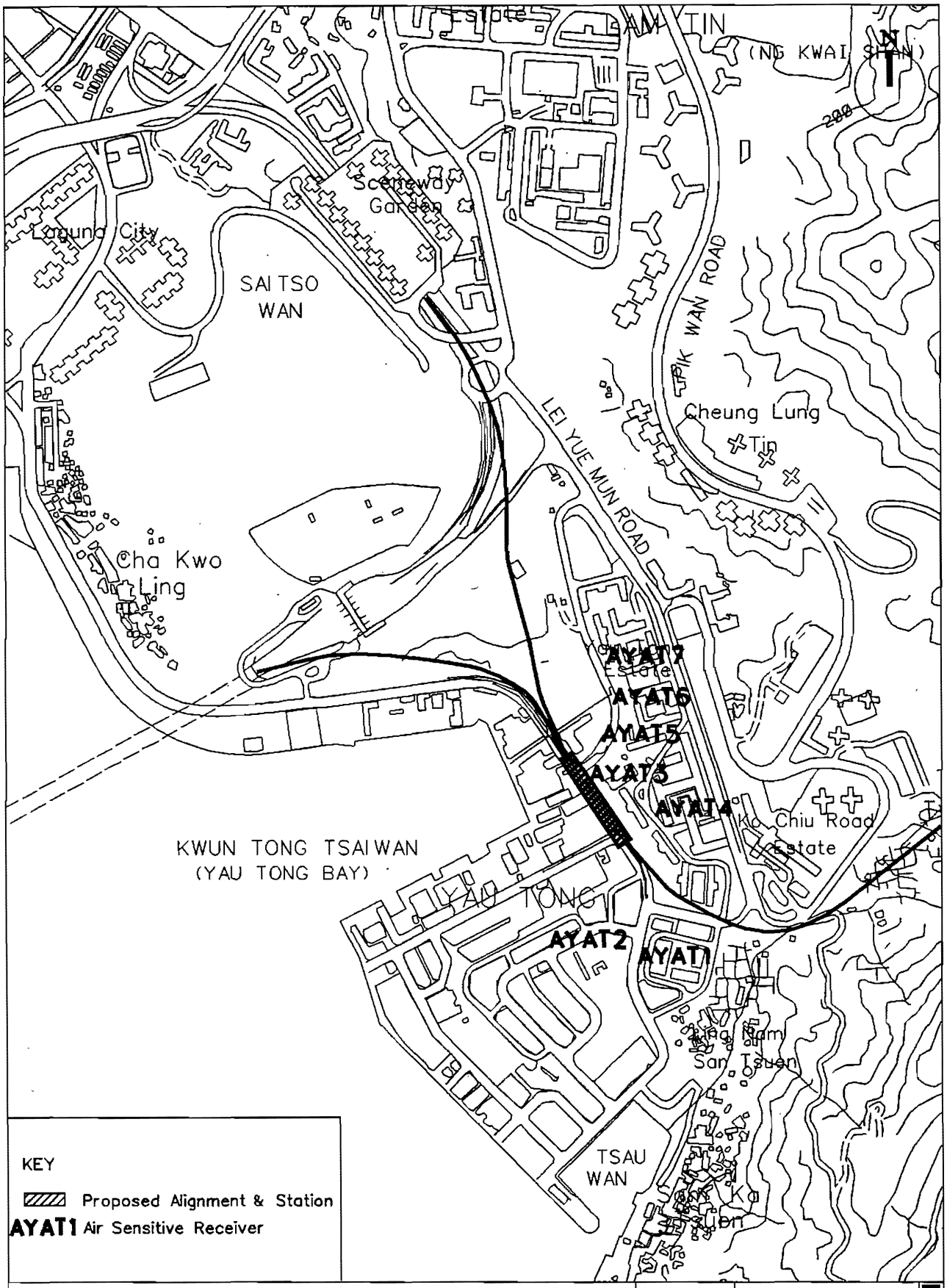
	Air Sensitive Receivers	Distance from Work Site (m)		
		Alignment	Station	Tunnel Portal
AYAT1	Yau Tong Centre	30	224	90
AYAT2	Sam Ka Tsuen Recreation Ground	104	186	110
AYAT3	St. Antonius Primary School	64	10	176
AYAT4	Yau Tong Estate Phase 1	80	78	152
AYAT5	Yau Tong Estate Phase 2	138	90	244
AYAT6	Yau Tong Estate Phase 3	176	166	200
AYAT7	Yau Tong Estate Phase 3 Playground	194	190	180

Tseung Kwan O Section

2.4.4 Tseung Kwan O Station (TKO) and alignment are located on newly reclaimed land and the surrounding area has not yet been developed. The proposed developments in the vicinity of the sites are seven schools and a clinic to the north of TKO, approximately 150 m away. To the south of the station, Area 65 and 67 will be developed as Private Sector Participation Scheme (PSPS) or Home Ownership Scheme (HOS) housing. The proposed route from TKO to Hang Hau Station (HAH) passes under Tseung Kwan O Park. According to HKPSG, this recreational use is also identified as ASR. The completion date of these developments are not available, however, these planned developments have been identified to be ASRs in this assessment and the shortest distances from the proposed station and alignments sites are listed in *Table 2.4b*, with their locations shown in *Figure 2.4c*.

Table 2.4b Identified ASRs in Tseung Kwan O

	Air Sensitive Receivers	Distance from Work Site (m)	
		Alignment	Station
ATKO1	Proposed School, southern part of Area 55	150	180
ATKO2	Proposed School, eastern part of Area 56	156	156
ATKO3	Proposed Clinic, Area 56	188	156
ATKO4	Proposed School, western part of Area 56	164	158
ATKO5	Proposed School, eastern part of Area 57	169	184
ATKO6	Proposed PSPS/HOS, Area 67	24	84
ATKO7	Proposed PSPS/HOS, Area 65	54	156
ATKO8	Proposed TKO recreational area, Area 45	128	446



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TKE: YAU TONG – AIR SENSITIVE RECEIVERS

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FIGURE No. 2.4a

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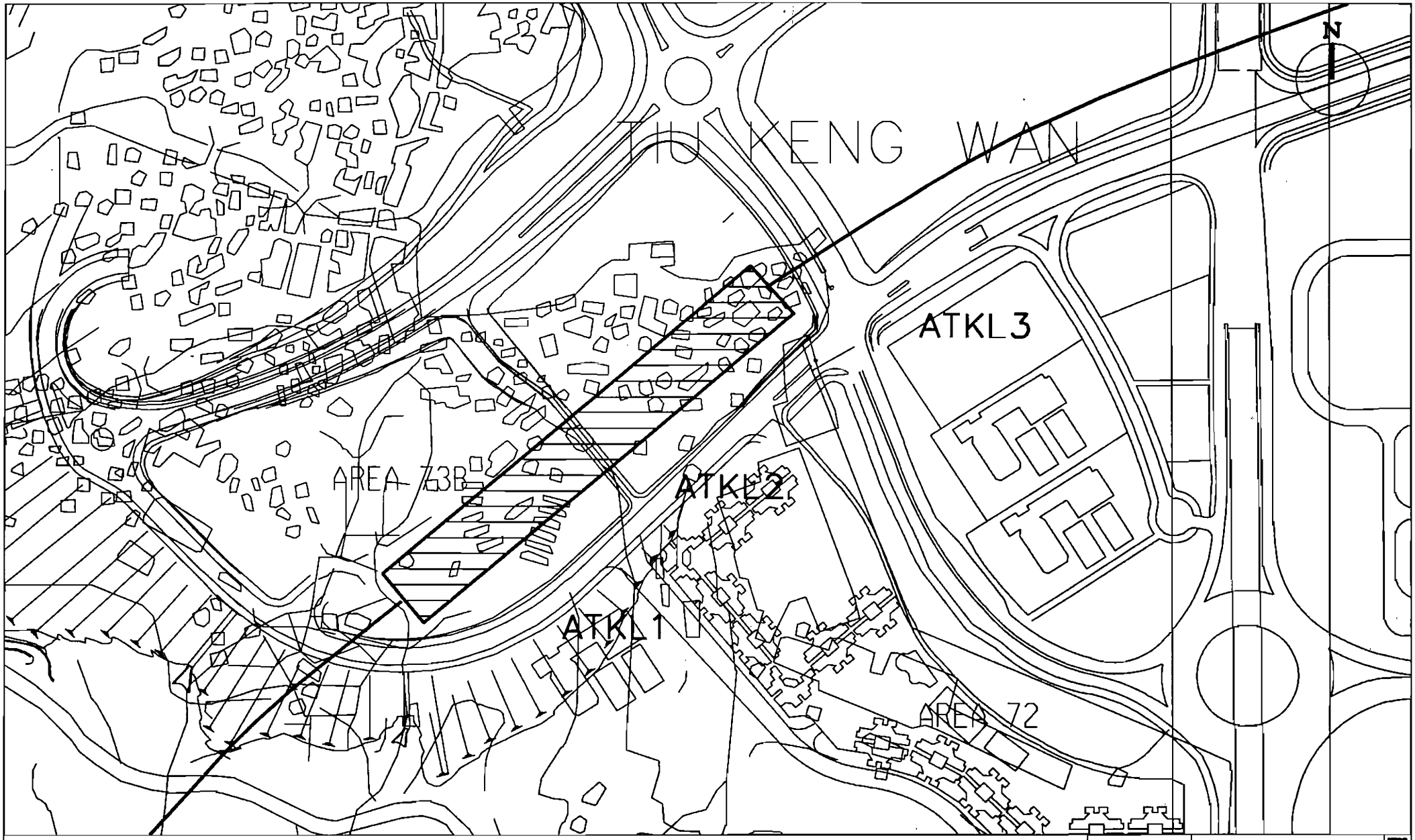

Proposed Alignment & Station

ATKL1 Air Sensitive Receiver

TIU KENG LENG: AIR SENSITIVE RECEIVERS

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FIGURE No. 2.4b

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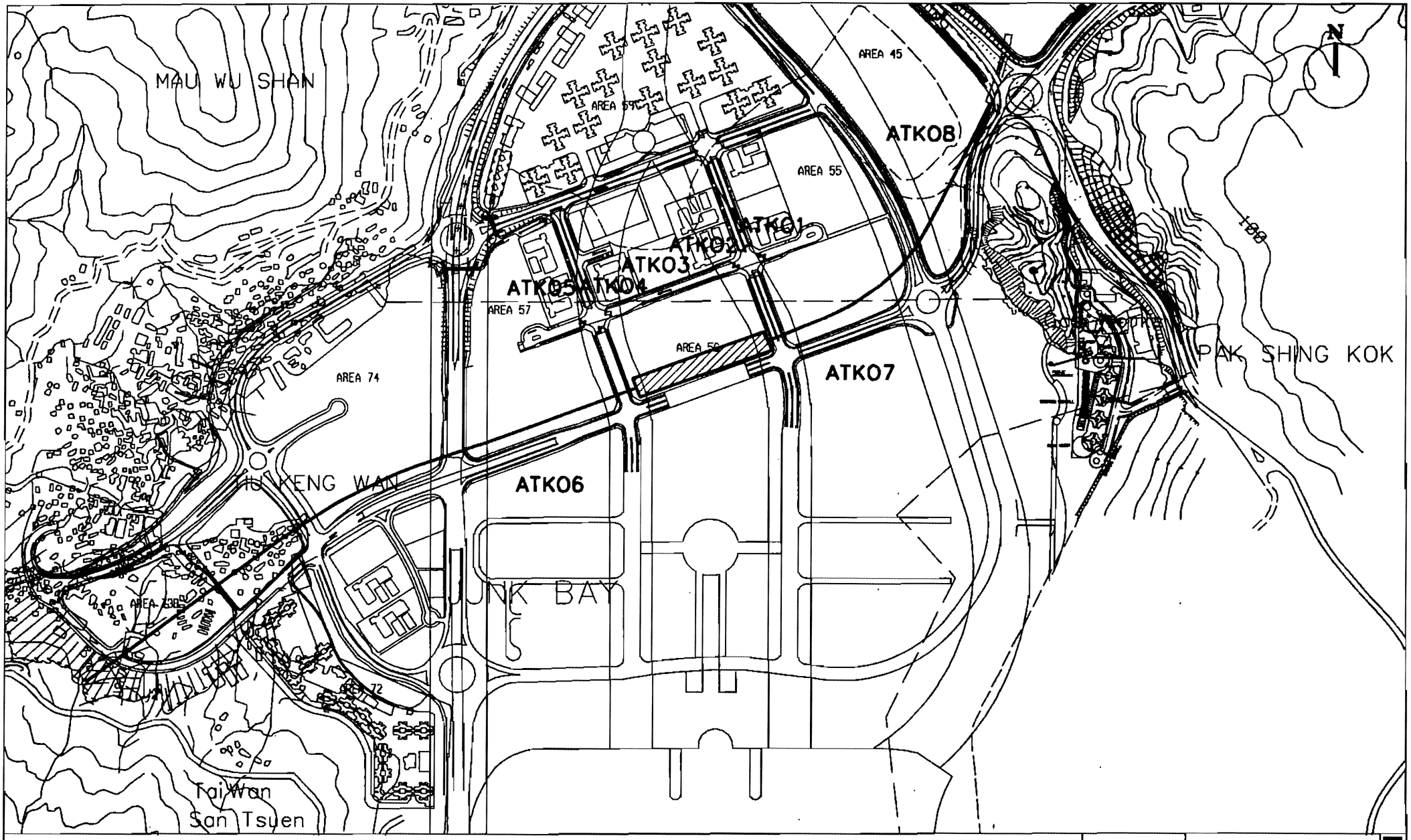

Proposed Alignment & Station

ATK01 Air Sensitive Receiver

TSUENG KWAN O CENTRE: AIR SENSITIVE RECEIVERS

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FIGURE No. 2.4c

SCALE: NTS

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Hang Hau Section

2.4.5 Hang Hau lies to the north-east of Tseung Kwan O, behind the reclamation site of Tseung Kwan O New Town. On Ning Garden and Hau Tak Estate are existing residential uses. Residential and commercial developments in Area 38a are under construction and Yuk Ming Court in Area 37b is at the final stage of construction with only electrical and mechanical works remaining to be completed. These developments will be completed by the time the construction stage of the TKE commences and will be subject to construction dust impacts. Residential uses are proposed at Areas 37a-c and there will be two schools in Areas 37d&e. The completion date of these developments are not available, however, these planned developments have been identified to be ASRs in this assessment. The shortest distances between the identified ASRs and the proposed station and alignment sites are listed in *Table 2.4c*, with locations shown in *Figure 2.4d*.

Table 2.4c Identified ASRs in Hang Hau

	Air Sensitive Receivers	Distance from Work Site (m)	
		Alignment	Station
AHAH1	Chung Man Court (Block E)	10	54
AHAH2	Residential and Commercial Development in Area 38	66	30
AHAH3	Proposed Residential Development in Area 37c	7	52
AHAH4	Yuk Ming Court	40	154
AHAH5	Proposed School in Area 37d	8	80
AHAH6	Proposed Residential and Commercial Development Area 37a	22	32
AHAH7	Proposed School in Area 37e	112	62
AHAH8	On Ning Garden	22	60

Po Lam Section

2.4.6 The identified ASRs in Po Lam are listed in *Table 2.4d* below.

Table 2.4d Identified ASRs in Po Lam

	Air Sensitive Receivers	Distance from Work Site (m)	
		Alignment	Station
APOL1	King Lam Estate	22	190
APOL2	Ho Ming Court	38	88
APOL3	Residential and Commercial Development in Area 17	54	24
APOL4	Proposed Small Household Block	50	56
APOL5	Proposed School in Area 15	80	98
APOL6	Leung Kit Wah Primary School in Area 19b	270	48
APOL7	Proposed Residential and Commercial Development Area 19a	34	30
APOL8	Proposed Residential and Commercial Development Area 19c	28	29
APOL9	Proposed Residential Uses	26	110
APOL10	Proposed School in Area 24	22	216
APOL11	King Lam Catholic Primary School	17	268

2.4.7 The Po Lam area is already highly developed with two large residential estates, Ho Ming Court and Keng Lam Estate, to the north of the proposed station and alignment. Residential and commercial developments and schools are proposed to the south of the Po Lam Station (POL) including a small household block to the east and developments in Areas 19a-c. Some of them, such as the residential blocks in Area 19c, are currently under construction and are expected to be completed by the time the construction of POL and alignment commences. All these existing and proposed developments are identified as ASRs and the shortest distances from the station and alignment sites are listed in *Table 2.4d*, with their locations shown in *Figure 2.4e*.

2.5 CONSTRUCTION IMPACTS

Potential Sources of Impact

2.5.1 The atmospheric pollutants which may arise during the construction phase include dust and vehicular emissions.

2.5.2 The principal source of potential air quality impacts during the construction of the TKE will be dust. The access roads to the worksites are all paved in Lam Tin, Yau Tong, Hang Hau, and Po Lam; therefore dust will mainly arise within the construction sites themselves. However, at Tiu Keng Leng and Tseung Kwan O, the area is newly developed, public roads have not yet been built and haul road dust can be expected.

2.5.3 Other construction dust sources include site clearance, drill and blast tunnelling, ground excavation, materials handling and transfer off-site, vehicle movement on unpaved site roads and stockpiling of excavated material from station and alignment construction.

2.5.4 Vehicular emissions will impose limited impacts upon the surrounding area since the extent of potential sources are limited.

2.5.5 Whilst the proposed alignment at Lam Tin falls outside the Sai Tso Wan Landfill boundary and the disturbance of landfill materials is not required, it does lie within the landfill consultation zone. Potential air quality impacts following venting of the exhaust air from the tunnels have been considered in the *Sai Tso Wan Landfill Interim Qualitative Risk Assessment, ERM, July 1997* (IQRA) and are considered to be negligible, taking into account the expected initial low concentrations and the amount of dilution that will occur. Following completion of the monitoring programme, the findings of the IQRA will be reviewed and a Final Report produced.

Yau Tong Station and Tunnels

2.5.6 The construction of the proposed alignments from LAT and the Eastern Harbour Crossing (EHC) to TKL will mainly be by cut and cover method with some drilling and blasting. For the construction of the tunnel, there will be 12,000 m^3 of excavated rock to be handled and transferred off-site over a period of 20 months. Additionally, there will also be 20,000 m^3 and 50,000 m^3 of soil to be excavated from the cut and cover tunnel and station respectively. Lorries and loaders will be required for such construction activities. Fugitive emissions are likely to be generated through handling of the spoil.

2.5.7 Drill and blast operations are expected on the Yau Tong section and at Devil's Peak for the construction of the tunnels and access adit. The largest amounts of dust will be emitted during the initial phase of the drill and blast operations.

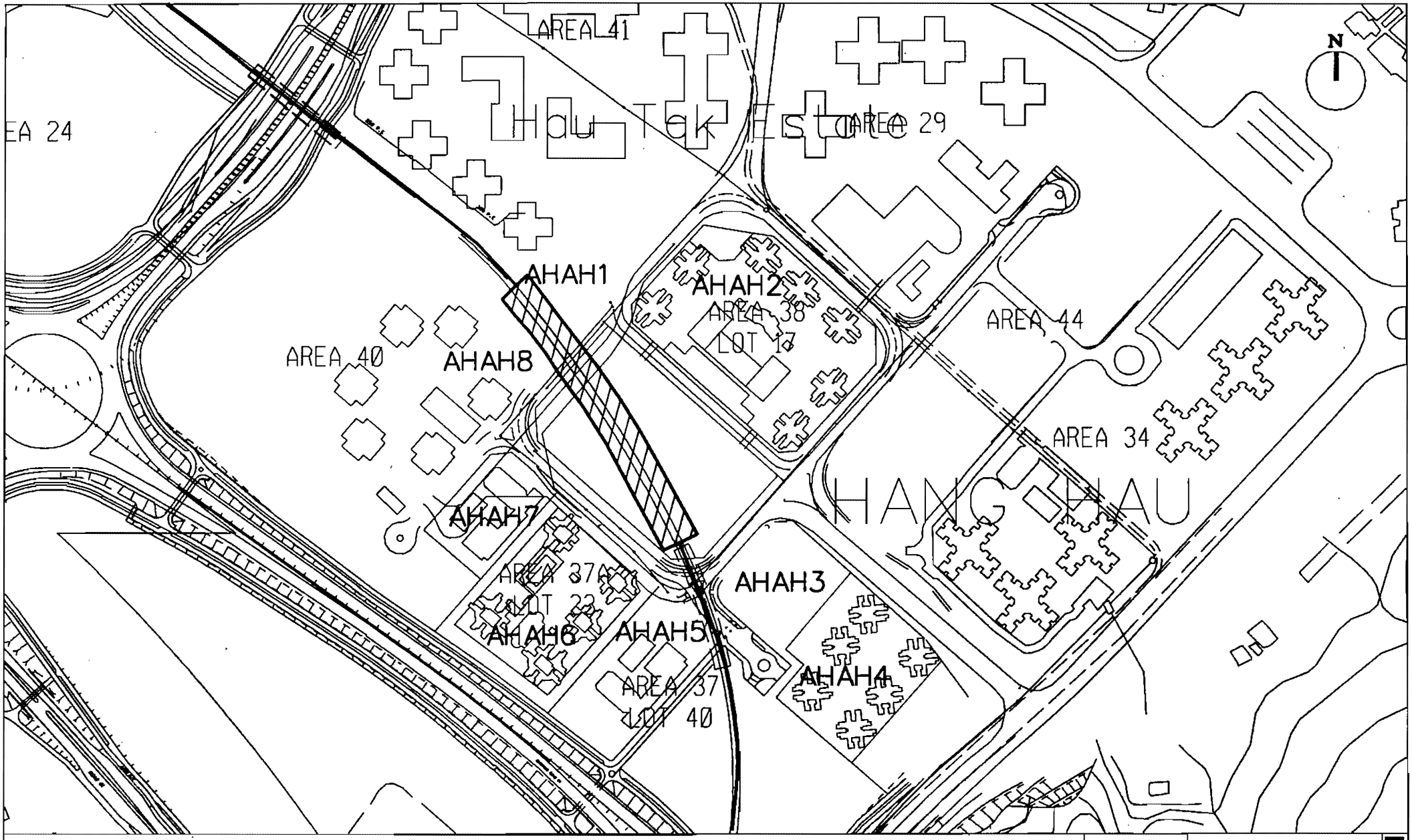
AREA 41
Hau Tak Estate
AREA 29
EA 24
N
AHAH1
AHAH2
AREA 38
LOT 17
AREA 44
AREA 40
AHAH8
AREA 34
HANG HAU
AHAH7
AREA 37
LOT 23
AHAH3
AHAH6
AHAH5
AHAH4
AREA 37
LOT 40
Proposed Alignment & Station
AHAH1 Air Sensitive Receiver
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FIGURE No. 2.4d
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N
APOL4
TSEUNG KWAN O
APOL5
APOL6
AREA 17
LOT 27
AREA 21
Yau Yue
Wan
AREA 19B
LOT 35
AREA 19A
LOT 34
APOL7
APOL3
APOL2
APOL8
AREA 19C
LOT 36
King Lam
Estate
APOL1 AREA 23
KWAN O TUNNEL RD
KWAN O ROAD
APOL9
APOL11
APOL10
Proposed Alignment & Station
APOL1 Air Sensitive Receiver
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FIGURE No. 2.4e
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Tiu Keng Leng Station and Tunnels

2.5.8 The construction of the proposed alignment and station will mainly be by cut and cover method. For the construction of the tunnel, there will be 100,000 m^3 of excavated rock to be handled and transferred off-site over a period of 20 months. Additionally, there will also be 300,000 m^3 of rock and 150,000 m^3 of soil to be excavated at the station site. Excavated materials will be taken away from site by lorry for transport by barge. Lorries and loaders will be used for such construction activities. Fugitive emissions are likely to be generated through handling of the spoil.

2.5.9 Drill and blast operations are expected at Tiu Keng Leng Tunnel Portal. The largest amounts of dust will be emitted during the initial phase of the drill and blast operation.

Tiu Keng Leng to Po Lam

2.5.10 The proposed alignment from TKL to POL is mainly underground and constructed by cut and cover methods. Reclamation works at Tiu Keng Leng will be completed by others before the MTRC construction works commence. There will be 400,000 m^3 of sand and mud excavated from both the Tiu Keng Leng to Tseung Kwan O and Tseung Kwan O to Hang Hau sections and 100,000 m^3 from Hang Hau to Po Lam. Excavated spoil will be removed from sites by lorry. About half of the excavated material will be used for landscaping the MTRC route or adjoining developments and the storage locations of the spoil will depend on the availability of space.

Tseung Kwan O, Hang Hau and Po Lam Stations

2.5.11 TKO and HAH are underground while POL is at-grade. Cut and cover will be employed during the excavation and preliminary construction works at all three stations. There will be 100,000 m^3 of sand excavated at both Tseung Kwan O and Hang Hau stations over four and three months respectively. Since Po Lam station is at-grade, less excavation is required and there will be only 20,000 m^3 of sand to be excavated over a period of two months.

Table 2.5a Worksite Spoil Generation and Vehicle Numbers

Worksite Location	Spoil Quantity (m^3)	Number of Vehicles on site[1] (vehicles hr^{-1})
YAT Station	50,000 soft material	1.4
TKL Station	300,000 rock and 150,000 soft material	10
TKO Station	100,000 soft material	5
HAH Station	100,000 soft material	7
POL Station	20,000 soft material	2
YAT -TKL	20,000 soft material from cut & cover tunnel and; 220,000 rock from bored tunnel	6
TKL - TKO	400,000 soft material	5
TKO - HAH	400,000 soft material	3
HAH - POL	100,000 soft material	1.5

(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.

Assessment Methodology

2.5.12 The assessment will focus on the potential dust impacts from the construction of stations and tunnels for the TKE. The section at YAT and from TKL to POL will be constructed by means of cut and cover, with drill and blast method employed for the tunnel construction between YAT and TKL. Excavation, drilling, blasting and materials handling will be the major dusty construction activities. It has been assumed that concrete will be delivered by concrete trucks and no concrete batching plants will be required. The maximum 1-hour and 24-hour particulate concentrations were modelled to assess the likely dust impacts at the identified ASRs.

2.5.13 The impact of fugitive dust source on air pollutant 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 atmosphere turbulence, would 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 Particulates (TSP). To evaluate the dust impact during the construction phase of the TKE, TSP levels were predicted.

2.5.14 To evaluate the dust impacts under the worst conditions, 1-hour and 24-hour TSP levels were predicted with the assumption of concurrent construction activities taking place at all the station and alignment worksites. A background TSP level of 77 $\mu g\ m^{-3}$ taken from the EPD's Junk Bay Monitoring Station in 1993 was also included to estimate the cumulative impacts of the construction dust impacts from the TKE.

Dispersion Model

2.5.15 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 alignment, tunnels and stations. 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, 1996 (AP-42). The dominant dust source for the construction of the TKE is anticipated to be vehicle movements within unpaved worksites, therefore, the proportion of the emission rate arising from haul road movement for each dust size established in *Section 13.2.2-4*, AP-42 is adopted in the model and are summarised in *Table 2.5b*. The gravitational settling velocity for each dust category was calculated by the FDM.

Table 2.5b 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

2.5.16 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. The highest predicted TSP levels were presented and compared to the recommended hourly target level of 500 $\mu g\ m^{-3}$.

24-hour TSP Levels

2.5.17 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

2.5.18 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.

2.5.19 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

2.5.20 This assessment focuses on dust emissions from general construction activities for stations and alignment, including materials handling and vehicle movement within 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 2.5c* below.

2.5.21 Soft spoil and hard materials in Hong Kong are generally wet, with moisture contents in the order of ten percent (referenced to the recent geological study for 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.

2.5.22 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. Blasting dust impacts can be expected during the initial excavation stage when blasting takes place at the access adit portal, dust impacts will diminish as works move inside the tunnel. Blasting dust impacts will be further 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).

Table 2.5c Emission Factors for Construction activities at Station Worksites

Activities	Emission Factor	Remarks
Handling of excavated spoil	0.12 g te^{-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}	• Based on USEPA AP-42 Vol. 1, 5th Edition, Section 11.19.12.
Truck movements on unpaved haul roads	2.57 g veh^{-1} m^{-1}	• Based on 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.
Blasting	27.5 g $blast^{-1}$	• Based on USEPA AP-42 Vol. 1, 5th Edition, Section 11.9-5. • Assume blast area with dimension of 5 m x 5 m

Prediction of Impacts

2.5.23 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 2.5d*.

Table 2.5d Predicted Blast Dust Concentrations ($\mu g\ m^{-3}$)(1)

Down Wind Distance from Blasting site (m)	1-hour TSP levels $\mu g\ m^{-3}$
5	583
10	286
15	157
20	98
25	67
30	49
35	37
40	29
45	24
50	19
100	6
200	2

Note: (1) the background TSP level of 77 $\mu g\ m^{-3}$ is not included.

2.5.24 The 1-hour and 24-hour TSP levels arising from the construction work for the TKE at the identified ASRs in Yau Tong, Tseung Kwan O, Hang Hau and Po Lam, including the background levels of 77 μg m^{-3} measured at Tseung Kwan O, under the worst meterological conditions in 1994 are shown in *Tables 2.5e-h* below.

Table 2.5e Yau Tong Predicted Averaged TSP Concentrations (μg m^{-3}) without Mitigation

ASRs	Description	1-hour TSP levels	24-hour TSP levels
AYAT1	Yau Tong Centre	1222	518
AYAT2	Sam Ka Tsuen Recreation Ground	694	227
AYAT3	St. Antonius Primary School	1051	276
AYAT4	Yau Tong Estate Phase 1	649	183
AYAT5	Yau Tong Estate Phase 2	640	180
AYAT6	Yau Tong Estate Phase 3	430	148
AYAT7	Yau Tong Estate Phase 3 Playground	424	143

Table 2.5f Tseung Kwan O Predicted Averaged TSP Concentrations (μg m^{-3}) without Mitigation

ASRs	Description	1-hour TSP levels	24-hour TSP levels
ATKO1	Proposed School southern part of Area 55	576	199
ATKO2	Proposed School at the eastern part of Area 56	674	179
ATKO3	Proposed Clinic in Area 56	761	172
ATKO4	Proposed School at the western part of Area 56	1232	342
ATKO5	Proposed School at the eastern part of Area 57	515	183
ATKO6	Proposed PSPS/HOS in Area 67	524	200
ATKO7	Proposed PSPS/HOS in Area 65	850	255
ATKO8	Proposed TKO creational area in Area 45	416	173

Table 2.5g Hang Hau Predicted Averaged TSP Concentrations (μg m^{-3}) without Mitigation

ASRs	Description	1-hour TSP levels	24-hour TSP levels
AHAH1	Chung Man Court (Block E)	1692	436
AHAH2	Residential and Commercial Development in Area 38	1368	375
AHAH3	Proposed Residential Development in Area 37c	1981	377
AHAH4	Yuk Ming Court	1210	240
AHAH5	Proposed School in Area 37d	3054	927
AHAH6	Proposed Residential and Commercial Development Area 37a	2139	641
AHAH7	Proposed School in Area 37e	1203	399
AHAH8	On Ning Garden	2229	386

Table 2.5h Predicted Averaged TSP Concentrations (μg m^{-3}) at Po Lam without Mitigation

ASRs	Description	1-hour TSP levels	24-hour TSP levels
APOL1	King Lam Estate	652	264
APOL2	Ho Ming Court	566	226
APOL3	Residential and Commercial Development Area 17	649	257
APOL4	Proposed Small Household Block	1457	211
APOL5	Proposed School in Area 15	680	156
APOL6	Leung Kit Wah Primary School	766	233
APOL7	Proposed Residential and Commercial Development Area 19a	1009	325
APOL8	Proposed Residential and Commercial Development Area 19c	988	336
APOL9	Proposed residential uses	1083	318
APOL10	Proposed School in Area 24	1213	333
APOL11	King Lam Catholic Primary School	683	278

Evaluation of Impacts

2.5.25 As indicted from *Table 2.5d*, 1-hour TSP levels from blasting at the tunnel portals for the Yau Tong to Tiu Keng Leng section are predicted to be 586 μg m^{-3} (+ 77 μg m^{-3} background = 660 μg m^{-3}) at 5 m from the blasting site, exceeding the EPD's recommended hourly criteria of 500 μg m^{-3}. However, the nearest identified ASRs are located at least 90 m from the tunnel portal and the contribution of dust from blasting towards the total TSP level will be only about 6 μg m^{-3}. There will be no ASRs at Tiu Keng Leng area during the construction of the TKE. The contribution to TSP levels at these ASRs from blasting will, therefore be minimal. It should be noted that 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 shall be implemented to further reduce TSP levels.

Yau Tong

2.5.26 The predicted 1-hour and 24-hour TSP levels at the ASRs in the Yau Tong area during the construction of the station and alignment are shown in *Table 2.5e*. The cumulative 1-hour TSP is predicted to be in range of 424-1222 μg m^{-3}. Without dust mitigation measures, the EPD's recommended hourly TSP level of 500 μg m^{-3} would be exceeded at all the identified ASRs except Yau Tong Estate Phase 3 (AYAT6) and the playground (AYAT7). The 24-hour TSP levels exceed the AQO of 260 μg m^{-3} at Yat Tong Centre (AYAT1) and St. Antonius Primary School (AYAT3) which are only 30 m from the alignment worksite and 10 m from the station worksite respectively.

Tseung Kwan O

2.5.27 The predicted 1-hour and 24-hour TSP levels arising from the construction activities within the station and alignment worksites are presented in *Table 2.5f*. The 24-hour TSP modelling results show that the dust levels are in range of 172 - 342 μg m^{-3} and are mostly within the AQO of 260 μg m^{-3}, the exception being the proposed school in the western part of TKO area 56 (ATKO4). However, 1-hour TSP levels are predicted to be much higher than the EPD's criteria of 500 μg m^{-3}. The predicted 1-hour TSP levels exceed the EPD's recommended level at all the identified ASRs except ATKO8. Dust exceedances predicted at the ASRs in the close proximity to the worksites during the construction of the station and alignment will need to be controlled through the application of appropriate mitigation measures.

Hang Hau

2.5.28 The 1-hour and 24-hour TSP levels arising from the station and alignment construction works are predicted to exceed the EPD recommended criteria at the AQOs, as shown in *Table 2.5g*. The predicted 1-hour and 24-hour averaged TSP levels are all high as there will be large amount of spoil removed within a short period of time and the buffer distance between the ASRs and the worksites is limited. The proposed residential development in Area 37c and school in Area 37d are less than 10 m from the station worksite. Extensive mitigation measures will be necessary to control dust impact if these developments are occupied before the completion of construction works.

Po Lam

2.5.29 As indicated in *Table 2.5h*, the 1-hour and 24-hour TSP levels arising from the station and alignment construction works exceeded the EPD recommended criteria and the AQO at some ASRs.

2.5.30 The sensitive uses are generally only 20-30 m from the nearest worksites. Dust mitigation measures are particularly important in the Po Lam area as most of the identified ASRs are existing developments or are scheduled to be occupied before the completion of the TKE construction works.

2.5.31 The modelling results indicate that many of the predicted 1-hour and 24-hour dust levels at Yau Tong, Tseung Kwan O, Hang Hau and Po Lam will be above the established criteria during the construction of the TKE without effective mitigation measures. However, it should be noted that the active working areas of the construction sites are not likely to be fully utilised at the same time. It is, therefore, expected that the actual dust emission rates will be lower than predicted. Nevertheless, dust mitigation measures are necessary to control the dust emission and should aim to reduce the dust emissions to meet the TSP criteria.

2.5.32 A number of the developments at Yau Tong, Tiu Keng Leng, Tseung Kwan O and Hang Hau areas are still at the planning stage. Since the programme of these developments and layout are not fully known, dust levels are presented in the form of contours to indicate the overall dust impacts in these areas. 1-hour and 24-hour TSP levels are presented in Figures B1.1a-h in *Annex B* which show similar levels to those predicted for identified ASRs. Both 1-hour and 24-hour TSP levels are above the criteria at areas close to the TKE work sites, with the highest levels predicted for station construction.

Mitigation Measures

2.5.33 Unmitigated construction work is likely to cause dust impacts exceeding the established criteria at most of the ASRs close to the sites. The following dust control measures are recommended as good construction practice and will minimise dust nuisance arising from the works:

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 watering the work site to increase the water content of the blasted material;

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 and water applied in dry or windy conditions;

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, with the cover properly secured and extended over the edges of the side and tail boards;
- 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; and

Excavation

- to minimise dust emissions, 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.

2.5.34 In predicting the likely amount of dust suppression, it has been assumed that there will be a 50% reduction in dust generated by materials handling and a 70% reduction of dust generated by vehicle movements within the work sites through:

- a 50% reduction from frequent surface watering and compacting on active areas on the site; and
- a 60% reduction in dust emission potential from vehicle movements on site by restricting speeds to 8 kph.

2.5.35 The predicted TSP levels were revised on the basis of these assumed dust suppression measures and the results are shown in *Tables 2.5i-l* and *Figures B1.1i-p* in *Annex B*. These show that the ambient dust levels arising from general construction activities, including material handling for station and alignment construction and haul road dust within the worksites, can be reduced such that the hourly TSP levels are below the EPD's recommended level of 500 $\mu g\ m^{-3}$ at the ASRs at Yau Tong and Tseung Kwan O.

Table 2.5i YAT Mitigated 24-hour and 1-hour averaged TSP Concentrations ($\mu g\ m^{-3}$)

ASRs	Description	1-hour TSP levels	24-hour TSP levels
AYAT1	Yau Tong Centre	423	209
AYAT2	Sam Ka Tsuen Recreation Ground	266	129
AYAT3	St. Antonius Primary School	422	159
AYAT4	Yau Tong Estate Phase 1	286	121
AYAT5	Yau Tong Estate Phase 2	280	122
AYAT6	Yau Tong Estate Phase 3	211	108
AYAT7	Yau Tong Estate Phase 3 Playground	205	105

Table 2.5j Tseung Kwan O Mitigated Averaged TSP Concentrations ($\mu g\ m^{-3}$)

ASRs	Description	1-hour TSP levels	24-hour TSP levels
ATKO1	Proposed School at the southern part of Area 55	225	116
ATKO2	Proposed School at the eastern part of Area 56	254	111
ATKO3	Proposed Clinic in Area 56	277	109
ATKO4	Proposed School at the western part of Area 56	431	172
ATKO5	Proposed School at the eastern part of Area 57	207	112
ATKO6	Proposed PSPS/HOS in Area 67	210	116
ATKO7	Proposed PSPS/HOS in Area 65	318	142
ATKO8	Proposed TKO creational area in Area 45	179	109

Table 2.5k Hang Hau Mitigated Averaged TSP Concentrations ($\mu g\ m^{-3}$)

ASRs	Description	1-hour TSP levels[1]	24-hour TSP levels
AHAH1	Chung Man Court (Block E)	576(472)	208
AHAH2	Residential and Commercial Development in Area 38	469(440)	178
AHAH3	Proposed Residential Development in Area 37c	676(478)	199
AHAH4	Yuk Ming Court	424(390)	138
AHAH5	Proposed School in Area 37d	939(562)	341
AHAH6	Proposed Residential and Commercial Development in Area 37a	677(488)	252
AHAH7	Proposed School in Area 37e	405(302)	177
AHAH8	On Ning Garden	706(532)	189

Note: (1) Figures in parentheses include the additional effects of site hoardings.

2.5.36 At Hang Hau, the 24-hour TSP levels are within the AQOs at all receivers with the recommended dust mitigation measures, however, the predicted 1-hour TSP levels are still above the EPD's criteria at some ASRs. The buffer distances between the work sites and the closest ASRs are generally less than 10 m. The highest 1-hour TSP levels predicted at Chung Ming Court (AHAH1), proposed residential development in Area 37c (AHAH3), the proposed school in Area 37d (AHAH5), the proposed residential uses in Area 37a (AHAH6) and On Ning Garden (AHAH8) exceeded the EPD's recommended criteria and further mitigation measures need to be considered.

2.5.37 Since the ASRs at Hang Hau are close to the work sites, hoardings at the site boundary could be effective in limiting ground level fugitive dust dispersion. Assuming a 3 m hoarding at the site boundary, the first floors of the nearest ASRs will be then be the worst affected. 1-hour TSP levels are predicted at the first floors of ASRs and the results are presented in *Table 2.5k*. The use of a 3 m hoarding will reduce the predicted 1-hour TSP levels to below the established criterion at all ASRs except On Ning Garden and the proposed school in Area 37d where the levels are reduced to 532 μg m^{-3} and 562 μg m^{-3} respectively.

2.5.38 The modelling is based on the worst case meteorological records and further inspection of the full 1994 data set indicates that there would only have been two exceedances of the hourly criteria at the proposed school and four at On Ning Garden throughout the whole year. The exceedances are predicted during the early morning and evening with stable meterological conditions and it is considered likely that the extent of construction works, and therefore impacts, during these morning and evening periods will be less than during the main part of the working day.

2.5.39 The installation of supplementary glazing and air conditioning has been recommended at the proposed school (AHAH5) as a noise mitigation measure and this will also serve as further dust mitigation. Nevertheless, further mitigation measures should be considered, such as restricting the number of vehicle movements when exceedances of the 1-hour TSP criterion are anticipated.

2.5.40 The main source of fugitive dust is from vehicle movements within the station and alignment worksites. A reduction in the number of concrete mixer trucks from two to one per hour and a 20% reduction in lorry numbers (reduced to six for the station site and one for the alignment) would produce a reduction in emission factors of 26% and 36% respectively. As the ASRs are affected by both station and alignment sites, a worst case scenario of a 26% reduction has been assumed. This will reduce the predicted 1-hour TSP level at HAH5 to 449 μg m^{-3} and at HAH8 to 424 μg m^{-3}, which are both within the EPD's recommended criterion.

Table 2.5l Po Lam Mitigated Averaged TSP Concentrations (μg m^{-3})

ASRs	Description	1-hour TSP levels	24-hour TSP levels
APOL1	King Lam Estate	269	148
APOL2	Ho Ming Court	237	132
APOL3	Residential and Commercial Development in Area 17	265	144
APOL4	Proposed Small Household Block	501	129
APOL5	Proposed School in Area 15	260	107
APOL6	Leung Kit Wah Primary School	286	132
APOL7	Proposed Residential and Commercial Development Area 19a	360	162
APOL8	Proposed Residential and Commercial Development Area 19c	357	167
APOL9	Proposed residential uses	384	163
APOL10	Proposed School in Area 24	423	169
APOL11	King Lam Catholic Primary School	281	154

2.5.41 At Po Lam, the impacts are sufficiently well mitigated that 24-hour TSP levels are within the AQO. The 1-hour TSP levels are also below the EPD criteria at all the ASRs except the Small Household block with a level of 501 μg m^{-3} which exceeds the criteria by only 1 μg m^{-3}. Given that the predicted exceedance is a worst case assumption, the air quality

at Po Lam can be readily controlled to within the recommended criterion by the application of vehicle movement controls described in Section 2.5.40 above.

2.6 *OPERATIONAL IMPACTS*

2.6.1 No potential air quality impacts during the normal operation of the TKE have been identified since electric trains will be used and R134a will be used for air conditioning in compliance with the Montreal Protocol. Impacts will be limited to the emergency use of the station and tunnel ventilation systems.

Ventilation Shafts

2.6.2 Ventilation shafts will provide air exchange and air-conditioning for the proposed TKE 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 proposed stations would be used for emergency smoke extraction in the event of fire.

2.7 *CONCLUSIONS*

2.7.1 Unmitigated dust has been identified as the main air quality impact arising during the construction phase of the proposed TKE. In the absence of any mitigation measures, high dust impacts are predicted at a number of the identified ASRs. Drill and blast tunnel construction, excavation works and vehicles moving on unpaved haul roads have been identified as the main sources of dust. The proposed construction works will be undertaken in partially and fully developed areas, and the majority of land uses close to the potential sites are identified to be ASRs. In Tiu Keng Leng and Tseung Kwan O, new developments are proposed or under construction and the number of occupied ASRs will be likely to increase by the time of TKE construction.

2.7.2 Sufficient 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. Construction methods should be selected to minimise potential impacts. 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.

2.7.3 Most of the identified ASRs which have been considered in this assessment, especially at Tiu Keng Leung and Tseung Kwan O, are currently at the planning stage and the programme of development is not known yet. The number of occupied ASRs will increase if the planned developments are completed before TKE construction ends.

2.7.4 Dust impacts have only been evaluated for the construction of the TKE since information on other construction projects is not available. To ensure the ASRs are protect from cumulative dust nuisance from any other construction work, contingency plans for other construction works will need to be prepared by the Contractor and regular dust monitoring will be required during the construction of the TKE.

2.7.5 Air quality impacts during operation of the TKE 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 outlines the likely noise impacts arising from the construction and operational phases of the TKE on the nearby noise sensitive receivers (NSRs). Appropriate mitigation measures will be recommended to mitigate any adverse impacts. The proposed alignment will be underground or undercover and hence, activities during the operational phase of the railway are not considered likely to cause significant noise impacts. Nevertheless, potential noise impacts from ventilation systems will be addressed.

3.1.2 Unmitigated construction works are predicted to generate exceedances of the recommended target criteria at most of the identified NSRs. Appropriate mitigation measures, including the use of quiet plant, moveable noise barriers and restriction on the numbers of plant, have been recommended to control these impacts to within the established criteria. Further mitigation, in the form of improved glazing and air conditioning have been identified to provide a number of schools with the additional protection necessary to achieve their more stringent recommended daytime noise level. No operational impacts from noise or vibration are anticipated.

3.2 LEGISLATION AND GUIDELINES

3.2.1 In Hong Kong the control of construction noise other than Percussive Piling outside of daytime, weekday working hours (07.00-19.00, Monday through Saturday excluding Public Holidays), is governed by the *Noise Control Ordinance* (NCO) and the subsidiary technical memoranda namely *Technical Memorandum on Noise From Construction Work Other Than Percussive Piling* (TM1). The control of Percussive Piling (at all times) is governed by the *Technical Memorandum on Noise From Percussive Piling* (TM2). These technical memoranda prescribe the permitted noise levels for construction work depending upon working hours and the existing noise climate.

3.2.2 A subsidiary *Technical Memorandum on Noise from Construction Work in Designated Areas* (TM3), will be applied on or after 1 August 1996. TM3 will be applicable 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.*

3.2.3 TM3 will cover the use of the following specified powered mechanical equipment (PME): hand-held breaker; bulldozer; concrete lorry mixer; dump truck; and hand-held poker vibrator. The prescribed construction works are: erection or dismantling of formwork or scaffolding; loading, unloading or handling or rubble, wooden boards, steel bars, wood or scaffolding material; and hammering.

3.2.4 The NCO criteria for TM1 and TM3 are dependent upon the type of area containing the NSR rather than the measured background noise level. The NCO requires that noise levels from construction at affected NSRs be less than a specified Acceptable Noise Level (ANL) which depend on the Area Sensitivity Rating (ASR) for the NSR under consideration.

3.2.5 It is intended that the construction activities of the proposed works should be planned and controlled in accordance with the NCO. Works requiring the use of PME during restricted hours (19.00-07.00 Monday through Saturday, and at all times during Sundays and Public Holidays), particularly at night (23.00-07.00), 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.

3.2.6 For this assessment, no information concerning the scheduling of other construction works in the area is currently available and, therefore, the ANL corrections have been set to zero. As a result, the ANLs are equal to the BNLs. The ANLs for the construction work other than percussive piling and for the construction work in designated areas are shown in *Table 3.2a(i)* and *3.2a(ii)* below.

Table 3.2a(i) Acceptable Noise Levels for Construction other than Percussive Piling ($L_{Aeq, 5min}$ dB)

Time Period	ASR"A"	ASR"B"	ASR"C"
All days during the evening (19.00-23.00) and general holidays (including Sundays) during the day and evening (07.00-23.00)	60	65	70
All days during the night-time (23.00-07.00)	45	50	55

Table 3.2a(ii) Acceptable Noise Levels for Construction in Designated Areas ($L_{Aeq, 5min}$ dB)

Time Period	ASR"A"	ASR"B"	ASR"C"
All days during the evening (19.00-23.00) and general holidays (including Sundays) during the day and evening (07.00-23.00)	45	50	55
All days during the night-time (23.00-07.00)	30	35	40

3.2.7 Although the NCO does not provide for the control of construction activities during normal working hours, a limit of $L_{Aeq, 30\ min}$ 75 dB is proposed in the *Practice Note For Professional Persons, Professional Persons Environmental Consultative Committee, Noise from Construction Activities: Non-statutory Controls, June 1993* (ProPECC PN2/93). This voluntary limit has been applied on major construction projects, including the Lantau and Airport Railway (LAR) and is now generally accepted in Hong Kong, and will therefore be adopted in this study in order to protect residential NSRs to an appropriate extent.

3.2.8 For schools, the ProPECC PN2/93 recommended noise level during normal school days is $L_{Aeq, 30\ min}$ 70 dB, this is lowered to $L_{Aeq, 30\ min}$ 65 dB during examination periods. The mitigation measures that are recommended later in this section aim to control noise levels to below the normal level for schools, additional measures such as restricting construction activities would, therefore, be required during exam periods if these occur within noisy construction phases.

3.2.9 There are further subsidiary regulations, *Noise Control (Hand held percussive breakers) Regulations* and *Noise Control (Air Compressors) Regulations* controlling the noise from hand held breakers and air compressors which require compliance with the relevant noise emission standards and the fixing of noise emission labels to the plant (114 dB for hand-held breakers and 109 dB for air compressors).

3.2.10 Percussive piling is only permitted within the constraints of a CNP. TM2 sets out the requirements for working under a CNP, the determination of the permitted hours of operations and, when necessary, other conditions. Percussive piling is prohibited during restricted hours (19.00-07.00) unless specifically exempted. ANLs for percussive piling are set out in TM2 and are dependent on the type of NSR. The ANLs for daytime

percussive piling are presented in *Table 3.2b*.

Table 3.2b Acceptable Noise Levels for Daytime Percussive Piling

Type of Receptor	Acceptable Noise Level (dB(A))
NSR with no windows or other openings	100
NSR with central air conditioning systems	90
NSR with windows or other openings but without central air conditioning system	85

3.2.11 It should be noted that for hospitals, clinics, schools, courts of law or other particularly sensitive receivers, the ANL is 10 dB(A) below that quoted in *Table 3.2b*.

3.2.12 The permitted hours of operations are determined by comparing the Corrected Noise Level (CNL) and the ANL at the NSR. *Table 3.2c* presents the permitted hours of operation for percussive piling.

Table 3.2c Permitted Hours of Operation for Percussive Piling

Amount by which CNL exceeds ANL	Permitted hours of operation on any day not being a holiday
More than 10 dB(A)	08.00-09.00 AND 12.30-13.30 AND 17.00-18.00
Between 1 dB(A) and 10 dB(A)	08.00-09.30 AND 12.00-14.00 AND 16.30-18.00
No exceedance	07.00-19.00

3.2.13 Noise from fixed plant operations also fall under the control of the NCO and noise restrictions are imposed at all times. The appropriate ANL for a particular NSR is obtained by referring to the *Technical Memorandum on Noise from Places Other Than Domestic Premises, Public Places or Construction Sites* (TM4). However, the EPD generally require that in planning for new developments operational noise impacts at nearby NSRs do not exceed the criteria set by the HKPSG. The HKPSG recommends 5 dB(A) less than the ANL as a criteria for fixed noise sources. The criteria for assessing operational activities associated with fixed noise sources are given in *Table 3.2d* below.

Table 3.2d Acceptable Noise Levels to be applied as Criteria to the Area Sensitivity Ratings (ANL, $L_{Aeq,\ 30\ min.}$ dB)

Time Period	ASR"A"	ASR"B"	ASR"C"
All days during the evening (19.00-23.00) and general holidays (including Sundays) during the day and evening (07.00-23.00)	60	65	70
All days during the night-time (23.00-07.00)	50	55	60

3.3 *SENSITIVE RECEIVERS AND BASELINE CONDITIONS*

Construction Phase

Yau Tong Section

3.3.1 The main residential developments in the vicinity of the proposed station are Yau Tong Centre and Ko Chiu court. There are currently two schools along Cha Kwo Ling Road namely Po Chiu College and St. Antonius Primary School, however the TKE construction works are likely to require the resumption of both schools. It is also anticipated that Yau Tong Estate and Ko Chiu Road Estate will be redeveloped.

3.3.2 There are currently industrial buildings along Cha Kwo Ling Road (between the EHC and Yau Tong Road) and along the waterfront at Yau Tong. Industrial buildings are not considered as NSRs and hence the noise impact from the construction of TKE do not need to be considered for this area.

3.3.3 The NSRs (planned and existing) closest to the proposed construction sites for YAT and the track alignment have been selected as representative NSRs and are listed below in *Table 3.3a* and shown in *Figure 3.3a*. For planned NSRs, the noise impact can only be predicted at the site boundary of the planned development as the master layout plans for the development are not yet available.

3.3.4 NSRs for the assessment are assumed to have no central air conditioning systems and a direct line of sight to the appropriate construction site.

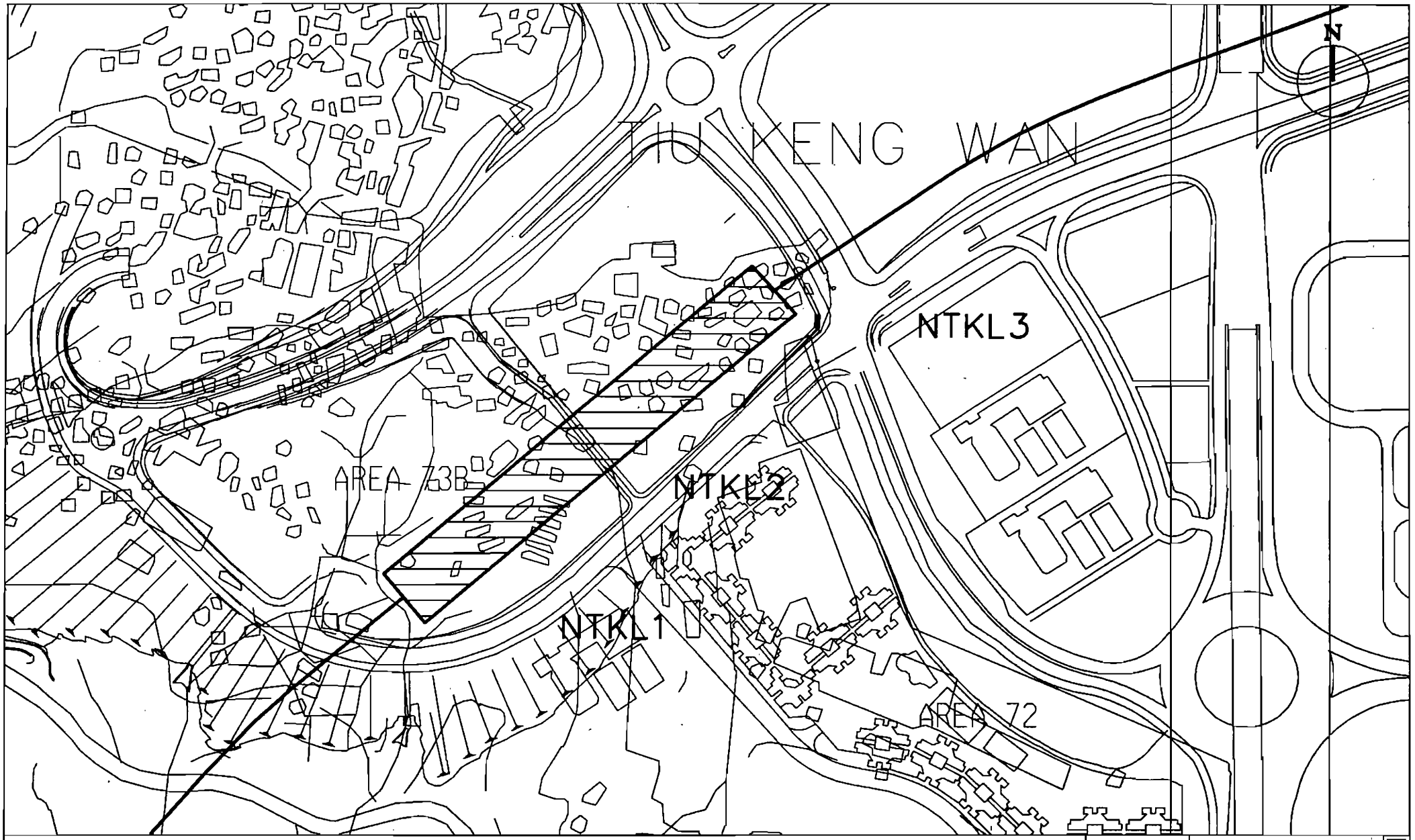
Table 3.3a Noise Sensitive Receivers - Yau Tong Section

Noise Sensitive Receivers	Representative NSRs	Distance to Worksite (m)		
		Station	Alignment	Tunnel Portal
Existing				
NYAT 1	Yau Tong Centre	180	30	60
NYAT 2	St Antonius Primary School	30	100	180
Potential				
NYAT 3	Yau Tong Estate Phase 1	80	85	160
NYAT 4	Yau Tong Estate Phase 2	100	145	240
NYAT 5	Yau Tong Estate Phase 3	260	200	180

3.3.5 The existing noise climate in the vicinity of the proposed station is dominated by traffic noise from Cha Kwo Ling Road, Lei Yue Mun Road, the distant EHC and local access roads. Industrial noise and aircraft noise also contribute to the overall ambient noise levels in the surrounding area.

Tiu Keng Leng Section

3.3.6 The current residents at Rennie's Mill are being relocated and their dwellings will be demolished, therefore none of the existing NSRs will be present during the TKE construction works. TKL station will be constructed mainly underground, with part of the concourse extending to ground level and the TKL to TKO section will be built on reclaimed land. Portal construction is expected to be carried out under the Devil's Peak, south of the TKL station. The potential NSRs are shown in *Figure 3.3b*.



Proposed Alignment & Station

NTKL 1 Noise Sensitive Receiver

TIU KENG LENG: NOISE SENSITIVE RECEIVERS

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DATE: NOV 95

FIGURE No. 3.3b

SCALE: NTS

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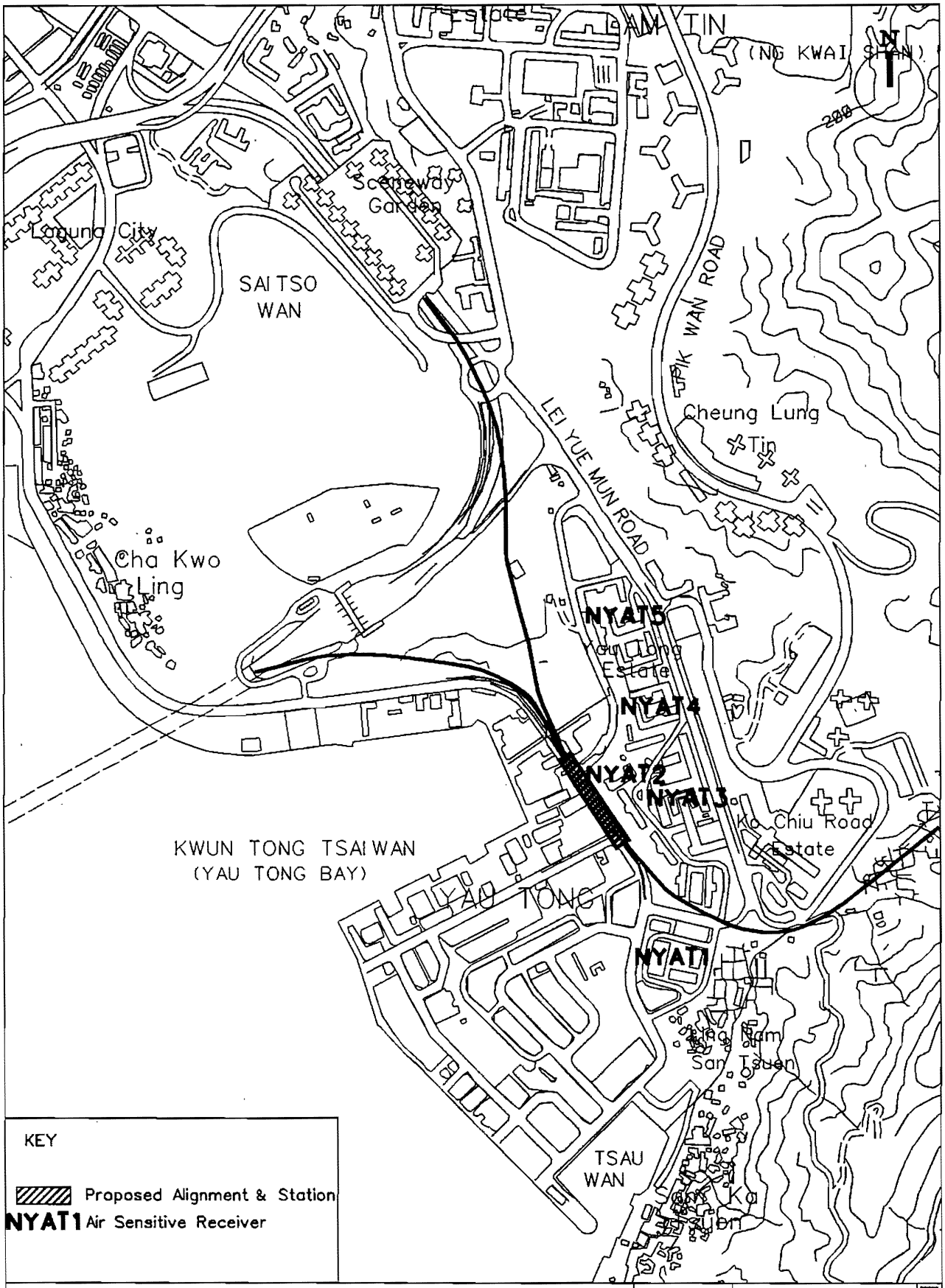

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TKE: YAU TONG - NOISE SENSITIVE RECEIVERS

DATE:	FIGURE No.
NOV 95	3.3a
SCALE: NTS	

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3.3.7 Public and private residential developments are expected to be built within Areas 73, 73b and 74. The current HKHA reclamation programme for Areas 73a, 73b and 74 surrounding the worksite is anticipated to be undertaken from mid-2001 to mid-2002, which is later than the expected completion of the TKL alignment and station development programme. Therefore, no NSRs are expected in this area during the TKE construction works.

Tseung Kwan O Section

3.3.8 There are currently no existing NSRs within 300 m of the proposed worksites. The areas surrounding the worksites are proposed for residential and educational developments which include schools to the north of the station in Areas 55, 56 and 57 and residential developments south of the station in Areas 65 and 67. For the planned NSRs in Areas 65 and 67, the master layout plans for the development are not yet available, hence the noise impact can only be predicted at the site boundary of the planned development.

3.3.9 The schools in Areas 55, 56 and 57 are the NSRs located closest to the proposed TKO worksites. A large public housing development north of the station would be screened from noise from TKO worksites by these schools. Three of these schools, which are expected to be most affected by the construction activities, have been selected as representative NSRs are shown in *Figure 3.3c* and are listed in *Table 3.3b* below. For the purposes of this assessment, the NSRs are assumed to have no central air conditioning systems and a direct line of sight to the appropriate construction site.

Table 3.3b Noise Sensitive Receivers - Tseung Kwan O Section

Noise Sensitive Receivers	Representative NSR	Distance to Worksite (m)	
		Station	Alignment
NTKO 1	School at the southern part of Area 55	280	170
NTKO 2	School at the western part of Area 56	175	220
NTKO 3	School at the eastern part of Area 57	240	180
NTKO 4	Area 65 residential block	200	70
NTKO 5	Area 67 residential block	130	35

Hang Hau Section

3.3.10 There are currently two large residential developments (On Ning Garden to the west and Chung Ming Court to the east) beside the alignment north of HAH. Two additional schools have been proposed to the west of HAH (Area 37d and 37e). There are also a number of proposed residential developments located to the south (Area 27c and 44e), west (Area 38a) and east (Area 37a) of the station. The two schools in Hau Tak Estate are located approximately 200 m north-west of the station and are screened from construction noise by Chung Man Court and the associated commercial centre.

3.3.11 The NSRs closest to the proposed construction sites have been selected as representative NSRs. These NSRs are shown in *Figure 3.3d* and listed in *Table 3.3c* below. The NSRs are assumed to have no central air conditioning systems and a direct line of sight to the appropriate construction site.

Table 3.3c Noise Sensitive Receivers - Hang Hau

Noise Sensitive Receiver	Representative NSR	Distance to Worksite (m)	
		Station	Alignment
Existing NSR			
NHAH 1	Chung Ming Court (Block E)	100	15
NHAH 2	Yuk Ming Court	200	50
NHAH 3	On Ning Garden Block 2	70	80
NHAH 4	On Ning Garden Block 3	110	40
Potential NSR			
NHAH 5	Area 38a Western Residential Block	60	120
NHAH 6	Area 37c Residential Block	120	30
NHAH 7	Area 37a Residential Block	100	40
NHAH 8	Area 37e School	80	130
NHAH 9	Area 37d School	160	30

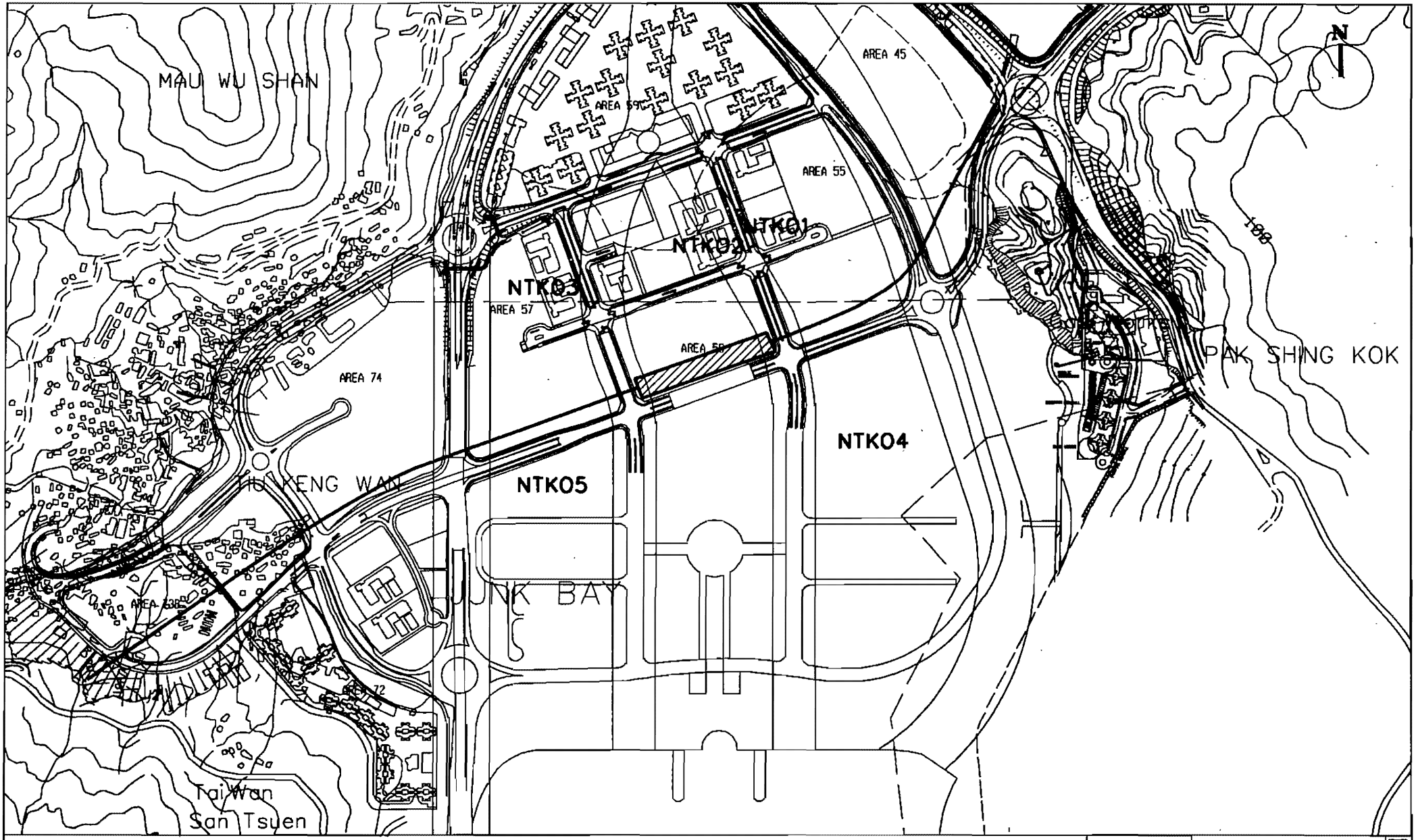
Po Lam Section

3.3.12 There are currently two existing NSRs, a residential development, King Lam Estate and Ho Ming Court. There are a number of proposed residential and commercial developments (Areas 17, 19 east and west of the station and the small household block to the north) surrounding the worksites. A total of six proposed schools are located to the north-west (two schools at Area 15 and one at Area 19b) and the south (two at Area 24 and one at Area 19c) of the proposed station. Representative NSRs which would be the worst affected are identified and shown in *Figure 3.3e*. NPOL1b and NPOL3b are located at the ground floor and provided with air-conditioning. These NSRs and their respective minimum distances to the worksites are listed in *Table 3.3d* below.

3.3.13 The NSRs are assumed to have no central air conditioning systems and a direct line of sight to the appropriate construction site.

Table 3.3d Noise Sensitive Receivers - Po Lam Section

Noise Sensitive Receiver	Representative NSR	Distance to Worksite (m)	
		Station	Alignment
Existing NSR			
NPOL 1a	King Tao House	200	40
NPOL 1b	King Lam Kindergarten	200	40
NPOL 2	King Lam Primary School	270	45
NPOL 3a	Ho Ming Court	140	60
NPOL 3b	Tung Wah Group Kindergarten	140	60
Potential NSR			
NPOL 4	Nearest school in Area 15	130	80
NPOL 5	Nearest residential block, southern part of Area 17	50	90
NPOL 6	Nearest school in Area 19	160	50
NPOL 7	Nearest residential block in Area 19 (north)	60	60
NPOL 8	Nearest residential block in Area 19 (south)	60	80
NPOL 9	Nearest school in Area 24	200	50



Proposed Alignment & Station

NTKO1 Noise Sensitive Receiver

TSUENG KWAN O CENTRE: NOISE SENSITIVE RECEIVERS

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DATE: NOV 85

SCALE: NTS

FIGURE No. 3.3c

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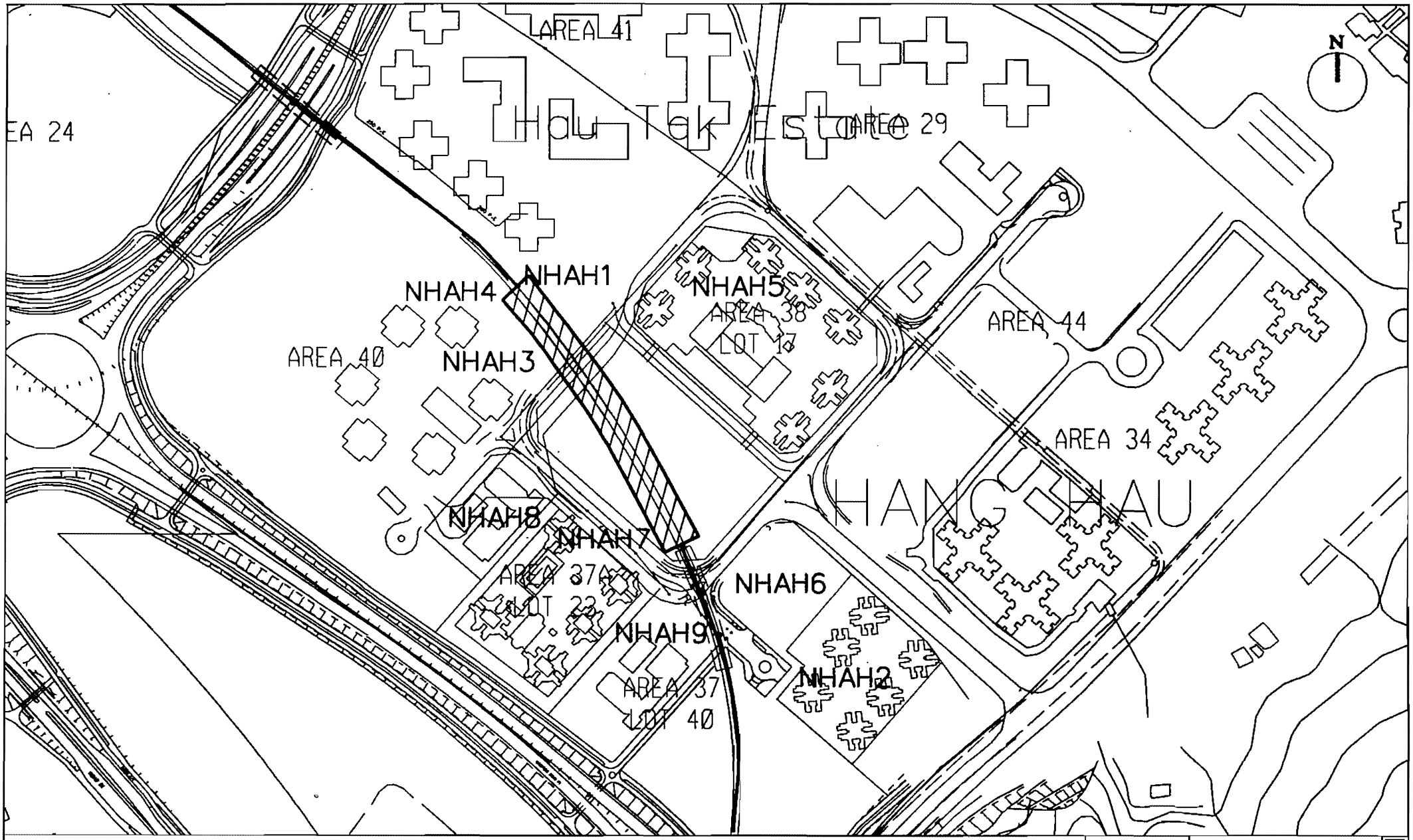

Proposed Alignment & Station

NHAH1 Noise Sensitive Receiver

HANG HAU: NOISE SENSITIVE RECEIVERS

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DATE: AUG 95

SCALE: NTS

FIGURE No. 3.3d

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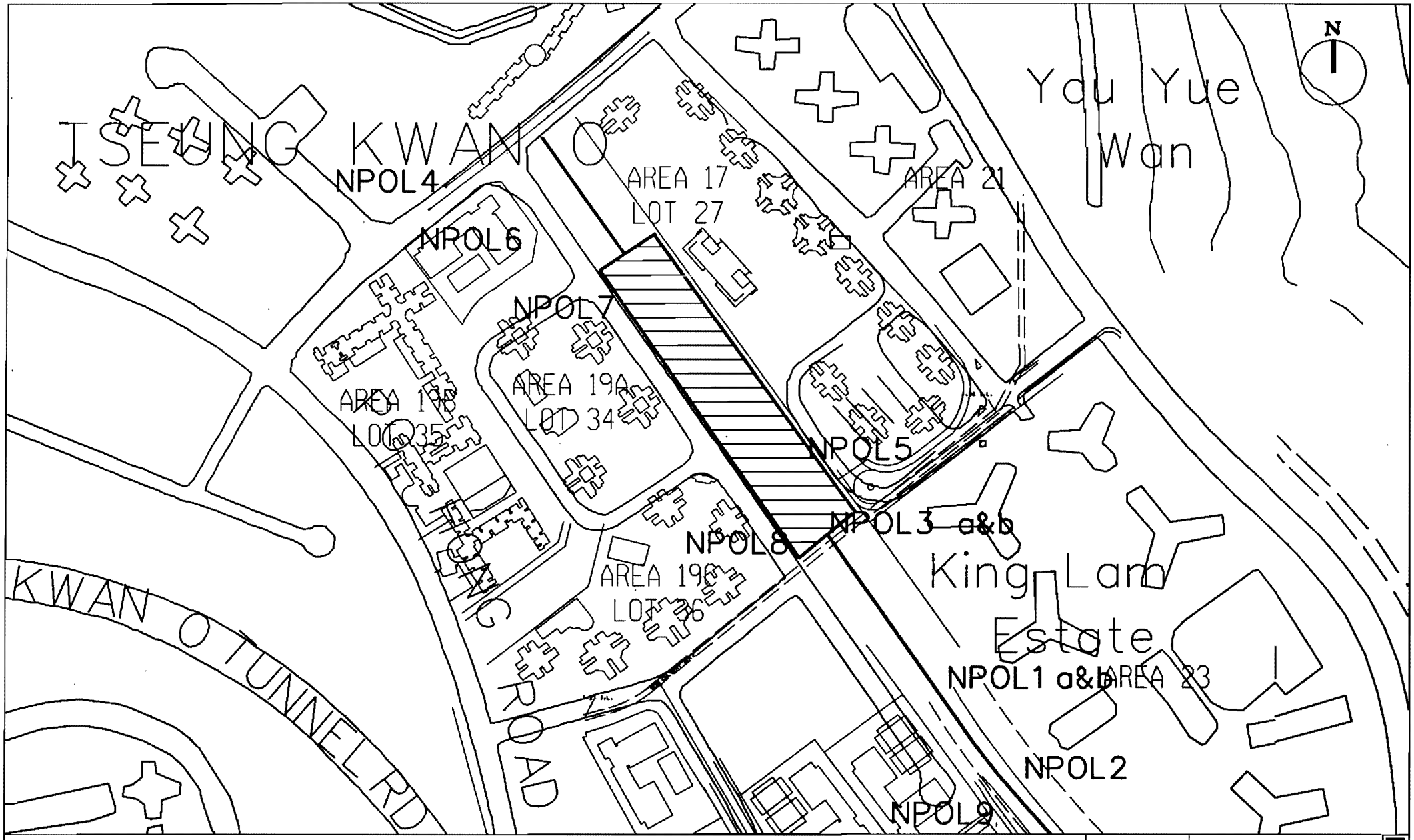

Proposed Alignment & Station

NPOL1 Noise Sensitive Receiver

PO LAM: NOISE SENSITIVE RECEIVERS

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DATE: NOV 95

SCALE: NTS

FIGURE No. 3.3e

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Operational Phase

3.3.14 The TKE alignment from YAT to HAH is below ground in cut and cover tunnel. After HAH, the alignment rises to ground level north of Road P2 and continues at ground level into POL. The above ground section of the alignment will be fully enclosed within a concrete structure. This structure will be designed to prevent the transmission of train noise and there will, therefore, be no adverse noise impacts from the movement of trains at any point along the alignment.

3.3.15 The potential operational noise impacts will be from the new ventilation systems (fixed plant) serving the TKE and the potential generation of ground-borne noise and vibration from the underground trains. As sufficient detailed information on inter alia track form and lithology is not available at this stage, the ground-borne noise from underground trains is not assessed as part of the DEIA. However, any ground-borne noise and vibration can be effectively mitigated by means of a suitably designed resilient track form, although this has not generally been found to be necessary on other MTRC lines.

3.3.16 A new ventilation building is proposed to be located mid-way between YAT and TKL. As there are currently no existing or planned NSRs in the surrounding area the operational noise will not be assessed in this report. Other ancillary buildings or plant rooms will be located at both ends of the station. The potentially affected NSRs, their distance to the noise sources and ASRs are presented in *Table* 3.3*e* below.

Table 3.3e Potential NSRs and Distances to Fixed Plant Sources

Station	Representative NSRs	Distance (m)	ASR
YAT	NYAT 1	200	C
	NYAT 2	90	C
	NYAT 3	90	C
	NYAT 4	120	C
	NYAT 5	260	C
TKL	NTKL 1	100	B
	NTKL 2	100	B
	NTKL 3	160	B
TKO	NTKO 1	200	B
	NTKO 2	120	B
	NTKO 3	160	B
	NTKO 4	120	B
	NTKO 5	120	B
HAH	NHAH 1	40	C
	NHAH 2	160	C
	NHAH 3	70	C
	NHAH 4	40	C
	NHAH 5	90	C
	NHAH 6	80	C
	NHAH 7	50	C
	NHAH 8	130	C
	NHAH 9	100	C

Station	Representative NSRs	Distance (m)	ASR
POL	NPOL 1	170	B
	NPOL 2	230	B
	NPOL 3	80	B
	NPOL 4	200	B
	NPOL 5	60	B
	NPOL 6	110	B
	NPOL 7	40	B
	NPOL 8	40	B
	NPOL 9	190	B

3.4 CONSTRUCTION IMPACTS

Potential Sources of Impact

3.4.1 The construction of the proposed alignment and stations will mainly be by cut and cover method, except for the QUB-YAT, LAT-YAT and YAT-TKL tunnel sections where drill and blast will be used. Above ground construction will be carried out at the tunnel access adits andstation sites and the HAH-POL section of the alignment. The potential sources of noise impact during the construction phase are described below according to the locations of the worksites.

Yau Tong Station

3.4.2 It has been assumed that the station will mainly be constructed in cut and cover excavation with drill and blast where necessary. During station construction there are six main activities capable of producing significant noise impacts at NSRs. These are:

- site establishment;
- excavation;
- station box construction (including bored piling);
- reinforced concrete structure construction; and
- reinstatement.

3.4.3 Operations within the tunnels are expected to be continuous, but the operation of mechanical plant on the surface is expected to be carried out during the daytime only. However, any above ground and underground construction activities during the evening and night-time periods will be subject to the issue of a CNP by the EPD.

Site Establishment

3.4.4 The station box will be constructed along the line of the existing Cha Kwo Ling Road. The northern side of the station may require cutting into existing slopes to enable construction and this will be dependent on the stage of redevelopment of the housing estates directly to the north.

Excavation

3.4.5 This task will initially involve the removal of the road surface and underlying soil. Cut and cover method will be used for the alignment. The construction activities are expected to take approximately eight months.

Station Box Construction and Structures

3.4.6 YAT will have two levels of platforms with the construction largely below ground level in rock. The station structure formation will take place for approximately 16 months.

Reinstatement

3.4.7 This task will mainly involve the relaying of the road and pavement and the reinstatement of the station site.

Yau Tong to Tiu Keng Leng Alignment

3.4.8 This section of the alignment will consist of two different components, a cut and cover tunnel from the east of YAT station to the edge of Devil's Peak and a tunnel constructed by drill and blast from Devil's Peak to TKL.

3.4.9 Particularly noisy activities during the construction of cut and cover tunnel will be:

- site establishment;
- excavation;
- reinforced concrete structure construction;
- portal construction;
- blasting spoil removal; and
- reinstatement.

Site Establishment

3.4.10 Cha Kwo Ling Road will need to be diverted to enable the tunnels to be constructed. The site will then be cleared to enable slope stabilisation and excavation to proceed.

Excavation

3.4.11 The tunnels to the east and west of YAT will be constructed in boxes by cut and cover method, these will lead into the rock tunnel portals. The excavation activities are expected to take approximately eight months.

Structures

3.4.12 This task will involve the tunnel structure formation. Although all the noisy construction will carried out inside the tunnel, there will be some above ground construction activities and the operation of ventilation fans.

Reinstatement

3.4.13 This task will involve reinstatement above the tunnel boxes and the relaying of the road and pavement.

Portal Construction and Blasting Spoil Removal

3.4.14 It has been assumed that for tunnel construction passing through Devil's Peak, drilling and blasting will be required initially at the surface and then underground. As a consequence, the surrounding NSRs are likely to be affected by short term impulsive noise impacts. As most of the construction activities will take place within the tunnels, the majority of the potential impacts for this phase of construction will be well screened

and will only affect NSRs in the immediate vicinity of the tunnel portal site, which is assumed to be located to the south-east of Ko Chiu Road. Removal of blasting spoils and rubble will be required at the entrance of the tunnel portal.

Alignment from Tiu Keng Leng to Tseung Kwan O

3.4.15 It has been assumed that the alignment leaving TKL will be underground and constructed by cut and cover method. The main noise sources around the construction site are:

- site establishment;
- piling of foundations;
- excavation;
- reinforced concrete structure construction; and,
- reinstatement.

Site establishment

3.4.16 Site clearance will be needed for the Tiu Keng Leng section. The site will be cleared to enable the excavation, and any cut slope stabilisation, to proceed.

Piling and Excavation

3.4.17 The tunnels from TKL to TKO station will be constructed in boxes by cut and cover method. The excavation and piling activities are expected to take approximately two years.

Structures

3.4.18 This task will involve the tunnels structure formation. Although all the noisy construction will carried out inside the tunnel, there will be some above ground construction activities and the operation of ventilation fans.

Reinstatement

3.4.19 This task will mainly involve reinstatement along the alignment above the tunnel boxes and laying of the road and pavement.

Tseung Kwan O, Hang Hau and Po Lam Stations

3.4.20 It has been assumed that for all these station construction works, cut and cover method will be used. The main activities capable of producing significant noise impacts at NSRs are:

- site establishment;
- piling of foundation;
- excavation;
- station box construction;
- reinforced concrete structure construction; and,
- reinstatement.

Site Establishment

3.4.21 The works areas will initially be cleared to street level, involving clearance works and

cut slope stabilisation.

Piling

3.4.22 Piling work for the foundation is expected to be completed within four months.

Excavation

3.4.23 This task will initially involve the removal the road surface and underlying soil. Cut and cover method will be used. The excavation activities are expected to take approximately four months.

Station Box Construction and Structures

3.4.24 All of these stations will have one level of platforms. TKO and HAH will be constructed largely below ground level in newly reclaimed land and POL will be constructed above ground level. The station structure formation will take approximately 12 months.

Reinstatement

3.4.25 This task will mainly involve the relaying of the road and pavement and the reinstatement of the station site.

Alignment from Tseung Kwan O to Po Lam

3.4.26 It has been assumed that the whole route will be underground and constructed by cut and cover method, except near POL station where the alignment will be at grade. However, the at grade section of the alignment will be covered by a reinforced concrete structure and hence construction methods will be similar to the construction of the train track from TKL to TKO.

Assessment Methodology

General Construction Noise

3.4.27 A methodology for assessing noise from the construction of the proposed alignment and stations has been developed based on TM1. In general, the methodology is as follows:

- locate NSRs that may be affected by each worksite;
- identify plant items for construction activities based on available information;
- assign sound power levels (SWLs) to plant based from TM1;
- calculate the maximum total site SWL for construction activities using the plant inventory and the SWL data in TM1;
- calculate distance attenuation to NSRs from worksite notional noise source point;
- predict construction noise levels at NSRs in the absence of any mitigation measures; and
- compare predicted levels with established noise criteria.

3.4.28 If the noise assessment criteria are exceeded at NSRs, mitigation measures must be considered. A re-evaluation of the total SWL for activities will be made assuming the use of practical mitigation measures such as silenced equipment and noise barriers. If the criteria are still exceeded, further mitigation measures such as a reduction in the number of noisy plant working simultaneously would be recommended. Detailed plant

lists and SWLs are provided in *Tables C1.1a-d* in *Annex C.*

3.4.29 For the assessment of noise from percussive piling, a methodology based on TM2 has been adopted. The CNL at the NSRs is calculated and the permitted hours of operation are determined by the degree by which the CNL exceeds the ANL.

Assumed Construction Plant Inventories

3.4.30 Construction of the TKE extension will include five main types of above ground construction operations. These are site establishment, piling, excavation, structures and reinstatement. The breakdown of these activities and the plant items indicated by the Maunsell Engineering Design Team for each activity are given in Annex C. The excavation phase has been divided into two activities, above ground and underground, as it has been assumed that initially all the PME will be in operation at the surface. However, as the works progress most of the PME will operated underground and hence, the majority of the noisy plant will be better screened from the NSRs.

Blasting

3.4.31 The control of all blasting operations in Hong Kong is vested in the M&Q Division of the 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.

3.4.32 For Hong Kong a conservative limiting peak particle velocity (ppV) of 25 mm s^{-1} for reinforced concrete structures, below which no damage to the structures are likely, is recommended. Both the MTRC and China Light and Power company (CLP) recommended 25 mm s^{-1} ppV to minimise the risk of damage to their structures from vibration. Water retaining structures tend not to be as resilient as buildings, and the Water Supplies Department recommends 13 mm s^{-1} ppV to minimise damage to their structures from vibration impacts.

3.4.33 A methodology for estimating the likely levels of vibration is given by the Dupont formula, which when tailored to the situation in Hong Kong can be used to give indicative vibration levels. However, the M&Q Division require 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 mitigation of the possible impacts on nearby sensitive landuses.

Prediction of Impacts

Yau Tong Section

3.4.34 Analysis of the construction activities plus the likely methods of working has enabled an inventory of plant items and site total SWLs to be assembled and used to predict impact at individual NSRs.

3.4.35 Façade noise levels at the NSRs were calculate based on the total SWLs and distance attenuation values given in TM1. In order to assess the worst case scenario, it has been assumed that construction work at each work site would occur simultaneously. The

cumulative effect of the construction impacts on the nearby NSRs are shown in *Table 3.4a* below.

Table 3.4a Total Predicted Noise Levels for Yau Tong Section (dB(A))

NSR reference	Construction Activities	Predicted Noise Level
NYAT 1	**Station & Alignment**	
	site establishment	85
	excavation (initial)	86
	excavation (final)	84
	station box construction	74
	structures	86
	reinstatement	85
	portal construction	78
	blasting spoil removal	80
	vent fans (night-time)	70
NYAT 5	**Station & Alignment**	
	site establishment	70
	excavation (initial)	71
	excavation (final)	70
	station box construction	71
	structures	71
	reinstatement	70
	portal construction	69
	blasting spoil removal	70
	vent fans (night-time)	61

Note : Noise levels exceeding 75 dB(A) for residential, 70 dB(A) for school and 55 dB(A) for vent fans night-time operation are in **bold**. Levels at schools should be reduced by a further 5 dB(A) during examination periods.

Tseung Kwan O to Po Lam Section

3.4.36 The extent of the construction impacts at TKO, HAH and POL are considered to be similar to YAT Section.

3.4.37 The total predicted maximum noise levels associated with each of the construction activities at the façade of the representative NSRs are shown in *Tables 3.4b-d* taking into account the distance attenuation for each source. In order to assess the worst case scenario, it has been assumed that construction work at each site would occur simultaneously.

Table 3.4b Predicted Construction Noise Levels for Tseung Kwan O Section (dB(A))

NSR reference	Construction Activities	Predicted Noise Level
NTKO 1 (school)	site establishment	71
	piling	72
	excavation (initial)	72
	excavation (final)	70
	station box construction	70
	structures	72
	reinstatement	71
NTKO 2 (school)	site establishment	71
	piling	72
	excavation (initial)	72
	excavation (final)	70
	station box construction	74
	structures	72
	reinstatement	71
NTKO 3 (school)	site establishment	71
	piling	72
	excavation (initial)	72
	excavation (final)	70
	station box construction	71
	structures	72
	reinstatement	71

NSR reference	Construction Activities	Predicted Noise Level
NTKO 4	site establishment	78
	piling	78
	excavation (initial)	79
	excavation (final)	77
	station box construction	73
	structures	79
	reinstatement	78
NTKO 5	site establishment	84
	piling	84
	excavation (initial)	85
	excavation (final)	83
	station box construction	77
	structures	85
	reinstatement	83

Note : Noise levels exceeding 75 dB(A) for residential and 70 dB(A) for school are in **bold**. Levels at schools should be reduced by a further 5 dB(A) during examination periods.

Table 3.4c Predicted Construction Noise Levels for Hang Hau Section (dB(A))

NSR reference	Construction activities	Predicted Noise Level
NHAH 1	site establishment	91
	piling	91
	excavation (initial)	92
	excavation (final)	90
	station box construction	79
	structures	92
	reinstatement	90
NHAH 2	site establishment	80
	piling	81
	excavation (initial)	81
	excavation (final)	80
	station box construction	73
	structures	81
	reinstatement	80
NHAH 3	site establishment	80
	piling	80
	excavation (initial)	81
	excavation (final)	79
	station box construction	82
	structures	81
	reinstatement	80
NHAH 4	site establishment	83
	piling	83
	excavation (initial)	84
	excavation (final)	82
	station box construction	78
	structures	84
	reinstatement	82
NHAH 5	site establishment	79
	piling	80
	excavation (initial)	81
	excavation (final)	79
	station box construction	83
	structures	80
	reinstatement	79

NSR reference	Construction activities	Predicted Noise Level
NHAH 6	site establishment	**85**
	piling	**86**
	excavation (initial)	**86**
	excavation (final)	**84**
	station box construction	**77**
	structures	**86**
	reinstatement	**85**
NHAH 7	site establishment	**83**
	piling	**83**
	excavation (initial)	**84**
	excavation (final)	**82**
	station box construction	**79**
	structures	**84**
	reinstatement	**83**
NHAH 8 (school)	site establishment	**77**
	piling	**78**
	excavation (initial)	**78**
	excavation (final)	**77**
	station box construction	**81**
	structures	**78**
	reinstatement	**77**
NHAH 9 (school)	site establishment	**85**
	piling	**86**
	excavation (initial)	**86**
	excavation (final)	**84**
	station box construction	**75**
	structures	**86**
	reinstatement	**85**

Note : Noise levels exceeding 75 dB(A) for residential and 70 dB(A) for school are in **bold**. Levels at schools should be reduced by a further 5 dB(A) during examination periods.

Table 3.4d Predicted Construction Noise Levels at Po Lam Section (dB(A))

NSR reference	Construction activities	Predicted Noise Level
NPOL 1a	site establishment	**82**
	piling	**83**
	excavation (initial)	**83**
	excavation (final)	**82**
	station box construction	73
	structures	**83**
	reinstatement	**82**
NPOL 2 (school)	site establishment	**81**
	piling	**82**
	excavation (initial)	**82**
	excavation (final)	**81**
	station box construction	70
	structures	**82**
	reinstatement	**81**
NPOL 3a	site establishment	**79**
	piling	**80**
	excavation (initial)	**80**
	excavation (final)	**79**
	station box construction	**76**
	structures	**80**
	reinstatement	**79**

NSR reference	Construction activities	Predicted Noise Level
NPOL 4 (school)	site establishment	77
	piling	78
	excavation (initial)	78
	excavation (final)	77
	station box construction	77
	structures	78
	reinstatement	77
NPOL 5	site establishment	81
	piling	82
	excavation (initial)	82
	excavation (final)	81
	station box construction	85
	structures	82
	reinstatement	81
NPOL 6 (school)	site establishment	81
	piling	81
	excavation (initial)	82
	excavation (final)	80
	station box construction	75
	structures	82
	reinstatement	80
NPOL 7	site establishment	82
	piling	82
	excavation (initial)	83
	excavation (final)	81
	station box construction	83
	structures	83
	reinstatement	81
NPOL 8	site establishment	80
	piling	81
	excavation (initial)	81
	excavation (final)	80
	station box construction	83
	structures	81
	reinstatement	80
NPOL 9 (school)	site establishment	80
	piling	81
	excavation (initial)	81
	excavation (final)	80
	station box construction	73
	structures	81
	reinstatement	80

Note : Noise levels exceeding 75 dB(A) for residential and 70 dB(A) for school are in **bold**. Levels at schools should be reduced by a further 5 dB(A) during examination periods.

Evaluation of Impacts

Yau Tong Section

Construction Noise Impacts

3.4.38 Construction impacts in excess of the daytime criteria are expected at all NSRs from unmitigated construction operations except Yau Tong Estate Phase 3 (NYAT5) and, as a result, mitigation measures will be necessary. It is expected that any restricted hours construction works would need to be carefully planned to mitigate noise levels owing to the proximity of the NSRs to the worksites.

3.4.39 From *Table 3.4a*, noise levels of up to 11 dB(A) above the proposed daytime working limit are expected at Yau Tong Centre (NYAT 1), and mitigation measures are required to ensure that NSRs are protected from excessive noise levels. Without mitigation, the facade noise levels at the St. Antonius primary school (NYAT 2) would be 19 dB(A) above the recommended daytime noise limit during the station box construction period.

3.4.40 The predicted noise levels from the ventilation fans during the night-time period exceed the statutory limit of 55 dB(A) for all receivers. It is therefore expected that night-time tunnelling work could not be carried out without the use of fan silencers which would reduce noise levels to below 55 dB(A), thereby allowing the granting of a CNP.

3.4.41 Measurements of vibration from construction plant have shown that, even from percussive piling equipment, levels generally fall to imperceptibility beyond approximately 100 m from the source. Imperceptible levels are reached at much smaller distances from other plant such as excavators and dozers. Since vibration sensitive receivers lie within 100 m of the probable positions of vibration emitting plant; perceptible levels of ground vibration may be experienced at some NSRs. No percussive piling has been assumed for this construction and therefore blasting is likely to be the source of the highest levels of vibration.

3.4.42 For blasting there are two effects which need to be assessed, vibration in structures and air overpressure. Blasting activities are likely to result in disturbance in the form of ground borne vibration and noise to the occupants of NSRs around the construction site. Given the site safety requirements of M&Q, it is considered that the full mitigation of these effects is not practicable. The detonation of explosives leads to the generation and propagation of airborne waves or air overpressure. These waves consist of energy over a wide range of frequencies, some are audible and are know as sound waves, while most are at frequencies below the audible range, less than 20 Hz.

3.4.43 The weakest part of a structure exposed to overpressure is usually the windows. Air overpressure values of 150 dB could be sufficient to damage a badly mounted window pane with most windows breaking at 170 dB. Air overpressure values in excess of 180 dB are sufficient to damage structures and therefore attention should be taken during the selection of the exact location of the blast so that the blast is not in the direct line of sight to any nearby by buildings. The audible portion of the air overpressure may be disturbing to the occupants of schools and residential buildings in the vicinity of the construction site.

Tseung Kwan O Section

3.4.44 Construction impacts in the region of 1-10 dB(A) above the daytime criteria were predicted at all NSRs from unmitigated construction activities. NTKO 4 (Area 65 residential block) and NTKO 5 (Area 67 residential block) are impacted by construction noise during the piling, excavation and structures period and as a result mitigation measures will be required in order to reduce the noise impacts at these receivers.

Hang Hau Section

3.4.45 Adverse construction impacts in the region of 2-17 dB(A) above the daytime criterion have been predicted at all NSRs from unmitigated daytime construction operations from the station and alignment worksite. 17 dB(A) exceedances are predicted at Chung Man Court (NHAH 1) during the excavation and structures construction periods, and, as a result, mitigation measures will be essential.

3.4.46 There will be potential construction noise impacts at the schools adjacent to the worksites during all phases of construction. Without any mitigation, the façade noise levels at the schools during would be 5-16 dB(A) higher than the 70 dB(A) limit during normal school periods and 10-21 dB(A) higher than 65 dB(A) examination period limit.

Po Lam Section

3.4.47 Construction impacts in the region of 1-12 dB(A) above the daytime criteria are expected at all the NSRs from unmitigated daytime construction operations. Exceedance of 8 dB(A) are predicted at NPOL 1a (King Tao House) during the piling, excavation and structures periods and mitigation measures will be essential. It is expected that restricted hours construction could not be undertaken due to the proximity of the NSRs.

3.4.48 There will be potential construction noise impacts at the schools adjacent to the worksites during all phases of construction. Without any mitigation, the façade noise levels at the school (NPOL 6) during these operations would be 5-12 dB(A) higher than the 70 dB(A) limit during normal school periods and 10-17 dB(A) higher than 65 dB(A) examination period limit.

Mitigation Measures

3.4.49 Mitigation measures for each construction site are detailed below. As it is considered too restrictive to specify that a contractor has to use specific items of plant for the construction operations, recommendations for mitigation to achieve the applicable noise criterion have generally been specified as a combination of noise barriers and a plant noise performance specification. This performance specification requires the contractor to incorporate 'quiet' or silenced plant or reduced plant inventories so that noise levels at nearby NSRs are kept below the applicable noise criterion.

Quiet plant

3.4.50 Quiet plant is defined as PME whose actual SWL is less than the value specified in TM1 for the same piece of equipment. Examples of SWLs (or Sound Pressure Levels (SPLs) at 7 m) for specific silenced PME, which are known to be used in Hong Kong, or otherwise generally available, are given below:

Bulldozer	SWL 110 dB (A) max;
Bored Piling Rig	SWL 110 dB (A) max;
Dump Truck	SWL 110 dB (A) max;
Excavator	SWL 105 dB (A) max;
Lorry	SWL 105 dB (A) max;
Concrete Pumps	SWL 105 dB (A) max;
Compressors	SWL 100 dB (A) max;
Generators	SWL 100 dB (A) max;
Water Pumps	SWL 88 dB (A) max;
Poker Vibrator	SWL 110 dB (A) max;
Loader	SWL 105 dB (A) max;
Modern Breakers (mounted on demolition robot)	SPL 89-91 dB(A);
Modern Saw (power wire saw, or modern wall saw)	SPL 76-81 dB(A);
Kick Ripper (saw and lift method)	SPL 78-80 dB(A)
Bursting System	SPL 70-72 dB(A)
Crusher (hand-held or mounted on demolition robot, hydraulic)	SPL 67-69 dB(A);
Pipe Jacking	SPL 60-65 dB(A); and
Non-explosive Chemical Agent	SPL 60-65 dB(A).

3.4.51 It should be noted that various types of silenced equipment can be found in Hong Kong. However, EPD, 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.

Mobile Noise Barriers

3.4.52 Mobile or movable barriers that can be located close to noisy plant can be very effective at screening NSRs from particular plant. 3 m high mobile barriers with skid footing and a small cantilevered upper portion can be located within a few meters of static plant and within about 5 m of more mobile plant such as excavators, bulldozers etc. Based on the NSR heights and site geometry in this case it is estimated that, if properly used, mobile noise barriers of this type can produce 10 dB (A) of screening for static plant and 5 dB (A) of screening for mobile plant. Where these screening effects can be achieved at upper floors of NSRs, greater benefits would result at lower floors. The noise screening benefit for each plant considered in this study is listed as follows:

- stationary plant - 10 dB screening: compressor, water pump, concrete pump, drilling rigs, generator, various hand tools and saw.
- mobile plant - 5 dB screening: bulldozer, excavator, loader, truck mixer, mobile crane, vibrator and breaker.

Reducing the Numbers of Plant Operating in Critical Areas Close to NSRs

3.4.53 In general the numbers of plant used should be left to the choice of the Contractor so that in combination with the selection of quiet plant, further reduction in the total plant noise level can be achieved. This method could be more effective for activities associated with foundation work, station box construction and excavation activities in which a large number of PME are anticipated, but not all of them would be utilized at the same time. In some cases, however, it is necessary to stipulate the maximum permissible number of plant types to achieve the required maximum site SWL.

Constructing Temporary Noise Barriers

3.4.54 In general, noise barriers of 3-5 m high, located on the site boundaries between noisy construction activities and NSRs, could give up to 5 dB reduction from screening (estimated in accordance with TM1). It should be possible for the Contractor to provide these in the form of site hoardings to achieve this level of reduction, providing the barriers have no openings or gaps, with a superficial surface density of at least 10 kg m^{-2}.

Good site practice

3.4.55 Good site practice and noise management can considerably reduce the impact of the construction sites' activities on nearby NSRs. The following measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be

orientated so that the noise is directed away from nearby NSRs;

- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction programme;
- 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.

3.4.56 The noise benefits of these techniques can vary according to specific site conditions and operations, and whilst they would provide some attenuation, they cannot be assumed to guarantee a high level of noise mitigation.

3.4.57 A summary of all the different mitigation measures for the noisiest construction phases at each NSR are presented in *Tables 3.4e-h.*

- Mitigation A - use of quiet plant (and noise insulation at school where applicable);
- Mitigation B - use of quiet plant and movable barriers within the site; and
- Mitigation C - use of a combination of Mitigation A and B together with limiting the number of plant.

Yau Tong Section

3.4.58 For the construction of the station and alignment tunnel, if the use of quiet plant and movable barriers within the construction site are employed, the total SWL of the alignment and station construction will be reduced by 8 -12 dB(A) respectively. Hence the cumulative construction noise levels at most NSRs will be below the $L_{Aeq\ 30\ mins}$ 75 dB daytime limit except at Yau Tong Centre (NYAT 1). It is therefore recommended that the number of each type of plant be reduced to one so as to meet the noise criterion during the daytime construction period. However, a 2 dB(A) exceedance is still predicted at Yau Tong Estate Phase 2 (NYAT 4) during the site clearance stage. The application of a restriction requiring no two items of noisy equipment to be operated simultaneously within a distance of 60 m of NYAT 4, during this phase, will enable the Contractor to meet the 75 dB(A) target.

3.4.59 Blasting activities are likely to result in some form of disturbance in the form of ground borne vibration and noise to certain NSRs around the construction site. It is considered that unreasonable constraints on the Contractor would be necessary to fully mitigate these effects. However, it is recommended that the impact of these effects should be reduced by making sure the persons likely to be affected are aware of the source of the disturbance and that the magnitude of blasting has been adequately controlled to minimise the risk of damage to their properties and MTRC structures.

3.4.60 In addition, it is recommended that the disturbance due to vibration and noise impacts from blasting could be further reduced by ensuring that all potentially affected persons are aware of the timing of blasting operations. In this way, the potential shock and surprise which may arise from the blasting procedure could be alleviated and particularly sensitive activities could be rescheduled to avoid these periods.

Table 3.4e Yau Tong Mitigated Construction Noise Levels

Construction Activities	Unmitigated Noise Level	Mitigation A	Mitigation B	Mitigation C
NYAT 1				
site establishment	85	80	76	74
excavation(initial)	86	80	76	75
excavation(final)	84	78	75	-
structures	86	84	78	74
reinstatement	85	79	76	74
NYAT 2 (School)				
site clearance	83	82	77	77
site establishment	85	79	76	74
excavation(initial)	86	81	77	75
excavation(final)	84	79	75	73
station box	89	86	82	79
structures	86	84	79	74
reinstatement	85	79	76	74
NYAT 3				
site establishment	79	73	-	-
excavation(initial)	80	75	-	-
excavation(final)	78	72	-	-
station box	77	75	-	-
structures	80	78	72	-
reinstatement	79	73	-	-
NYAT 4				
site clearance	83	82	77	77
site establishment	76	70	-	-
excavation(initial)	77	72	-	-
excavation(final)	75	-	-	-
station box	79	75	-	-
structures	77	75	-	-
reinstatement	76	70	-	-

Note : Noise levels exceeding 75 dB(A) for residential and 70 dB(A) for school are in **bold**. Levels at schools should be reduced by a further 5 dB(A) during examination periods.

Tseung Kwan O Section

3.4.61 The highest construction impacts predicted at the nearby NSRs for the TKO section are in the region of 1-10 dB(A) above the target criteria for both the station and alignment construction. A combination of mitigation measures such as the use of quiet plant and the use of movable barriers within the construction site, can reduce the total SWL of the alignment and station construction by 7-12 dB(A). Hence the cumulative construction noise levels at all NSRs will be below the $L_{Aeq,\ 30\ mins}$ 70 dB and 75 dB targets.

Table 3.4f Tseung Kwan O Mitigated Noise Levels

Construction Activities	Unmitigated Noise Level	Mitigation A	Mitigation B	Mitigation C
NTKO 1 (school)				
site establishment	71	66	-	-
piling	72	67	-	-
excavation (initial)	72	67	-	-
excavation (final)	70	65	-	-
structures	72	70	-	-
reinstatement	71	65	-	-
NTKO 2 (school)				
site establishment	71	66	-	-
piling	72	68	-	-
excavation (initial)	72	67	-	-
excavation (final)	71	65	-	-
station box	74	70	-	-
structures	72	71	65	-
reinstatement	71	65	-	-
NTKO 3 (school)				
site establishment	71	66	-	-
piling	72	67	-	-
excavation (initial)	72	67	-	-
excavation (final)	70	65	-	-
station box	71	68	-	-
structures	72	70	-	-
reinstatement	71	65	-	-
NTKO 4				
site establishment	78	73	-	-
piling	78	74	-	-
excavation (initial)	79	73	-	-
excavation (final)	77	71	-	-
station box	73	-	-	-
structures	79	77	71	71
reinstatement	78	72	-	-
NTKO 5				
site establishment	84	79	75	-
piling	84	80	72	-
excavation (initial)	85	79	75	-
excavation (final)	83	77	74	-
station box	77	73	-	-
structures	85	83	77	73
reinstatement	83	78	75	-

Note : Noise levels exceeding 75 dB(A) for residential and 70 dB(A) for school are in **bold**. Levels at schools should be reduced by a further 5 dB(A) during examination periods.

Hang Hau Section

3.4.63 Adverse noise impacts of up to 17 dB(A) above daytime criteria were predicted. For the construction of the station and alignment tunnels, if the use of quiet plant and movable barrier within the construction site are employed, the total SWL of the alignment and station construction will be reduced by 8-12 dB(A) respectively. However, the total construction noise levels at receivers NHAH 1, NHAH 4, NHAH 6, NHAH 7, NHAH 8 and NHAH 9 will still be above the $L_{Aeq, 30\ mins}$ 70 dB and 75 dB daytime targets.

3.4.64 Exceedances of the daytime criteria are still predicted at those receivers and other mitigation measures are necessary to further alleviate the construction noise levels at

these NSRs. It is recommended that are limits on the numbers of plant operating within the construction site. As a result, NHAH 1 and NHAH 9 still have 2-6 dB(A) exceedances during the daytime period. The application of a restriction requiring no two items of noisy equipment to be operated simultaneously within a distance of 15 m and 30 m of NHAH1 and NHAH 9 respectively, during this phase, will enable the Contractor to meet the 75 dB(A) target.

3.4.65 At the Area 37d school (NHAH 9), a 5 dB(A) noise exceedance has been predicted, even with the recommended package of mitigation measures. Windows facing the worksite should, therefore, be fitted with Type I glazing with air conditioning prior to the start of construction. The Type I glazing will provide up to 10 dB (A) reduction in sound pressure levels inside the school compared to the open window situation. It is considered that the insulation of Type I glazing will be sufficient to mitigate impacts from the construction activities associated with TKE.

Table 3.4g Hang Hau Mitigated Noise Levels (dB(A))

Construction Activities	Unmitigated Noise Level	Mitigation A	Mitigation B	Mitigation C
NHAH 1				
site establishment	91	86	82	80
piling	91	87	79	78
excavation (initial)	92	86	82	81
excavation (final)	90	84	81	79
station box	79	75	-	-
structures	92	90	84	80
reinstatement	90	85	82	80
NHAH 2				
site establishment	80	76	72	-
piling	81	77	69	-
excavation (initial)	81	76	72	-
excavation (final)	80	74	71	-
structures	81	80	74	-
reinstatement	80	74	72	-
NHAH 3				
site establishment	80	74	71	-
piling	80	76	68	-
excavation (initial)	81	75	71	-
excavation (final)	79	73	70	-
station box	82	78	74	-
structures	81	79	73	-
reinstatement	80	74	71	-
NHAH 4				
site establishment	83	78	74	-
piling	83	79	71	-
excavation (initial)	84	78	74	-
excavation (final)	82	76	73	-
station box	78	74	-	-
structures	84	82	76	72
reinstatement	82	77	74	-
NHAH 5				
site establishment	79	74	71	-
piling	80	76	68	-
excavation (initial)	81	75	71	-
excavation (final)	79	73	70	-
station box	83	80	76	-
structures	80	79	73	-
reinstatement	79	74	71	-

Construction Activities	Unmitigated Noise Level	Mitigation A	Mitigation B	Mitigation C
NHAH 6				
site establishment	85	80	76	74
piling	86	81	73	-
excavation (initial)	86	81	77	75
excavation (final)	84	79	75	-
station box	77	74	-	-
structures	86	84	78	74
reinstatement	85	79	76	74
NHAH 7				
site establishment	83	78	74	-
piling	83	79	71	-
excavation (initial)	84	78	74	-
excavation (final)	82	76	73	-
station box	79	75	-	-
structures	84	82	76	72
reinstatement	83	77	74	-
NHAH 8 (school)				
site establishment	77	72	69	-
piling	78	74	66	-
excavation (initial)	78	73	69	-
excavation (final)	77	71	68	-
station box	81	77	73	70
structures	78	77	71	67
reinstatement	77	72	69	-
NHAH 9 (school)				
site establishment	85	80	76	74
piling	86	81	73	72
excavation (initial)	86	80	76	75
excavation (final)	84	78	75	73
station box	75	71	67	-
structures	86	84	78	74
reinstatement	85	79	76	74

Note : Noise levels exceeding 75 dB(A) for residential and 70 dB(A) for school are in **bold**. Levels at schools should be reduced by a further 5 dB(A) during examination periods.

Po Lam Section

3.4.66 Adverse noise impacts of up to 12 dB(A) above the daytime criteria have been predicted. For the construction of the station and alignment tunnels, if the use of quiet plant and movable barrier within the construction site are employed, the total SWL of the alignment and station construction and alignment construction will be reduced by 7-12 dB(A) respectively. However the total construction noise levels at NPOL 2, NPOL 6 and NPOL 9 will be above the $L_{Aeq, 30\ mins}$ 70 dB(A) daytime limit.

3.4.67 At the King Lam Primary School (NPOL 2), and the schools in Area 19b (NPOL 6) and Area 24 (NPOL 9), 1-2 dB(A) exceedances have been predicted even with a package of mitigation measures. Windows of NPOL 2, NPOL 6 and NPOL 9 facing the worksite should be fitted with Type I glazing and air conditioning prior to the start of construction. The Type I glazing to be installed will provide up to 10 dB(A) reduction in noise levels inside the school compared to the open window situation. It is considered that the insulation of Type I glazing will be sufficient to mitigate impacts from the construction activities associated with TKE.

Table 3.4h Po Lam Mitigated Noise Levels (dB(A))

Construction Activities	Unmitigated Noise Level	Mitigation A	Mitigation B	Mitigation C
NPOL 1				
site establishment	82	77	74	-
piling	83	79	71	-
excavation (initial)	83	78	74	-
excavation (final)	82	76	73	-
station box	73	-	-	-
structures	83	81	76	72
reinstatement	82	76	73	-
NPOL 2 (school)				
site establishment	81	76	73	71
piling	82	78	70	69
excavation (initial)	82	77	73	72
excavation (final)	81	75	72	70
station box	70	-	-	-
structures	82	80	75	71
reinstatement	81	75	72	71
NPOL 3				
site establishment	79	74	71	-
piling	80	76	68	-
excavation (initial)	80	75	71	-
excavation (final)	79	73	70	-
station box	76	76	-	-
structures	80	78	73	-
reinstatement	79	73	70	-
NPOL 4 (school)				
site establishment	77	72	69	-
piling	78	74	66	-
excavation (initial)	78	73	69	-
excavation (final)	77	71	68	-
station box	77	73	69	-
structures	78	77	71	67
reinstatement	77	72	69	-
NPOL 5				
site establishment	81	76	73	-
piling	82	78	70	-
excavation (initial)	82	77	73	-
excavation (final)	81	75	72	-
station box	85	81	77	74
structures	82	80	75	-
reinstatement	81	75	72	-
NPOL 6 (school)				
site establishment	81	76	72	70
piling	81	77	69	-
excavation (initial)	82	76	72	71
excavation (final)	80	74	71	69
station box	75	71	67	-
structures	82	80	74	70
reinstatement	80	75	72	70

Construction Activities	Unmitigated Noise Level	Mitigation A	Mitigation B	Mitigation C
NPOL 7				
site establishment	82	76	73	-
piling	82	78	70	-
excavation (initial)	83	77	73	-
excavation (final)	81	75	72	-
station box	83	80	76	73
structures	83	81	75	-
reinstatement	81	76	73	-
NPOL 8				
site establishment	80	75	72	-
piling	81	77	69	-
excavation (initial)	81	76	72	-
excavation (final)	80	74	71	-
station box	83	80	76	73
structures	81	80	74	-
reinstatement	80	75	72	-
NPOL 9 (school)				
site establishment	80	76	72	70
piling	81	77	69	68
excavation (initial)	81	76	72	71
excavation (final)	80	74	71	69
station box	73	69	-	-
structures	81	80	74	70
reinstatement	80	74	72	70

Note : Noise levels exceeding 75 dB(A) for residential and 70 dB(A) for school are in **bold**. Levels at schools should be reduced by a further 5 dB(A) during examination periods.

3.5 *OPERATIONAL IMPACTS*

Potential Sources of Impacts

3.5.1 The entire TKE alignment will be enclosed, either in tunnel, or within a substantial concrete structure. Therefore, no adverse impacts from operational train noise are expected.

3.5.2 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.

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

3.5.4 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.

3.5.5 The use of effective noise control equipment will be included in the ventilation system design to ensure no adverse impacts from the ventilation shafts.

3.5.6 Vibration from train movements may be transmitted through the structure of adjoining buildings and adversely affect the occupants. Potential impacts and options for mitigation are discussed in *Section 3.5.10*.

Assessment Methodology

3.5.7 The limiting $L_{Aeq, 30min.}$ levels at 1 m from the louvres of the ventilation shaft have been predicted to establish the limiting atmospheric noise specifications, which will ensure that no unacceptable noise impacts will result for the operation of the plant.

3.5.8 The location of the ventilation shafts for the station and tunnels are at the ends of each station. The target levels at the receivers of the night-time ANL minus 5 dB(A) (in line with the HKPSG) will be applicable for the NSRs near the ventilation shafts. As the detailed design of the ventilation shafts is not available, the location of the louvres are not shown in this stage; the worst case distance between the louvres and the NSRs has been considered, assuming a maximum noise level of $L_{Aeq, 30min.}$ 75 dB at 1 m would be specified at the louvres for YAT, TKL, TKO and HAH stations and 70 dB for POL.

Table 3.5a Predictions of Operational Noise levels

Station	Representative NSRs	Predicted Noise Level	Noise Criteria (ANL-5 dB(A)
YAT	NYAT 1	37	55
	NYAT 2	44	55
	NYAT 3	44	55
	NYAT 4	41	55
	NYAT 5	($L_{Aeq\ 30min.}$ dB)35	55
TKL	NTKL 1	43	50
	NTKL 2	43	50
	NTKL 3	39	50
TKO	NTKO 1	37	50
	NTKO 2	41	50
	NTKO 3	39	50
	NTKO 4	41	50
	NTKO 5	41	50
HAH	NHAH 1	51	55
	NHAH 2	39	55
	NHAH 3	46	55
	NHAH 4	51	55
	NHAH 5	44	55
	NHAH 6	45	55
	NHAH 7	49	55
	NHAH 8	41	55
	NHAH 9	43	55

Station	Representative NSRs	Predicted Noise Level	Noise Criteria (ANL-5 dB(A)
POL	NPOL 1	33	50
	NPOL 2	31	50
	NPOL 3	40	50
	NPOL 4	32	50
	NPOL 5	42	50
	NPOL 6	37	50
	NPOL 7	46	50
	NPOL 8	46	50
	NPOL 9	32	50

Prediction of Impacts

3.5.9 The recommended 1 m facade noise levels required to achieve the ANL-5 dB(A) target at each of the NSRs have been calculated and are given in *Table 3.5a* above.

Evaluation of Impacts

3.5.10 The noise levels predicted at the NSRs are a worst case estimate as screening corrections have been ignored in the assessment. Compliance with 75 dB(A) at 1 m from the facade will prevent unacceptable noise impacts to all NSRs at YAT, TKL, TKO and HAH. At POL, the fixed plant noise level of 70 dB(A) at 1 m from louvre will also prevent unacceptable noise impacts to all NSRs to within the recommended noise criterion. The use of specially designed mitigation measures, including louvred enclosures and intake and outlet silencers may be required to meet the noise criterion.

3.5.11 Vibration measurements taken on the existing MTR Island Line at Tai Koo Shing, for the assessment of impacts on proposed developments above the new Airport Railway, have indicated that tangible (feelable) vibration is unlikely to exceed the acceptable vibration limits defined by the *Guidance to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz), BS6472: 1992.* Vibration re-radiated as noise (perceived as a rumble) within adjacent structures may exceed acceptable limits, defined as NR35 and NR45 for residential buildings and hotels respectively. However, experience on the existing lines shows that with appropriate mitigation in the form of floating or isolated track all vibration related impacts can be controlled to acceptable levels. The requirement for vibration control measures will be determined at the detailed engineering design stage.

3.6 CONCLUSIONS

3.6.1 This assessment has predicted that unmitigated construction noise would cause adverse noise impacts at the nearby NSRs (existing and potential). Mitigation measures have been identified which have reduced noise levels to below the appropriate daytime criteria and these have been recommended, as described above, to alleviate the high levels of construction noise. Measures include the use of silenced PME, restriction of the number of PME and the installation of mobile barriers.

3.6.2 In some cases, noise levels remain above criteria even after the application of the mitigation measures described above. Additional measures, such as the limiting of numbers of plant and working schedules will be required to achieve the required noise levels.

3.6.3 The assessment indicates that no unacceptable noise impacts will occur at the NSRs from the fixed plant noise associated with the TKE, provided the recommended limiting level of $L_{Aeq, 30min}$. 70 dB and 75 dB at 1 m is achieved at the louvres.

3.6.4 The mitigation of ground-borne noise and vibration by means of a suitably designed resilient trackform may be required and this should be addressed at the detailed design stage.

4 WATER QUALITY

4.1 INTRODUCTION

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

4.1.2 Adverse water quality impacts should not arise from construction works for the TKE, provided that good site standards are maintained. Appropriate mitigation measures have been identified to control all land based impacts so that discharge levels meet the TM standards. No adverse residual operational impacts are expected, provided that the recommended measures are implemented.

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 Victoria Harbour (Phase 1) will be the receiving waters for discharges from the vicinity of Yau Tong, whereas Junk Bay will be the receiving water body for works in the vicinity of Tiu Keng Leng, Hang Hau, Tseung Kwan O and Po Lam. The WQOs for Victoria Harbour WCZ (Phase 1) were declared in November 1994, while 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.

Victoria Harbour and Junk Bay WCZ

- 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 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 WCZs are subject to standards for particular volumes of discharge. These are defined by EPD and 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 Victoria Harbour and Junk Bay WCZs will apply to the construction and operation of the TKE. These discharge standards are presented in *Tables 4.2a-c* respectively.

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	4	4	3	1.5	1.5	1	1	1	1	1	1	1
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	0.08	0.06
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 N	200	200	200	200	200	200	200	100	100	100	100	100	100
Total P	50	50	50	50	50	50	50	25	25	25	25	25	25
Surfactants (total)	200	150	15	50	40	30	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 Victoria Harbour Water Control Zone (All Phases)

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
Determinant												
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
SS	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	20
Iron	15	10	10	7	5	4	2.7	2	1.3	1	0.8	0.6
Boron	5	4	3	2.7	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Barium	5	4	3	2.7	2	1.6	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	0.25	0.2	0.15	0.1	0.1	0.1
Toxic metals total	2	2	1.6	1.4	1	0.8	0.5	0.4	0.3	0.2	0.14	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	0.13	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 CL	1	1	1	1	1	1	1	1	1	1	1	1
Total N	100	100	100	100	100	100	80	80	50	50	50	50
Total P	10	10	10	10	10	10	8	8	5	5	5	5
Surfactants (total)	20	15	15	15	15	15	10	10	10	10	10	10
E. coli (count per 100 ml)	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000

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

Table 4.2c 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
Determinant												
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
SS	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	20
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
Toxic metals total	2	2	1.6	1.4	1	0.8	0.5	0.4	0.3	0.2	0.14	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 CL	1	1	1	1	1	1	1	1	1	1	1	1
Total N	100	100	80	80	80	80	50	50	50	50	50	50
Total P	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

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, which provide guidelines for planning development in Hong Kong. The water sensitive receivers (WSRs) are illustrated in *Figure 4.3a.*

Sensitive Receivers

4.3.2 Yau Tong Bay, Sam Ka Tsuen Typhoon Shelter, and Junk Bay comprise the nearest receiving water bodies and water sensitive receivers which may be impacted by the works or subsequent railway operation, in addition to the larger water body of Victoria Harbour. In addition, it is understood that seawater is abstracted for cooling water for both the Dairy Farm Ice Factory and the Water Supplies Department's (WSD) seawater pumping station and thus these seawater intakes are also WSRs, as indicated in *Figure 4.3a.* The water quality standard for the WSD intake is set at 20 mg l-1 for SS and this will be the determining factor for the acceptability of mitigation measures. The underlying water table would also be sensitive to pollutants if impinged upon by tunnelling activities.

4.3.3 In addition, there are a number of streams and watercourses in the vicinity of the potential site, as illustrated in *Figure 4.3a* which may be sensitive receivers of the works. The nearest biological sensitive receiver is Tung Lung Chau Fish Culture Zone. However, this is approximately 6 km from the nearest point of the proposed works which is considered to be sufficiently far away for there to be any potential for this fish culture zone to be impacted by the site. There are no other identified sensitive receivers such as shell fisheries, or recreational areas along the coast in the vicinity of the proposed works.

Baseline Conditions

4.3.4 *Water Quality*: Water quality in the vicinity of the site is well documented by the EPD routine marine water quality monitoring programme with the latest available data for the year 1994. The nearest water quality monitoring stations are VM1 in Victoria Harbour, and JM3 and JM4 in Junk Bay (see *Figure 4.3a).* In general the data from these indicates that water quality is poor, exhibiting DO depth profiles with large gradients during the summer, where oxygen depletion occurs in the bottom layers. It is considered that this may be caused by the large amount of organic matter entering the water column from local organic (sewage derived) discharges. This is substantiated by high 5 day biological oxygen demand (BOD_5) levels measured in 1994 at VM1, JM3 and JM4 which ranged from 0.3-1.1 mg l^{-1}, 0.4 1.4 mg l^{-1}, and 0.4-1.7 mg l^{-1} respectively, with an annual mean of 0.7 mg l^{-1} at each station.

4.3.5 Concentrations of SS, a parameter of key concern with regard to water quality, ranged between 2.8-11.7 mg l^{-1}, 2.0-7.7 mg l^{-1} and 2.1-15.8 mg l^{-1} at VM1, JM3 and JM4 respectively. However, each of these monitoring stations is located over 500 m from the coast, and it is considered that the SS concentrations further inshore may be locally elevated as a result of polluted discharges in the area.

4.3.6 Although water quality within both Victoria Harbour and Junk Bay is poor, it will be important to ensure that neither construction or operation of the project lead to further deteriorations in water quality.

4.4 CONSTRUCTION IMPACTS

Potential Sources of Impact

4.4.1 Potential sources of water quality impacts during construction will comprise construction runoff and drainage, general construction activities including cut and cover tunnelling in particular, sewage from the on-site construction workforce, and possible leachate impacts where TKE tunnels are located in close proximity to the Siu Ho Wan ? Landfill boundary. Potential physical, chemical and biological water quality impacts Sai Tso Wan? which may result are discussed below.

4.4.2 Potential sources of pollution from site runoff and drainage include runoff and erosion from site surfaces, drainage channels, earth working and stockpiles, which may contain increased loads of sediments, other SS and contaminants. Potential contaminants include:

- bentonite slurries and other grouting materials; and
- fuel, oil and lubricants from construction vehicles and equipment.

4.4.3 Cut and cover tunnelling will create a construction area open to the elements, including rain, for the majority of the construction period. This could lead to large volumes of construction runoff containing high concentrations of SS, which could result in siltation of receiving drainage channels and water courses, increased concentrations of SS in the receiving water body, and associated difficulties arising from poor water quality affecting cooling water intakes.

4.4.4 In addition, the degree of water quality impact could increase if any demolition of buildings were required, as this would result in volumes of construction debris. Unless carefully controlled, this construction waste could enter any nearby water body and lead to impacts upon water quality.

4.4.5 Bentonite will also be required for cut and cover tunnel diaphragm wall construction which could lead to those impacts discussed above.

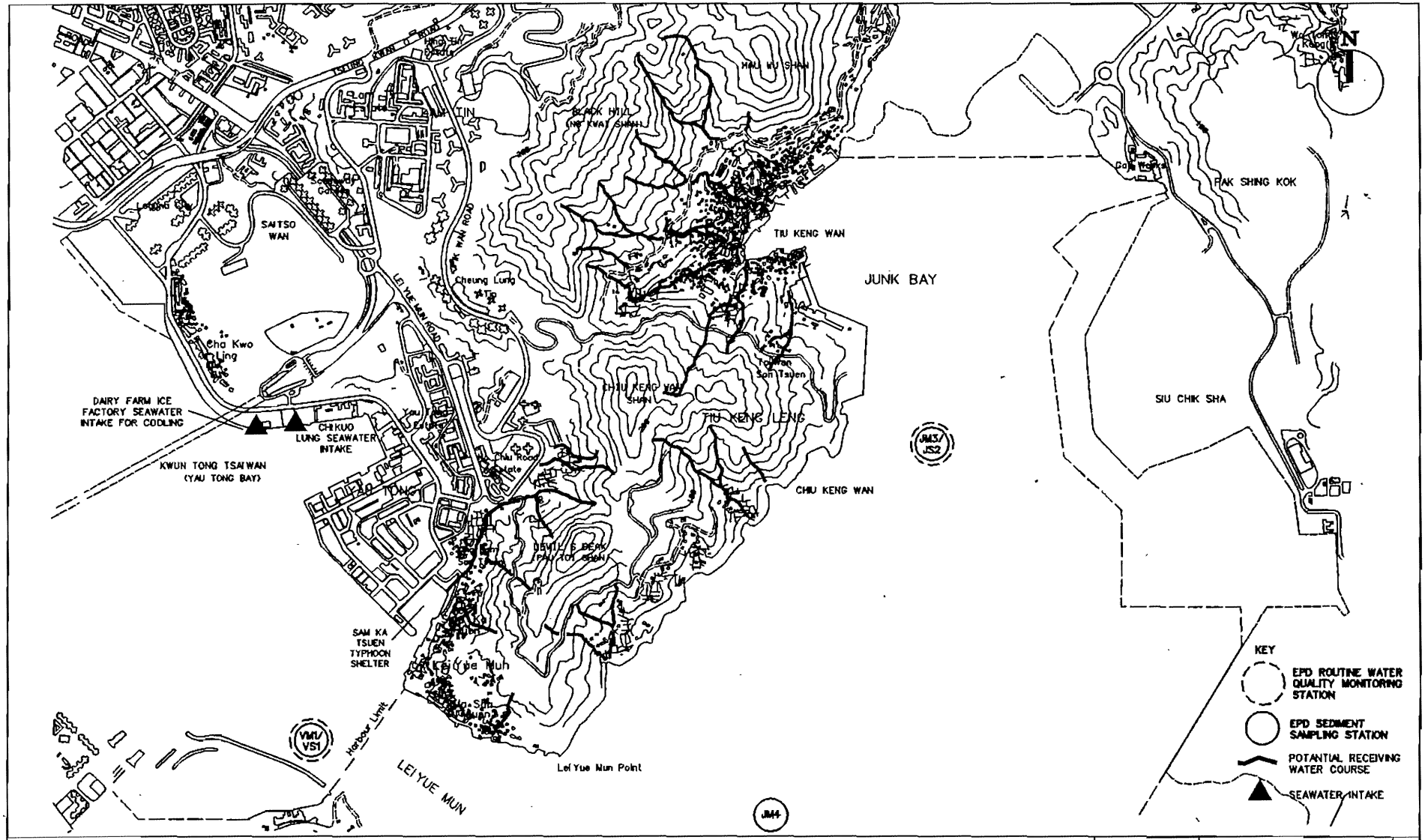
4.4.6 Additionally, water quality impacts could result if the tunnel depth impinged upon the water table, causing pollutants such as bentonite to enter the water table.

4.4.7 A section of the tunnel from LAT to YAT, is located, at its closest point, within the consultation zone of the Sai Tso Wan Landfill. As a result there may be a potential for leachate associated impacts, if leachate enters any water bodies, including the water table during tunnel formation.

4.4.8 On-going site 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.

4.4.9 Sewage effluents arising from the on-site construction workforce have the potential to cause water pollution. Any effluents generated would require appropriate treatment, and TM standards (*Table 4.2a*) should be applied to any sewage effluent discharges.

4.4.10 Water quality impacts could result from marine disposal of excavated material, depending upon its nature including contamination levels and particle sizes. Reuse of



LOCATION OF WATER SENSITIVE RECEIVERS
& EPD MONITIORING STATIONS

MAUNSELL CONSULTANTS ASIA LTD
天能工程顧問有限公司

DATE: NOV 05

FIGURE No. 4.3a

SCALE: NTS

Maunsell

suitable inert excavated materials and land based disposal are not expected to lead to unacceptable water quality impacts from tunnelling activities. Inert material excavated from tunnel construction could provide valuable reclamation fill depending on type and nature of the fill.

Assessment Methodology

4.4.8 This section of the study assesses the potential water quality impacts which could result from the construction of the works, against the relevant environmental legislation defined above, with regard to the identified sensitive receivers.

Yau Tong Station and Tunnels

4.4.9 Station and alignment construction activities at Yau Tong will comprise two drill and blast tunnel sections to connect into the existing QUB to LAT tunnel and a third drill and blast section through the hillside to Tiu Keng Leng. The station and central section of the alignment will be constructed by cut and cover tunnelling. This will generate approximately 120,000 m^3 of rock material which will be stockpiled near the Ko Chui Road prior to removal, and may lead to rainfall runoff depending upon the nature and particle sizes of the material. In addition, cut and cover tunnelling for the alignment will generate 50,000 m^3 of soft material, while station construction will generate 20,000 m^3 of soft material, which could therefore cause runoff (containing SS and bentonite or other grouting residues) from exposed areas and cuttings, and any on-site stock piles. This may lead to physical and chemical impacts associated with runoff within receiving water bodies including the water table, if unmitigated.

4.4.10 Sewage effluents will be generated at the YAT site by a work force of 100-200, this could cause adverse water quality impacts and will require appropriate treatment prior to disposal.

Tiu Keng Leng Station and Tunnels

4.4.11 The tunnelling associated with this stage of the works will generate 100,000 m^3 of rock, while the station construction will generate 300,000 m^3 of rock and 150,000 m^3 of soft material. This material may be temporarily stored on site, and could lead to runoff related impacts, including blockage of receiving drainage and water courses, and localised deterioration in water quality, in addition to impacts in Junk Bay or the water table if these polluted waters drained into these water bodies.

4.4.12 Materials generated by the works will require disposal which may lead to water quality impacts if adequate controls are not implemented. The estimated volumes of material removed for TKL are shown in *Table 4.4b* below.

Table 4.4b Excavated Material from Tiu Keng Leng

TKL	Volume (m^3)	Nature of Material
Drill and Blast Tunnel	100,000	Rock
Station	300,000	Rock
Station	150,000	Soft (CDG)

4.4.13 Sewage effluents will be generated at the TKL section, by the 100-200 workforce anticipated to be required, which could cause adverse water quality impacts if

unmitigated and will require appropriate treatment prior to disposal.

Tseung Kwan O, Hang Hau and Po Lam Stations and Tunnels

4.4.17 This section of the works will comprise station construction which will generate 100,000 m^3, 100,000 m^3 and 20,000 m^3 of soft material (sand etc) at TKO, HAH and POL respectively. In addition, cut and cover tunnelling between each station will generate volumes of soft material, namely 400,000 m^3 each from TKL to TKO, TKO to HAH, and 100,000 m^3 from HAH to POL. Temporary storage of these materials could result in those water quality impacts detailed above, associated with rainfall runoff from exposed construction areas (elevated SS, chemical pollutants, spilled oil etc). Excavated materials will also require disposal where reuse is not practical, which may lead to water quality impacts if unmitigated. The tunnelling activities may impinge upon the local water table which could result in water quality impacts if pollutants gained access to this sensitive water body. The estimated volumes of material removed for HAH, TKO and POL are summarised in *Table 4.4c* below.

Table 4.4c Excavated Material from Tseung Kwan O, Hang Hau and Po Lam

Location	Volume (m^3)	Nature of Material
TKO	100,000	Soft (sand)
HAH	100,000	Soft (sand)
POL	20,000	Soft (sand)
TKL to TKO	400,000	Soft (sand)
TKO to HAH	400,000	Soft (sand)
HAH to POL	100,000	Soft (sand)

4.4.18 In addition, an estimated construction workforce of 100-200 at each of the three sites (TKO, HAH and POL) will generate sewage effluents which could cause water quality impacts in receiving waters if unmitigated.

Evaluation of Impacts

Sai Tso Wan Landfill

4.4.19 The additional tunnels from the existing Lam Tin Station will be bored in close proximity to the south-east boundary of the Sai Tso Wan Landfill site. An initial examination of the site plans indicated that the proposed tunnels will pass within approximately 40 m of the estimated waste boundary. The site has a liner system across the base of the site to minimise the migration of leachate from the landfill. A granular layer and network of drainage pipes below the landfill collects the leachate before discharge to sewer. This reduces the leachate head within the waste and limits the volumes of leachate which may migrate from the landfill and contaminate ground water. The potential for environmental impacts from leachate arising form the construction and operation of the tunnels are therefore considered to be minimal.

4.4.20 Waste will not be disturbed during the construction of the tunnels or the proposed vertical monitoring drill holes, thereby removing the waste as a potential source of impacts.

4.4.21 The *Sai Tso Wan Landfill Interim Qualitative Risk Assessment, ERM, July 1997* (IQRA) has identified the overall risk from leachate migration within groundwater from the Sai Tso

Wan Landfill to either tunnel as being *very low* to *low*. However, a number of precautionary and protection measures have been recommended to further reduce any potential risks. Following completion of the monitoring programme, the IQRA will be reviewed and a Final Report produced.

Yau Tong Station and Tunnels

4.4.22 Tunnel and Station Construction: the majority of the construction associated with the TKO extension will comprise cut and cover tunnelling, and station construction, which could lead to water quality impacts discussed above. However, tunnelling will be undertaken at a distance of around at least 400 m from the closest point to the shoreline. As such, it is considered that the potential runoff related impacts can be readily controlled through the use of appropriate mitigation measures prior to discharge into any receiving drainage channels or the local drainage systems.

4.4.23 In addition, the engineering team should pay particular attention to avoiding impacts to the water table during tunnelling, as this could be adversely impacted if pollutants entered this sensitive water body.

4.4.24 There are no watercourses identified in the Yau Tong area. However, if construction associated with the TKE impinges upon any of the small watercourses between Yau Tong and Tiu Keng Leng, appropriate local mitigation measures should be implemented to minimise water quality impacts.

4.4.25 It is considered that water quality impacts associated with disposal of material excavated during tunnel formation will be minimal. This material will mainly comprise rock from tunnel and station excavation which may be available for re-use or can be disposed to public dump, as appropriate, with few associated water quality impacts as a result of large particle size and the likely uncontaminated nature of rock.

4.4.26 Sewage Effluents: owing to the lack of established guidelines for sewage generation raters fro 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. A volume of 5.5-11.0 m^3, could be generated by the 100-200 staff on each of the construction sites along the alignment and it is recommended that on-site toilet facilities be provided with the sewage collected by a reputable sewage collector for disposed at an appropriate sewage treatment works.

Tiu Keng Leng Station and Tunnels

4.4.27 Construction associated with TKL and tunnels will comprise cut and cover tunnelling, and station construction, which could lead to water quality impacts. However, the station construction and the tunnelling will be undertaken at locations remote from the shoreline and on newly formed reclamation. As such, it is considered that the potential runoff related impacts can be readily controlled through the use of appropriate mitigation measures prior to discharge into any receiving drainage channels or the local drainage systems.

4.4.28 Construction works for TKL are likely to impinge on some small watercourses as these works will require cut slopes. Appropriate mitigation measures should be implemented to minimise water quality impacts.

Tseung Kwan O, Hang Hau and Po Lam Stations and Tunnels

4.4.26 Works associated with TKO, HAH, POL and the connecting tunnels, will comprise cut and cover tunnelling and station construction, which could lead to water quality impacts. However, the station construction and the tunnelling will be undertaken at locations remote from the shoreline and on newly formed reclamation. As such, it is considered that the potential runoff related impacts can be readily controlled through the use of appropriate mitigation measures prior to discharge into any receiving drainage channels or the local drainage systems.

4.4.27 In addition, the engineering team should pay particular attention to avoiding impacting the water table during tunnelling, as this could be adversely impacted if pollutants entered this sensitive water body.

Mitigation Measures

4.4.28 The mitigation measures described below for the construction and operational phases are equally applicable to all sites. Construction phase mitigation measures, in accordance with Practice Note for Professional Persons on Construction Site Drainage, Professional Persons Environmental Consultative Committee, 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.

4.4.29 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 such silt removal facilities. The design of efficient silt removal facilities should be based on the guidelines in ProPECC PN 1/94 (Appendix A1).

4.4.30 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 revegetated as soon as possible after earthworks have been completed, or alternately, 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.

4.4.31 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 prolonger periods of inclement weather and the reduction of surface sheet flows.

4.4.32 Sediment tanks of sufficient capacity, constructed from pre-formed individual cells of approximately 6-8 m^3 capacity, are recommended as a general mitigation measure which can be used at all sites for settling wastewaters prior to disposal. The tanks are readily available and used primarily for recycling water for bored piling operations. 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. Various physical and chemical filters can be added should refinement of the sedimentation process be required.

4.4.33 Silt contained in ground water and drilling water collected from tunnelling operations should be removed with properly designed silt removal facilities, such as the specified portable sedimentation tanks, such that TM standards are achieved prior to the discharge of waters into storm drains.

4.4.34 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.

4.4.35 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.

4.4.36 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.

4.4.37 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. Discharge of surface runoff into foul sewers must always be prevented to avoid overloading the foul sewerage system.

4.4.38 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 ProPECC PN 1/94 (Appendix A2). Particular attention should be paid to the control of silty surface runoff during storms events, especially for sites located near steep slopes.

4.4.39 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 exit 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 wheelwash bay to the public road should be paved with sufficient backfall toward the wheelwash bay to prevent vehicle tracking of soil and silty water to public roads and drains.

4.4.40 As described earlier, if construction associated with the TKE impinges upon any of the small watercourses between Yau Tong and Tiu Keng Leng, appropriate local mitigation measures should be implemented to minimise water quality impacts. These would comprise ensuring the water body is protected from site activities through screening or covering/ culverting, and appropriate waste management procedures and drainage facilities.

4.4.41 Information detailing the wastewater discharge points, and the corresponding maximum (or range of) volumes of discharges expected from the construction sites on a dry day should be provided in the WPCO licence application. In general, assuming adequate information has been provided together with the licence application, EPD would need at least 20 days for the processing of a licence for a discharge, and in the

case of a discharge directly into any waters of Hong Kong, EPD would need at least 50 days to allow time for public notification as required by the WPCO. It is therefore recommended that the Contractor submit the licence application to EPD as early as possible before the commencement of any discharge.

4.5 *OPERATIONAL IMPACTS*

Potential Sources of Impact

4.5.1 Water quality impacts could result from tunnel seepage potentially contaminated with oil and grease from passing trains if such materials reach a water body or permeate into the water table. These effluents could result in physical, chemical and biochemical impacts within any receiving water body if appropriate collection and treatment to TM standards is not provided.

4.5.2 This section assesses potential impacts against the relevant environmental legislation, with regard to identified sensitive receivers in accordance with the HKPSG. Legislation of relevance are the TM and WQOs as detailed in Section 4.2.

4.5.3 Potential water quality impacts resulting from tunnel seepage during operation of the TKE tunnels and stations can be effectively controlled through the installation and maintenance of appropriate oil/grease interceptors and drainage at all stations. It is considered that provided these mitigation measures are implemented, operational water quality impacts associated with the TKE tunnels and stations will be acceptable.

4.5.4 Runoff related impacts should be effectively controlled through the design and implementation of appropriate drainage and siltation/oil traps (with regular maintenance procedures) prior to discharge to stormwater drains. These mitigation measures are listed in Section 4.6 below.

4.5.5 Where staff toilets are provided, appropriate sewerage to transfer effluent to treatment facilities should be built to ensure that all effluents from the TKE can meet the standards defined in the TM prior to discharge.

4.5.6 Operational stage mitigation measures should include the installation of appropriate drainage systems, including oil interceptors prior to discharge to public drainage systems where necessary. In addition, regular maintenance procedures for measures such as oil interceptors should be defined. Where staff toilets are provided, appropriate sewerage systems to transfer effluent to treatment facilities should be built to ensure that all effluents from the TKE meet the standards defined in the TM prior to discharge. The design of the operational stage mitigation measures should take into account the guidelines published in Drainage Plans subject to Comment by the EPD, Professional Persons Environmental Consultative Committee, Practice Note for Professional Persons (ProPECC PN 5/93).

4.5.7 It should also be noted that all discharges into any drainage or sewerage systems, or inland or coastal waters, or into the ground (e.g. from septic tanks) are controlled under the WPCO, except the discharge of domestic sewage into foul sewers or the discharge of unpolluted water into storm drains or into inland and marine waters of Hong Kong. Operational discharges potentially contaminated with SS or oil are controlled under the WPCO.

4.5.8 Discharges controlled under the WPCO must comply with the terms and conditions of a

valid WPCO licence. It should be noted that compliance with the recommendations in the TM and the relevant ProPECC Practice Notes does not necessarily imply compliance with the terms and conditions of a licence issued under the WPCO.

4.6 CONCLUSIONS

Construction Stage

4.6.1 Insurmountable residual (ie: after adoption of the proposed mitigation measures) construction stage water quality impacts are not predicted. Although general construction activities associated with tunnelling and station construction could lead to site runoff containing elevated concentrations of SS and associated contaminants, detailed mitigation measures have been set out in *Section 4.6* which will effectively control all potential impacts. The LAT to YAT tunnel is not expected to pass close enough to the Sai Tso Wan Landfill for leachate impacts to impinge on the TKE, however, this will be investigated as part of the Sai Tso Wan Landfill Hazards Study.

Operational Stage

4.6.2 It is considered that, with the adoption of the proposed mitigation measures, no insurmountable water quality impacts will result from the operational phase of TKE.

4.6.3 Appropriate drainage collection facilities should be incorporated into the station design as seepage may contain contaminants such as oil and grease, which could impact upon water quality in receiving water bodies. Mitigation in terms of treatment where necessary, to achieve WPCO discharge standards, will prevent associated residual water quality impacts.

5 WASTE

5.1 INTRODUCTION

5.1.1 This Section identifies the potential waste arisings from the construction and operation of the TKE and assesses the environmental impacts that may occur. The options for waste minimisation, reuse, treatment, storage, collection, transport and disposal for waste arisings from the TKE have been examined. Procedures for waste reduction and management are considered and mitigation measures for minimising the impacts of the wastes are recommended.

5.1.2 Uncontrolled handling and disposal of waste could lead to adverse impacts during both the construction and operational phases of the project. However, provided that the Contractor fulfills the Hong Kong Legislative requirements set out below and observed the additional recommended mitigation measures, no adverse impacts are expected.

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 issued for the collection and transport of construction and/or trade wastes.

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 Regulation, 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 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 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. This system is designed to allow the transfer of wastes to be traced from cradle to grave.

5.2.7 The Regulation prescribes 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 by the Regulation 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 with 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 authority 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 other material considered unsuitable by the dump supervisor.

Public Cleansing and Prevention of Nuisance by-Laws

5.2.10 These By-Laws 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.

Sensitive Receivers and Baseline Conditions

5.2.11 The sensitive receivers for the TKE 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 and operation of the TKE. Baseline conditions have also been described in the previous sections.

5.3 CONSTRUCTION IMPACTS

General

5.3.1 The construction activities of the TKE which may create potential environmental impacts comprise the excavation and construction works for drill and blast tunnelling, cut and cover tunnelling and YAT, TKL, TKO, HAH and POL.

Potential Sources of Impact

General

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

- excavated inert material,
- excavated contaminated material;
- construction and demolition waste;
- chemical waste; and
- general refuse.

5.3.3 The volumes and nature of each of these waste types arising from the construction of the TKE are estimated in *Table 5.3a* and described in detail below.

Excavated Inert Materials

5.3.4 Excavated material may comprise of inert virgin rock and sand or reclamation fill material removed from the ground and sub-surface. In addition to spoil from tunnel boring and cut and fill construction, excavated material will be generated at the proposed stations from the excavation of the station caverns and the digging of building foundations. Material from rock excavation will comprise volcanics or granite, with those portions from the surface and shallow sub-surface being partially or completely decomposed (CDG, CDV). Soft materials excavated will vary from sand to mud.

5.3.5 There will be considerable volumes of excavated material generated from the TKE railway construction works, particularly from tunnelling and station excavations, with an estimated total volume of 1.5 - 2 million m^3. There is scope for the reuse of over half the excavated materials on site, in the cut and cover tunnels and station complexes. However, considerable quantities of excavated materials will have to be disposed of off-site.

Excavated Contaminated Materials

5.3.6 Some excavated materials may be contaminated due to past land-use activities, and as such will require special handling and disposal procedures. The proposed southern tunnel from Lam Tin to Yau Tong will pass close to the Sai Tso Wan Landfill site. Preliminary investigations indicate that it is unlikely that the tunnelling operations will pass through waste, and as such, it in anticipated that no landfill refuse materials will require handling and disposal. This issue is being addressed in a separate study.

Construction and Demolition Waste

5.3.7 Construction waste comprises unwanted materials generated during construction, including rejected structures and materials, materials which have been over ordered or are surplus to requirements and materials which have been used and discarded. 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 and falsework;
- equipment and vehicle maintenance parts, including machinery used in tunnel boring;
- materials and equipment wrappings;

- unusable or surplus cement/grouting mixes; and
- damaged/surplus/contaminated construction materials.

5.3.8 It is expected that the volume of construction waste generated by the TKE construction activities will not differ significantly from other similar projects, indicating levels of approximately 20 m^3 per month per station construction site. The total construction waste arisings from the construction of the TKE may therefore be in the order of 2000 m^3.

5.3.9 Demolition wastes are generated as a result of the clearance of sites which are currently occupied by man-made structures. Demolition wastes may include:

- brick, concrete, reinforcing bars and other rubble;
- derelict equipment, plant and furniture;
- wood and general refuse; and
- asbestos bearing materials.

5.3.10 Depending upon the nature of such structures and the activities which have been undertaken in them, demolition wastes may be inert, mixed with putrescibles, or contaminated.

5.3.11 Demolition wastes will be generated from the clearance of the Yau Tong and Tiu Keng Leng work sites, with the total volumes being estimated to be in the order of 16,000 m^3. The volumes of demolition waste arisings from the other station sites are expected to be low.

Chemical Waste

5.3.12 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 for the TKE will, for the most part, arise from the maintenance of plant and equipment. These may include, but need not be limited to the following:

- scrap batteries or spent acid/alkali from their maintenance;
- used engine oil from servicing;
- used air, oil and fuel filters from machinery;
- spent mineral oils/cleaning fluids from mechanical machinery; and
- spent solvents/solutions, some of which may be halogenated, from equipment cleaning activities.

5.3.13 Estimates suggest that monthly arisings at each station site will consist primarily of a few hundred litres of used lubricating oils and small quantities of waste battery acids.

General Refuse

5.3.14 The presence of a construction site with large numbers of workers and site offices and canteens will result in the generation of a variety of general refuse materials requiring disposal. General refuse may include food wastes and packaging, waste paper and packaging from construction materials.

5.3.15 Each station site is expected to have 100-200 workers. Estimates based on these figures suggest that the general refuse produced by TKE construction will be in the order of

50-100 kg per construction site per day.

Assessment Methodology

5.3.16 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.

Prediction and Evaluation of Impacts

5.3.17 The nature and amount of the waste arisings from the construction of TKE and the potential environmental impacts which may arise from their handling, storage, transport and disposal are discussed in detail below under the headings of each waste type.

Excavated Inert Materials

5.3.18 Excavated materials will, where practicable, be reused in abutments and miscellaneous works such as landscaping, whilst excess materials comprising of inert rock and sand will be taken to reclamation sites or public dumps. Given the inert nature of this material, reuse on-site or in reclamation construction is unlikely to have any unacceptable environmental impacts relating to its disposal. However, air quality, noise and water quality impacts may arise from excavation, stockpiling and transportation of these materials as described in *Sections 2, 3 and 4.*

Construction and Demolition Waste

5.3.19 The storage, handling, transport and disposal of construction and demolition wastes have the potential to create similar visual, water, dust and associated traffic impacts to those associated with the storage and disposal of excavated materials as described above. However, the impacts related to demolition wastes will potentially be greater than those relating to construction because of the larger volumes to be handled, the dusty nature of the materials and the activities necessary to sort and store demolition wastes. As such, additional consideration should be given to demolition wastes.

5.3.20 It should be determined, prior to demolition, whether any of the materials comprising the demolition wastes are asbestos bearing materials. If this is the case, specific mitigation measures relating to asbestos must be taken because there is the potential for adverse health effects on workers.

5.3.21 The disposal of construction and demolition wastes is unlikely to raise any long term concerns because of the inert nature of most construction wastes. In accordance with an EPD policy, implemented 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. Segregation of wastes at construction sites may therefore be necessary before disposing of inert materials at public dumps for reclamation works and putrescible materials at a controlled landfill site. The segregation of materials to prevent wastes from going to landfill will also assist in minimising costs should landfill charges be introduced.

Table 5.3a Excavated and Waste Materials Arising from TKE Construction

TKE Component	Excavated (m^3)	Nature of Material (type, size)	Quantity (m^3)/Description		Construction Waste (m^3)	Demolition Waste (m^3)	Chemical Waste	Works Time Period
Yau Tong Area								
Drill and Blast Tunnel	120,000	Rock (probably granite)	60,000	Rock and sand will be used for cut and ciover tunnels. No scope for balancing cut and fill in design.	240	6,000	Few hundred litres of engine oil per month	12 months
Cut and Cover Tunnel	20,000	Soft (probably CDG)	10,000					
Station	50,000	Soft (probably CDG)	25,000					
Tiu Keng Leng								
Drill and Blast Tunnel	100,000	Rock (granite), ≤500 mm	50,000	Rock and sand will be used for cut/cover tunnels. No scope for balancing cut and fill in design.	240	10,000	Few hundred litres of engine oil per month	12 months
Station	300,000	Rock (granite), ≤500 mm	150,000					
Station	150,000	Soft (CDG, CDV)	75,000					
Tseung Kwan O, Hang Hau & Po Lam Stations								
TKO Station	100,000	Soft (sand, mud - wet)	50,000	Rock and sand will be used for cut/cover tunnels.	240	None	Few hundred litres of engine oil per month	12 months
HAH Station	100,000	Soft (sand, mud - wet)	50,000					
POL Station	20,000	Soft (sand, mud - wet)	20,000					
Cut/cover tunnels								
TKL to TKO	400,000	Soft (sand/clay mud - wet)	200,000	Rock and sand will be used for cut/cover tunnels.	240	None	Few hundred litres of engine oil per month	12 months
TKO to HAH	400,000	Soft (sand/clay mud - wet)	200,000					
HAH to POL	100,000	Soft (sand/clay mud - wet)	50,000					

5.3.22 Construction and demolition wastes currently form approximately 35% of the annual take-up of limited landfill void available in Hong Kong, although this proportion has varied widely over recent years. Therefore, it is important to minimise, wherever possible, the wastes being delivered to landfill.

Chemical Waste

5.3.23 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* (Chemical Wastes CoP). 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.

5.3.24 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 construction activities since it will be highly dependent on the Contractor's on-site maintenance intentions and the amount of plant and vehicles utilised.

General Refuse

5.3.25 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, vermin and other disease vectors 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.

Waste Reuse, Treatment, Storage, Transportation and Disposal Options

Introduction

5.3.26 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 construction of the facility under the headings of each waste type. The Contractor should consider these options and incorporate the recommendations 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

5.3.27 The various waste management options 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 and minimisation, ie not generating waste through changing or improving practices and design;
- reuse of materials, thus avoiding disposal (generally with limited reprocessing); and

- treatment and disposal, according to relevant laws, guidelines and good practice.

5.3.28 The Waste Disposal Authority should be consulted by the Contractor on the final disposal of wastes.

5.3.29 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, and costs are reduced both in terms of purchasing and in disposing of wastes.

Excavated Inert Materials

5.3.30 Uncontaminated inert materials may be delivered to public dumps and fill sites. Those public dumps and fill sites which will be in operation concurrently with the anticipated TKE excavation works, and their capacities, are listed in *Table 5.4c* and *5.4d*.

Table 5.4c Public Dumps Operating Concurrent with the TKE Excavation Works

Public Dump	Capacity during 1997-98 (m^3)
Tseung Kwan O Town Centre Phase III, Stage I	925,000
Tseung Kwan O Area 137 Stage I	1,000,000
Tseung Kwan O Area 38 Stage I	1,300,000
Tuen Mun Area 38 Stage I	750,000
Tuen Mun Area 38 Stage II	1,020,000
Pak Shek Kok Reclamation	1,060,000
Total Capacity	**6,055,000**

Predicted Construction and Demolition Waste Arisings from TKE is 18,000 m^3
Source: *Civil Engineering Department, Port Works Division, October 1996.*

Table 5.4d Fill Sites Operating Concurrent with the TKE Excavation

Fill Site Project Name	Start Date	End Date	Volume (m^3)
Shek Wu Hui Package 4	01/01/95	31/12/98	800,000
River Trade Terminal in Tuen Mun Area 36	01/05/96	01/12/98	1,810,000
Yuen Long (SW) Extension Site Formation Rd & Drain Work	01/10/97	01/10/00	600,000
Lantau Port Development	01/01/98	31/12/11	16,390,000
Total Capacity			**19,600,000**

Projected Total Rock and Soft Arisings from TKE Excavation is 750,000 m^3

5.3.31 From *Tables 5.4c* and *5.4d*, it can be seen that the public dump and fill sites have combined capacity of approximately 21.3 million m^3, which is greatly in excess of the inert material arisings from TKE. As such, it is anticipated that it is unlikely that disposal difficulties will occur, even when allowing for other construction project waste arisings. The majority of the inert excavated materials should go to fill sites, whilst those construction and demolition materials which do not meet the requirements of the

dumping licence will be disposed of in public dumps.

Construction and Demolition Waste

5.3.32 It has been estimated that approximately 2,000 m^3 of construction wastes and 16,000 m^3 of demolition waste will arise through the construction of TKE. In order to minimise waste arisings and keep environmental impacts within acceptable levels, the mitigation measures described below should be adopted.

5.3.33 Careful design, planning and good site management can minimise over ordering and waste of materials such as concrete, mortars and cement grouts. If feasible, the movable noise enclosures used at each site should be designed so that the construction materials are reusable, after they have been dismantled and removed, thereby not generating demolition waste. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse. Plywood containing tropical hardwoods shall not be used for hoardings or formwork.

5.3.34 It should be determined whether any asbestos bearing materials exist within the buildings scheduled for demolition. In this respect, the service of a specialist asbestos consultant, registered as such with the EPD should be engaged, to conduct a comprehensive survey for asbestos containing materials within the building and submit an Asbestos Investigation Report (AIR). If the AIR identifies the need, an Asbestos Abatement Plan should be submitted to EPD for comment at least 28 days prior to the commencement of the demolition works. If this is the case, all asbestos containing materials within the existing buildings should be removed and disposed of in accordance with the *Air Pollution Control (Amendment) Ordinance No 13 of 1993 (APC(A)O), Part IX, Sections 69 to 73*, and the *Code of Practice on the Handling, Transportation and Disposal of Asbestos, Environmental Protection Department, 1993* (Asbestos CoP), prior to any demolition works.

5.3.35 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 at a public dump, with the latter being the preferred option. Construction and demolition wastes currently comprise approximately 35% of the waste inputs to landfills. In order to maximise 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 should be sorted; the non-inert construction wastes should be disposed of at landfills; whilst the inert construction wastes should be disposed of at public dumps, where they have the added benefit of offsetting the need for removal of materials from terrestrial borrow areas for reclamation purposes.

5.3.36 If landfill disposal has to be used, the wastes will most likely be delivered to the SENT Landfill. At present, Government is developing a charging policy for the disposal of waste to landfill. This will provide additional incentive to reduce the volume of waste generated when it is implemented.

Chemical Waste

5.3.37 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.

5.3.38 Chemical waste that is produced, as defined by *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation, 1992* should be handled as follows.

5.3.39 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.

5.3.40 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 so that incompatible materials are adequately separated.

5.3.41 Disposal of chemical waste should:

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

General Refuse

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

5.3.43 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 for their deposit should be provided if possible. Waste paper should be reused, wherever practicable.

Summary of Recommended Mitigation Measures

5.3.44 This section summarises the waste management requirements and provides practical advice on actions which can be taken to minimise the environmental impacts which may arise from the generation, reuse, treatment, storage, transport and disposal of wastes.

5.3.45 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. Good management and control can prevent the generation of significant amounts of waste. 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.

5.3.46 The criteria for sorting solid waste is described in 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.

5.3.47 Proper storage and site practices will minimise the damage or contamination of construction materials and prevent them from becoming wastes. 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 to ensure that the former are taken to public dumps, while the latter are properly disposed of at controlled landfills. If wood and organics can be separated before becoming contaminated they may be respectively sold for reuse or composted. Since waste brought to public dumps will not attract a charge, while that taken to landfill may be charged, separating waste may also help to reduce waste disposal costs, should landfill charging be introduced.

5.3.48 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 collectors 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* (Cap 28);
- 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;

- the possible presence of asbestos bearing materials in the buildings which will be demolished at Yau Tong and Tui Keng Leng should be investigated and mitigated if considered necessary, in accordance with the APC(A)O and the Asbestos CoP.

5.3.49 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. The training requirements should be included in the site waste management plan.

5.4 *OPERATIONAL IMPACTS GENERAL*

5.4.1 This Section describes the likely waste streams arising from the operation of the five stations within the TKE and details the waste management mitigation measures which are recommended.

5.4.2 The TKE comprises the railway itself, the tunnels, associated electrical, communications, ventilation and drainage systems and five stations.

5.4.3 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 should occur in the TKE stations.

Potential Sources of Impact

General

5.4.4 During operation of the rail lines and stations in the TKE, waste will be generated by:

- the public and MTRC staff;
- the maintenance of building services in the stations, such as ventilation and lifts; and
- any renovation or modification to stations or tunnels:

5.4.5 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.

5.4.6 The waste arisings may differ between stations depending upon passenger usage, number and proximity of retail outlets, arisings from retailers located within stations, numbers of MTRC staff and maintenance requirements.

General Refuse

5.4.7 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.

Industrial Waste

5.4.8 Industrial waste will be generated from the maintenance and upkeep of TKE stations. Railway and station maintenance and renovation may generate large amounts of waste, although these arising are likely to be irregular, depending on particular needs and projects.

Chemical Waste

5.4.9 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.

5.4.10 The total volumes of chemical waste arisings from the operation of the TKE are expected to be small.

Assessment Methodology

5.4.11 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

5.4.12 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

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

Chemical Waste

5.4.14 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* and the Chemical Wastes CoP. 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.

5.4.15 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

5.4.16 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 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

5.4.17 The waste management strategy for the TKE 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.

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

General Refuse

5.4.19 General refuse should be collected from small bins and delivered to a dedicated station 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.

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

Industrial Waste

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

Chemical Waste

5.4.22 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.

5.4.23 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.

5.5 CONCLUSIONS

5.5.1 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 construction and operation.

5.5.2 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*.

5.5.3 Construction and demolition waste will be limited, at all sites except Yau Tong and Tiu Keng Leng which will generate a total of approximately 16,000 m^3 of demolition waste. 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 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.

5.5.4 The level of waste 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.

6 ECOLOGY

6.1 INTRODUCTION

6.1.1 Following the recommendation in the previous R8T Report, this section evaluates potential impacts to ecological resources arising from the proposed TKE, based on a more detailed ecological field survey and the latest engineering information in the MN9T Report.

6.1.2 Most of the TKE alignment is either within existing urban developments (Yau Tong), new developments on reclamation (Hang Hau and Po Lam), or is in the process of reclamation and other earthworks (Tiu Keng Leng and Tseung Kwan O). This land is of little or no ecological value and adverse construction impacts are extremely unlikely. However, the work site areas associated with the two tunnel portals and vent building on the slopes of Devil's Peak have been identified as potential ecological resources. Although none are of particular value or contain rare or endangered species, in keeping with general conservation policy in the Territory, they should be protected from unnecessary disturbance and appropriate mitigation measures are identified below. As the entire alignment is covered, no operational impacts are anticipated.

6.2 LEGISLATION

6.2.1 There are a number of international and local regulations, legislation and guidelines which provide the framework for the protection of species and habitats of ecological importance. These and their relevance to the proposed TKE are described in detail below.

6.2.2 Hong Kong legislation provides protection of animals and plants through the following relevant ordinances and guidelines:

- Forests and Countryside Ordinance (Cap 96) of the Revised Edition 1984;
- Wild Animals Protection Ordinance (Cap 170);
- Animals and Plants (Protection of Endangered Species) Ordinance (Cap 187) of the Revised Edition 1989;
- Waterworks Ordinance (Cap 102 covering Water Gathering Grounds); and
- Town Planning Ordinance (Cap 131).

6.2.3 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 Ordinance.

6.2.4 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. Prior approval from the Director of Agriculture and Fisheries is required for permission to destroy any of the protected wild animals listed in the Ordinance. The Second Schedule of the Ordinance which lists all the animals protected was last revised in June 1992. As construction of the TKE may cause the loss of habitat and may impact

some species, this Ordinance is relevant.

6.2.5 The *Animals and Plants (Protection of Endangered Species) Ordinance* controls the local possession of any endangered species of animals and plants listed in its schedules. It is designed to control trade in endangered species and restricting the local possession of them.

6.2.6 Under the *Waterworks Ordinance,* Water Gathering Grounds comprise areas which are conserved for use as water catchment. There are four broad categories which may warrant different controls on use and development. These are:

- Direct Gathering Grounds;
- Indirect Gathering Grounds;
- Minor Supply Gathering Grounds; and
- Flood Pumping Gathering Grounds.

6.2.7 The WSD has a specific requirement to control or restrict development and land use in water gathering grounds. For planning and management in water gathering grounds, WSD should be consulted. While this Ordinance is not designed explicitly to protect habitats and species, by conserving the areas for water gathering grounds and protecting them from development and other adverse land uses, they are often protected indirectly.

6.2.8 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. Where SSSIs are covered by statutory town plans, the land uses therein are controlled by the provision of the Town Planning Ordinance. The authority responsible for administering the Town Planning Ordinance is the Town Planning Board (Planning Department).

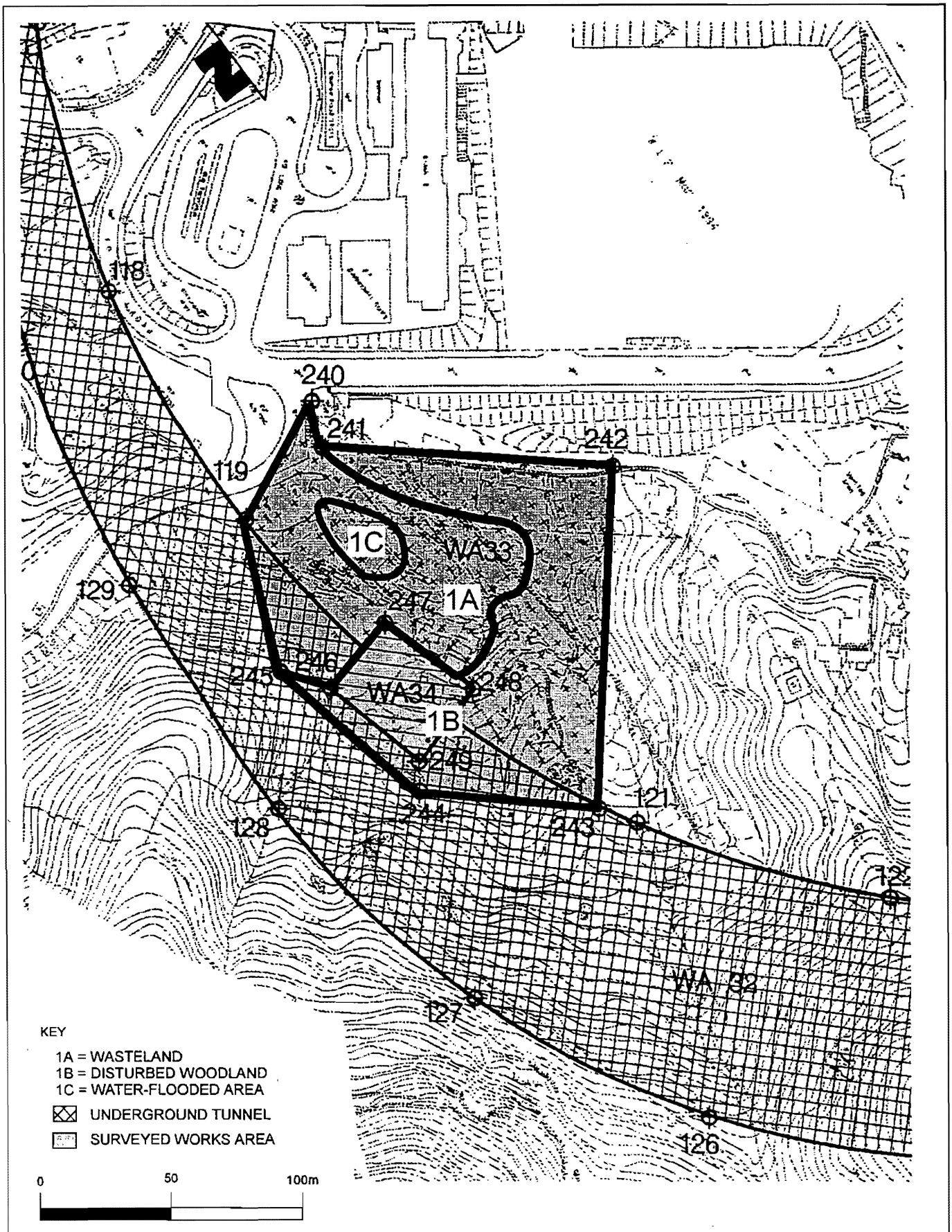
6.2.9 The new revised Chapter 10 of the HKPSG covers "Landscape and Conservation". This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The Appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and Government Departments involved in Conservation.

6.3 SENSITIVE RECEIVERS AND BASELINE CONDITIONS

6.3.1 As indicated in the R8T report, most of the alignment lies in urban areas subject to redevelopment or is located upon the Tseung Kwan O reclamation. Only two sites within the work areas are identified to have potential ecological resources (see *Figures 6.3a* and *6.3b*). Site 1 is located at the hillside near Yau Tong, where the western tunnel portal between YAT and TKL will be constructed. Site 2 is located on the hillside in Rennie's Mill, where the western tunnel portal and the ventilation building between YAT and TKL will be constructed. An ecological field survey of the two sites was undertaken on 3 July 1996.

Site 1

6.3.2 Site 1 is a highly disturbed area comprising three different habitat types: wasteland, disturbed woodland and water-flooded area as described below. As a result of long-



HABITAT MAP OF SURVEYED AREA AT SITE 1 (YAU TONG)

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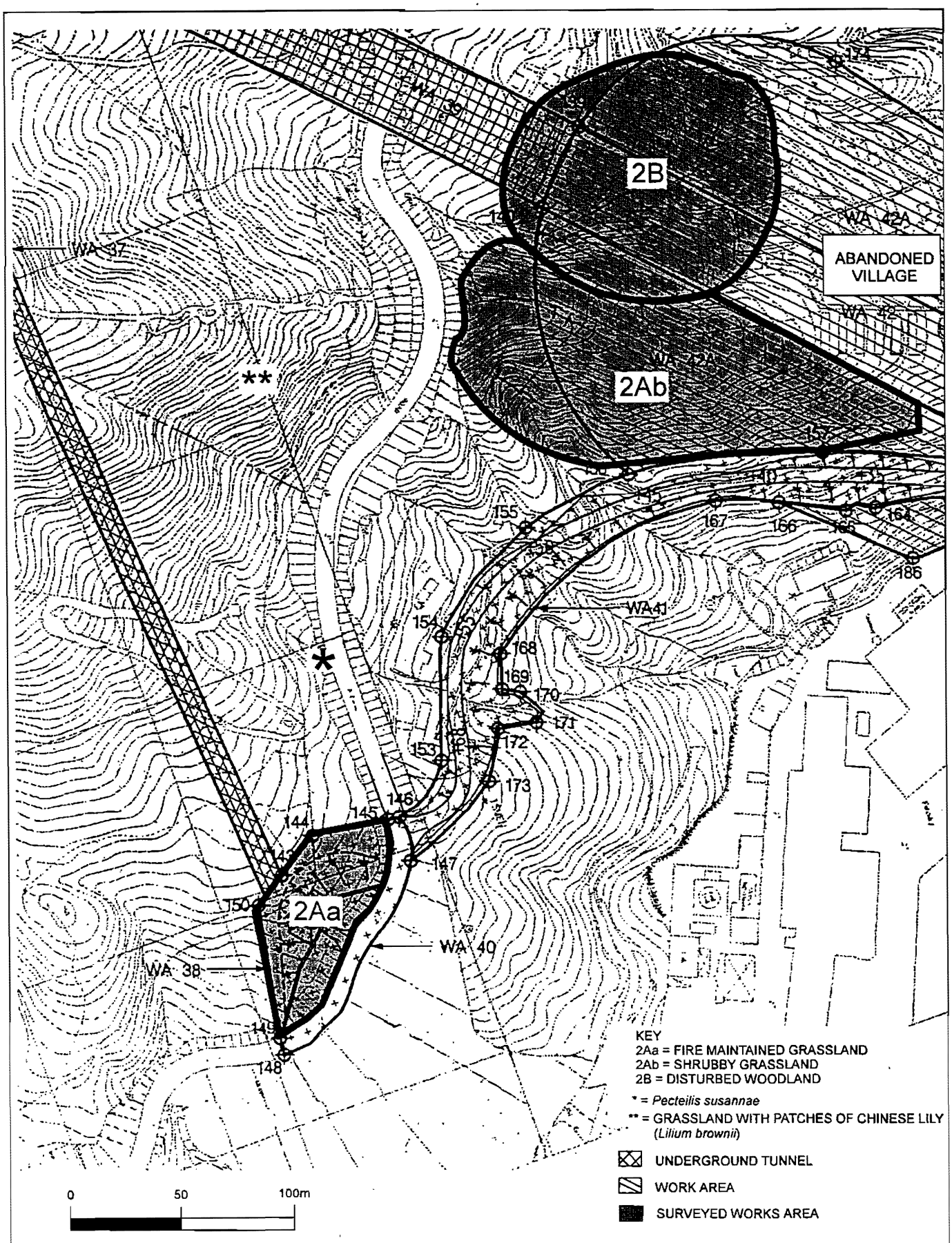
DATE: JULY 96

FIGURE No. 6.3a

SCALE: NTS

Maunsell



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HABITAT MAP OF SURVEYED AREA AT SITE 2 (RENNIE'S MILL)

DATE:	FIGURE No.
JULY 96	6.3b
SCALE: NTS	

Maunsell

term human interference (indicated by the presence of broken or abandoned squatter's huts), all plant species found are typical of disturbed areas in Hong Kong (see *Table 6.3a*). *Figure 6.3a* shows a habitat map of the surveyed area.

Wasteland

6.3.3 At Site 1A, patches of weedy plant are interspersed with concrete surfaces (vegetation cover is estimated to be 60%); the dominant plant species are *Biden pilosa, Mikania micrantha, Ipomoea carica* and *Lantana camara,* which are the most common weeds in the territory.

Disturbed Woodland

6.3.4 At Site 1B, trees on the hillside and fruit trees around abandoned squatter's huts form a wooded area. Species found are mainly *Macaranga tanarius* and other common fruit trees such as *Dimocarpus longan* and *Citrus spp,* all of which are common in disturbed low land areas in Hong Kong.

Water-Flooded Area

6.3.5 Site 1C is a water-flooded area on both sides of an existing covered storm water channel, with mainly herbaceous plant such as *Commenlina communis* and *Alocasia macrorrhiza.*

Table 6.3a Plant Species Recorded at Site 1 (3 July, 1996)

Amaranthus spinosa	*Ficus hirta*	*Panicum maxima*
Amaranthus viridis	*Ficus hispida*	*Paspalum spp.*
Apluda mutica	*Ficus microcarpa*	*Phyllanthus emblica*
Asparagus cochinchinensis	*Ficus variegata*	*Physalis angulata*
Bidens pilosa	*Ipomoea cairica*	*Pilea microphylla*
Blumea laciniata	*Lantana camara*	*Praxelis clematidea*
Celtis philippensis	*Leucanca leucocephala*	*Psidium guajava*
Celtis sinensis	*Litsea glutinosa*	*Pueraria phaseoloides*
Chloris barbata	*Macaranga tanarius*	*Rhynchelytrum repens*
Commenlina communis	*Mallotus paniculatus*	*Schefflera octophylla*
Desmodium gigantia	*Melia azedarach*	*Sida rhombifolia*
Desmodium heterocarpon	*Mikania micrantha*	*Solanum nigrum*
Digitaria spp.	*Mimosa pudica*	*Sonchus oleraceus*
Dimocarpus longan	*Miscanthus floridulus*	*Sterculia lanceolata*
Echinochloa crus-galli	*Musa paradisiaca*	*Triumfetta bartramia*
Elephantopus tomentosa	*Neyraudia reynaudiana*	*Urena lobata*
Eleusine indica	*Oxalis repens*	*Youngia denticulata*

6.3.6 Avifauna is quite rich (13 species were recorded during the survey) for such a small and highly disturbed area as shown in *Table 6.3b.* Species found are a mix of birds well-adapted to disturbed conditions such as Magpie robin *Copsychus saularis* and Spotted Dove *Streptopelia chinensis;* and birds confined to semi-natural or natural areas such as White-breasted King-Fisher *Halcyon smyrnensis* and Great-Tit *Parus major.* The high bird species richness may be due to the presence of abundant invertebrates (food sources) associated with the flooded area and the removal of human activities.

6.3.7 No signs of mammals of ecological interest were found during the survey, and the nature of the area is not expected to support any wildlife that would have considerable conservation importance.

6.3.8 Although avifauna associated with the water-flooded area is quite rich, Site 1 is disturbed and all species found are common in the territory. There is no evidence that species of conservation importance are supported.

Table 6.3b Bird Species Recorded at Site 1 and Site 2 (3rd July, 1996)

Species	Status #	Yau Tong (Site 1)	Rennie's Mill (Site 2)
Greater Coucal (*Centopus sinensis*)	R	*	
Crested Bulbul (*Pycnonotus jocosus*)	R	*	*
Spotted Dove (*Streptopelia chinensis*)	R	*	*
White-breasted Kingfisher (*Halcyon smyrnensis*)	R	*	
Black Drongo (*Dicrurus macrocercus*)	SV	*	
Hwamei (*Garrulax canorus*)	R	*	
Black Kite (*Milvus migrans*)	R	*	*
Magpie (*Pica pica*)	R	*	
Crested mynah (*Acridotheres cristatellus*)	R	*	*
Magpie-Robin (*Copsychus saularis*)	R	*	*
White-eye (*Zosterops japonica*)	R	*	
Yellow-bellied wren-warbler (*Prinia flaviventris*)	R	*	
Great-Tit (*Parus major*)	R	*	
Tree Sparrow (*Passer montanus*)	R	*	*

Key: R = Resident
SV = Summer Visitor

Site 2

6.3.9 Site 2 comprises two habitat types: grassland (Site 2A) and disturbed woodland (Site 2B). Both are located on the southern slope behind Rennie's Mill. *Figure 6.3b* shows a habitat map of the surveyed area and *Table 6.3c* lists the plant species observed.

Grassland

6.3.10 Site 2A includes two patches of grassland. Site 2Aa is a "fire-maintained" grassland, and the covering vegetation is dwarf and dominated by *Gahnia tristis, Baeckea frutescens,* and *Dicanopteris linearis,* typical of "fire-maintained" grassland in the territory. For Site 2Ab, the presence of tall shrubby vegetation indicates that the area has not been burnt off for a considerable time, with noticeable progress of the plant succession. Species found are common in the territory, such as *Rhodomyrtus tomentosa, Raphiolepis indica, Ischaemum spp* and *Arundinella setosa.*

Disturbed Woodland

6.3.11 Site 2B is the wooded area surrounding the portal area just behind the abandoned Rennie's Mill village. The species diversity of the woodland is not very high. The upper-storey is a closed canopy, dominated by tree species well-adapted to disturbed conditions, such as *Macaranga tanarius* and *Broussonetia papyrifera,* as well as other pioneer tree species *Mallotus paniculatus* and *Sapium discolor.* The under-storey is sparsely covered by common herbaceous plants.

6.3.12 No rare or endangered plant species were identified. Several small patches of Chinese Lily *Lilium brownii* and one individual Susan Orchid *Pecteilis susannae* were observed in the immediate vicinity, outside the site boundary. The two species are protected under the Forestry (Amendment) Regulation 1993, (Cap 96, section 3). However, both are widely distributed in the Sai Kung area.

Table 6.3c Plant Species Recorded at Site 2 (3rd July, 1996)

Ageratum conyzoides	*Ficus variolosa*	*Mimosa pudica*
Aporusa chinensis	*Gahnia tristis*	*Morinda umbellata*
Arundinella setosa	*Hedyotis corymbosa*	*Neyraudia reynaudiana*
Baeckea frutescens	*Helicteres angustifolia*	*Paederia scandens*
Bidens pilosa	*Homalium cochinchinensis*	*Phoenix hanceana*
Bridelia monoica	*Ilex asprella*	*Phyllanthus cochinchinensis*
Broussonetia papyrifera	*Ilex pubescens*	*Polygonum chinensis*
Chloris barbata	*Innula cappa*	*Praxelis clematidea*
Clerodendrum fortunatum	*Ipomoea carica*	*Pteroloma triquetrum*
Cratoxylum ligustrinum	*Ischaemum spp.*	*Pueraria phaseoloides*
Cymbopogon spp.	*Lantana camara*	*Rhaphiolepis indica*
Desmodium heterocarpon	*Liriope spicata*	*Rhodomyrtus tomentosa*
Dianella ensifolia	*Litsea glutinosa*	*Rhus succedanea*
Dicranopteris linearis	*Mallotus paniculata*	*Rhynoscopa rubra*
Elephantopus tomentosa	*Melastoma sanguineum*	*Sapium discolor*
Eleusine indica	*Mikania micrantha*	*Schefflera octophylla*
Embelia laeta	*Millettia nitida*	*Smilax china*
Eurya japonica	*Millettia reticulata*	*Smilax glabra*
Ficus hispida	*Millettia speciosa*	*Sterculia lanceolata*

6.3.13 Birds observed during the survey were only ubiquitous species (eg Tree Sparrow *Passer montanus* and Chinese Bulbul *Pycnonotus sinensis)* that are well-adapted to disturbed conditions (see *Table 6.3b).*

6.3.14 Animal groups of special ecological interest are not expected to be supported in the Site 2 area because of the simplicity of the composition and structure of the vegetated areas. There is no evidence that the grassland and disturbed woodland areas support species of conservation importance and the sites are considered to be of low ecological value.

6.4 CONSTRUCTION IMPACTS

6.4.1 Potential sources of impact to the habitat arise from land preparation, and construction activities for the tunnel portal and ventilation building. This will entail the removal of vegetation within the work areas, and may cause a loss of habitat for the associated species. However, since the affected areas are either highly disturbed (Sites 1A/1B/1C and Site 2B) or well-represented (Site 2A) in the territory, the ecological impact is considered to be low.

6.4.2 Since the two protected plant species identified are located outside the work area, they will not be affected provided proper mitigation measures are applied.

Mitigation Measures

6.4.3 This assessment confirms the findings of the previous report and the same mitigation measures are recommended. The natural features of the area, particularly large trees, are considered to be of concern for their landscape and visual rather than their ecological value, therefore, it is envisaged that mitigation measures designed to reduce impacts to landscape features will have the added effect of protecting the ecological diversity and value of the area. Mitigation measures for impacts to ecological resources arising during the construction phase should include the following:

- avoiding the area where the two protected species are located (see *Figure 6.3b*);
- erecting fences on the boundary of construction sites before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel into adjacent habitats;
- checking regularly to ensure that the work site boundaries are not exceeded and that no damage is being caused to the surrounding areas;
- employing high standards of dust control to protect habitats adjacent to work sites, through careful planning of access routes and dust suppression at source;
- restoring work areas with native plant species wherever possible to provide habitats for wildlife, native species which are known to be a resources for other local or migratory species, particularly birds and insects, are the preferred species for replanting and are given in *Plants attractive to frugivorous birds in Hong Kong, RT Corlett, Memoirs of the Hong Kong Natural History Society 19: 79-112, 1992*; and
- where the areas around the stations remain the responsibility of the MTRC, the maintenance of planted areas to remove climbers and ensure the survival of the trees should be undertaken by the MTRC for at least the first two years after the completion of the construction works.

6.5 *Operational Impacts*

6.5.1 Operational impacts upon ecological resources are those arising upon completion of the TKE and are minor compared with those arising during the construction phase. Mitigation measures to control noise impacts and those to water quality and air quality will also further protect wildlife within the sites and need not be considered further here.

6.6 *Conclusions*

6.6.1 This study confirms the findings of the previous preliminary assessment. The ecological habitats likely to be affected are the proposed work areas for the tunnel portals and ventilation building construction. The habitats found are either highly disturbed or well-represented in the territory, with low floristic diversity and simple structural complexity. No plant or animal groups of ecological interest were identified. The affected areas are considered to have low ecological value in terms of species diversity, habitat diversity, naturalness and rarity, and therefore ecological impacts are not anticipated.

7 *LANDUSE, LANDSCAPE AND VISUAL IMPACTS*

7.1 INTRODUCTION

7.1.1 This *Section* of the report outlines the potential land use, landscape and visual impacts of developing the preferred track alignment options and stations at their preferred locations.

7.1.2 The assessment initially identifies the existing land uses and landscape features of the station sites as well as the alignment corridor of the connecting rail-tracks. The locations from which the development would be visible are then described. People in the surrounding areas who would potentially be able to see the proposed development are identified and categorised according to their predicted sensitivity to the visual intrusion that would result from the proposed development.

7.1.3 The potential land use, landscape and visual impacts that would result from the TKE are then identified and the potential impacts are assessed according to whether they are of high, medium or low level. Measures are identified that would help reduce the level of these potential impacts on landuse, the landscape and on the visual receivers.

7.1.4 Unmitigated adverse landuse and visual impacts are predicted from the construction of the TKE and whilst landuse impacts can be largely overcome by careful planning, some residual visual impacts from construction works will remain even after mitigation. However, these impacts should be considered in the context of the local environment near the alignment which is one of ongoing urban renewal and new urban development. In such an environment, the construction works for the TKE only represent an additional element in an already disturbed landscape. The entire TKE alignment will be either below ground or fully enclosed and as such, provided that the above ground structures are designed to blend in with the rest of the planned townscapes, there will be no adverse impacts during the operational phase.

7.2 LEGISLATION

7.2.1 There is no legislation in Hong Kong that relates directly to the assessment of the landscape or visual impacts of new developments or construction sites. A degree of control is achieved through the requirement to address visual issues as part of an environmental review and assessment process. *Advice Note 2/92 - Application of the EIA Process to Major Private Sector Projects, EPD, May 1992*, 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. Government restrictions on the preservation and felling of trees in Hong Kong are detailed in *Government General Regulation 740.*

7.2.2 Some of the sites affected by the proposed railway alignment and stations may require resumption of properties under the *Crown Lands Resumption Ordinance* if permanent structures are required to be demolished. The Town Planning Board may recommend to the Governor in Council the resumption of any land if it deems that the proposed works serve the public purpose as provided under the *Town Planning Ordinance Section 4 para (2).*

7.3 *SENSITIVE RECEIVERS AND BASELINE CONDITIONS*

Yau Tong Station and Alignment

7.3.1 Yau Tong is located in south-east Kowloon. The area around the proposed alignment and station is generally surrounded by public housing, industrial areas, and some Government/Institution/Community (G/IC) facilities. Cha Kwo Ling Road provides access to the marine lots at Yau Tong Bay and the industrial areas in the southern part of Yau Tong Estate.

7.3.2 The proposed alignment and station would be located along Cha Kwo Ling Road. It is envisaged that the alignment and station would be constructed mainly by cut-and-cover methods. One of the major sensitive receivers is the Yau Tong public housing redevelopment area, located to the east of the proposed alignment and station. The Housing Authority intends to redevelop the Yau Tong Estate and the nearby Ko Chiu Estate comprehensively. Conceptual layouts have been planned with cognisance of an MTR alignment on Lei Yue Mun Road. Other major sensitive receivers are the Yau Tong Fire Station, St Antonius Primary School and Po Chiu College located on the eastern and western parts of the proposed alignment and station. However, Po Chiu College is expected to be resumed as part of the TKE Project. There are a number of Marine Lots which are physically affected by the proposed station and these may have to be resumed. Current proposals envisage future redevelopment of the area for residential and commercial uses.

7.3.3 The alignment of the proposed WCR, which would provide a connection between Tseung Kwan O and East Kowloon, was originally planned to pass along the section of Cha Kwo Ling Road that would be occupied by the proposed station, this could prove to be a major constraint on development.

7.3.4 One of the preliminary recommendations of the TKE study was for the WCR to follow a coastal alignment in preference to the inland alignment that was originally planned. In view of this potential conflict, Government is considering alternative alignments for the WCR that would avoid the above section of Cha Kwo Ling Road.

7.3.5 The proposed YAT site and the adjacent sections of alignment for the railway tracks are centred around Cha Kwo Ling Road which runs close and parallel to the waterfront at Yau Tong Bay. There are a large number of temporary and permanent industrial structures located to the east of this road, close to the waterfront. The Yau Tong Housing Estate, currently undergoing re-development, is located to the west of the road together with two educational establishments, Po Chiu College and St. Antonius Primary School. Steep rock-cut slopes, up to 22 m high, separate the Yau Tong Housing Estate from Cha Kwo Ling Road. A small, but well-vegetated, amenity open space is situated on the southern edge of the housing estate at the corner of Cha Kwo Ling Road and Ko Chiu Road. A group of commercial and/or residential buildings, the Yau Tong Centre, is located immediately to the south of this road.

7.3.6 At the western end of the station, the proposed alignment of the railway tracks heads north-west along Cha Kwo Ling Road and after approximately 100 m, enters a tunnel leading to Quarry Bay. The proposed railway tracks at the eastern end of the station veer to the south-east before entering a tunnel portal near the junction of Ko Chiu Road and Cha Kwo Ling Road. The railway tracks would thereafter pass under the steep hillsides that separate Yau Tong from Tiu Keng Leng located approximately 1.5 km to the north-east.

7.3.7 Sensitive receivers include residents of both the Yau Tong Estate and the Yau Tong Centre, workers at the industrial buildings located to the east of Cha Kwo Ling Road as well as users of the surrounding road network and workers in the waterfront structures.

Tiu Keng Leng Station and Alignment

7.3.8 Tiu Keng Leng is located to the south-west of Tseung Kwan O new town. The current proposal envisages the development of TKL within Area 73B near the junction of roads D4 and D8. The area is currently occupied mainly by villages and temporary housing. Tiu Keng Leng is designated primarily for public and private residential development. The Housing Authority is currently planning the future development of PSPS, HOS, Special Residential (RS) and G/IC facilities in the vicinity of the proposed station. Current proposals also envisage the development of private commercial and/or residential uses along the proposed TKL alignment and station.

7.3.9 The western half of the TKL station site is occupied by the lower levels of Tiu Keng Leng village. This existing area of land comprises steep hill slopes leading down to a rocky foreshore. The hill slopes are well vegetated with mature trees which are interspersed with temporary houses of either one or two storeys. The proposed railway tracks to the west of the station would be located in tunnel as they pass under the hills that separate Tiu Keng Leng from the Yau Tong area. The eastern half of the proposed site for TKL Station and the adjacent sections of alignment for the railway tracks is occupied by open water that has yet to be reclaimed.

7.3.10 Sensitive receivers potentially include any people who would be living in the planned residential blocks in Areas 72 and 74 that may be developed and occupied prior to the completion of the station construction works.

Tseung Kwan O Station and Alignment

7.3.11 The proposed TKO station is located at the southern portion of the new town in proximity to the reclaimed head of Junk Bay. The area is currently being reclaimed for future development of housing, G/IC facilities and the town centre.

7.3.12 The station is located within the future Tseung Kwan O town centre. Anticipated commercial and civic development within the town centre is intended to be supplemented by district centres located at Po Lam, Hang Hau and Tiu Keng Leng. It is envisaged that each district centre will be in close proximity to an MTR station and they are planned to include retail and transport interchange facilities sufficient to service the local district.

7.3.13 The planning of the town centre includes the development of a civic centre adjoining a district open space which would be linked to a waterfront promenade. The town centre south of road D4 is currently planned for commercial, civic and open space purposes. Public and private residential developments are planned adjacent to the town centre.

7.3.14 It is envisaged that this section of the alignment would be constructed by cut and cover. Users of the proposed town centre and developments envisaged in the vicinity of the station are identified as potential sensitive receivers of the proposed TKO station and alignment.

7.3.15 The proposed site for TKO station and much of the adjacent sections of alignment corridor for the railway tracks currently comprise large, flat areas of un-surfaced fill material devoid of any vegetation. The far western section of the alignment corridor,

close to where Road P2 will be built, is open water that has still to be reclaimed. Construction works have yet to commence on Roads D1, D2, P2, L461, L462 and L464 which surround the station site and the alignment corridor. Foundation construction works are in progress for the G/IC developments that are proposed to the north of Road L464 in Areas 55, 56 and 57. The planned developments include a clinic, an indoor recreation centre and several schools that are all likely to be developed prior to the completion of station construction works. No residential blocks will have been developed in these areas by the time that the station and railway construction works are due to be completed. Advance Works Tunnels have been constructed under Roads P1 and P2.

7.3.16 Sensitive receivers include any people who may be using the clinic, the indoor recreation centre and the schools which are all under construction approximately 200 m to the north of the station site in Areas 55, 56 and 57.

Hang Hau Station and Alignment

7.3.17 The layout of Hang Hau consists of existing and planned commercial and residential developments in the vicinity of the proposed station location. The MTR reserve is located within Area 38. It is envisaged that the alignment and station would be constructed below ground using open-cut construction. Users of existing residential developments in Areas 40 and 41 (On Ning Garden, Ching Ming Court and Hau Tak Estate) would be sensitive receivers of the potential visual impacts from the proposed MTR station and alignment. Residential development with Area 38A is well in progress and is likely to be completed and occupied prior to the completion of construction works on the station and associated structures.

7.3.18 Land within Area 37 has been acquired by private developers in the vicinity of the proposed HAH station. These sites are earmarked for future residential and commercial development and users of these sites would be considered as future potential sensitive receivers if the sites are developed and occupied prior to the completion of the station development.

7.3.19 The proposed sites for HAH and its adjacent sections of alignment are currently flat, open areas of wasteland. The sites in and around the area set aside for the station contain scattered clumps of self-seeded scrub vegetation and are being used temporarily for the parking of trucks and cars. The railway track alignment corridor in the southern end of this section comprises un-surfaced fill material devoid of any vegetation. Roads in the vicinity of the station site (i.e. Sheung Ning Road, Pui Shing Road and Chung Wa Road) have been completed and many have been recently planted with trees and shrubs. Roads P1 and D1 have yet to be constructed. Tunnel boxes have however been provided under Roads P1 and L3 for the future construction of the railway under these roads.

7.3.20 Building construction works are in progress in Area 37 (schools and residential buildings), in Area 34 (Ming Tak Estate) and in Area 38A (residential development). Existing residential developments, where residents would have close, unobstructed views of the station site and its adjacent sections of alignment, include Yu Ming Court within Area 39, On Ning Garden within Area 40 and Chung Ming Court within Area 41. Wide belts of tree/shrub planting and external recreation facilities, such as children's play areas, tennis courts and basketball courts, are associated with many of these existing residential developments.

7.3.21 Sensitive receivers include people living in the above existing residential areas as well as

those people who would use the schools and residential areas that are planned in Area 37 and are likely to be completed and occupied prior to the completion of the construction works on the station.

Po Lam Station and Alignment

7.3.22 In the Po Lam area, the existing and proposed land uses near the proposed station, are mainly public and private housing developments, G/IC facilities and open space. It is envisaged that the alignment will be constructed at grade by cut-and-cover for the section just north of road P2. A couple of schools are located adjacent to the alignment and these, like the existing and proposed residential blocks, are identified as sensitive receivers.

7.3.23 A station integrated with adjacent developments and a Public Transport Interchange (PTI) within Areas 17 and 19 is envisaged for Po Lam. The PTI has been developed and is operational. Areas 17 and 19 consist of proposed private residential and commercial development which are currently under construction. The potential interface problems between the MTR alignment and station with these developments will have to be considered.

7.3.24 The proposed site for POL is currently a large, flat area of concrete which is used for the parking of cars and buses. The reserve for the section of railway track between the station and Road P2 is currently a 40 m wide belt of flat open space that comprises un-surfaced fill material devoid of any vegetation. Roads L12 and L12A adjacent to the station site have been completed together with the footpath, cycle track and amenity strip. These are all located immediately to the west of the proposed station site. Road P2 and its associated belts of amenity planting have been completed on the southern edge of this section of alignment. A tunnel box has been provided under Road P2 for the future construction of the railway. Building construction works are in progress in Areas 17, 19 and 24 which surround the site. These areas, like much of the Tseung Kwan O reclamation, are flat open areas devoid of vegetation. An informal, but well-used footpath, crosses the reserve to connect roads L12 and L2.

7.3.25 There are seven major residential developments that have been completed within 200 m of the site and its adjacent section of alignment. These are Yan Ming Court, Ho Ming Court and the King Lam Estate, all located to the east of the site, Ying Ming Court and the Po Lam Estate both located to the north of the site and On Ning Court and Chung Ming Court both located to the south. Wide belts of tree/shrub planting and external recreation facilities, such as children's play areas, tennis courts and basketball courts, are associated with these residential developments. The tree/shrub planting includes screen/buffer planting located immediately inside the boundary fencing of these residential developments. Construction works in progress include residential development in Area 19, commercial and residential development in Area 17 as well as G/IC development in Area 24.

7.3.26 Visually sensitive receivers include the residents of the above existing developments, users of footpaths on the distant surrounding hill slopes, users of Roads P2, L12 and L12A as well as users of the planned schools and residential blocks that are likely to be built and occupied prior to the completion of station construction works.

7.4 CONSTRUCTION IMPACTS

Potential Sources of Impact

7.4.1 The proposed MTR extension from Yau Tong to Po Lam would create varying levels of potential impacts on the surrounding existing land uses (residential and G/IC uses) during the construction stage.

7.4.2 There will be three sections of tunnel on the TKE alignment. Landscape and visual impacts associated with these sections would be restricted to the tunnel portal areas. Construction of the remaining sections of railway track alignment and the stations themselves will all involve land-cuts and these may result in disturbance to existing vegetation and structures. Areas of disturbed land, the construction operations, as well as the rail track and the stations at their various stages of construction, would all have a visual impact on the surrounding areas and their populations.

Assessment Methodology

7.4.3 Site visits were conducted to gain an overview of the existing physical development of the proposed alignment and stations and the characteristics and features of the surrounding developments. References were made to current Outline Zoning Plans (OZP), Outline Development Plans and department layout plans to ascertain present and potential future land uses in the vicinity of the proposed alignment and stations. Information gathered was used to assess the level of potential impacts of the proposed construction sites on adjacent land uses.

7.4.4 The method for identifying potential landscape and visual impacts has initially involved identification of the various elements of the construction works. Baseline conditions and sensitive receivers have been established through site visits to the study area as well as by inspection of Building and Lands Department maps, Layout Plans, OZPs and aerial photographs.

Prediction of Impacts

Yau Tong Station and Alignment

7.4.5 A number of existing uses would be affected physically during the construction of YAT station. The Yau Tong Fire Station and Yau Tong Marine Lots would be physically encroached upon by the alignment and full or partial resumption of these sites may be necessary.

7.4.6 The existing Yau Tong Fire Station site would be partially affected by the proposed alignment. Only part of the site may have to be resumed to provide for the construction of the railway tracks. The area affected is currently used as car-parking space for the fire station. During the construction phase, an alternative car-park area may have to be identified, depending on the requirements of car-parking space for the fire station.

7.4.7 St Antonius Primary School would also be adversely affected by perceived environmental problems during construction of the MTR line and station. The school is in close proximity to the future station and as such, negative environmental impacts on these sites are anticipated.

7.4.8 The proposed alignment would also affect the existing Cha Kwo Ling Road and the junction of Cha Kwo Ling Road and Ko Fai Road. During the construction phase, it is

envisaged that there will be some disruption to existing pedestrian linkages and the local road network which would cause inconvenience to other land uses in the vicinity of the construction sites. A road diversion is proposed across the lots to keep Cha Kwo Ling Road open to traffic.

7.4.9 Development of a station and the adjacent sections of railway track at Yau Tong would require the removal of a row of temporary structures located between Cha Kwo Ling Road and Yau Tong Bay.

7.4.10 The station box under construction would occupy a large section of Cha Kwo Ling Road and would protrude approximately 18 m above grade at the lowest point in the road. Short sections of the rail track immediately outside the station box would be at-grade before entering tunnel portals located both to the north and to the south of the site. It is planned that these sections of at-grade track would be enclosed to protect sensitive receivers. A diversion of Cha Kwo Ling Road is proposed across the mouth of Yau Tong Bay between the western end of Ko Fai Road and the section of Cha Kwo Ling Road immediately to the south of the portal for the Western Harbour Crossing. In addition to Cha Kwo Ling Road, development of the station box and associated structures would result in the permanent closure of road junctions at both the corner of Ko Fai Road/Cha Kwo Ling Road and at the corner of Yau Tong Road/Cha Kwo Ling Road. Construction of the line between YAT and LAT would require work sites for both traffic management and for structural deck construction. These work sites would occupy part of a slip-road and associated planting located to the north-west of the EHC toll plaza at Yau Tong. A temporary road deck will be provided over Yan Ming Street so that road traffic is not disturbed during the course of the cut and cover excavation works across that street.

7.4.11 Construction of the station box is likely to involve excavation of a short length of the rock-slopes located immediately to the east of Cha Kwo Ling Road as well as the shrub vegetation associated with these slopes. Construction works would also result in the loss of a small area of mature tree and shrub growth located within the grounds of the fire-station at the Cha Kwo Ling Road /Ko Fai Road junction. A large area of mature trees in the existing amenity open space located at the junction of Cha Kwo Ling Road and Ko Chiu Road would also need to be removed as regrading of this land would be necessary to accommodate part of the station and a section of at-grade track.

7.4.12 Construction of the station superstructure, its associated structures and residential blocks would represent the introduction of large new visual elements in the local landscape. These elements, together with the excavations required for the station box and the tunnel portals would generate a visual impact on surrounding areas and their population. The construction works would generate visual impacts for the occupants of the fire-station, St. Antonius Primary School, the temporary structures along the water-front, as well as residential blocks both within the Yau Tong Centre and the Yau Tong Estate. The construction works would enclose views down Cha Kwo Ling Road, Ko Fai Road and Yau Tong Road. More distant views of the works would be available from hillsides located both to the north and to the east of the site as well as from Yau Tong Bay itself and areas of the harbour located further to the west.

7.4.13 Additional landscape and visual disturbance would be generated in the Yau Tong area by the development and use of work sites. Construction works for a tunnel and portal immediately to the south of the EHC Toll Plaza at Yau Tong would involve the severance of the access road to the EHC administration building. A road diversion is proposed immediately parallel to Cha Kwo Ling Road. The tunnel portal works, cut and cover excavations and road construction will involve the removal of existing rock

and soil cut slopes as well as their associated vegetation.

7.4.14 The construction of two additional tunnel portals to the north-west of YAT, leading to QUB and LAT, would involve large cut-slopes into the existing hillside and the associated loss of trees and shrubs.

7.4.15 Extensive earth works would be required for the works areas for the ventilation building and tunnel construction required on the site on the former squatter village to the south of Ko Chiu Road Estate.

7.4.16 The proposed works, together with the car parking areas, tunnel portal works, cut slopes and associated loss of vegetation and ventilation buildings, at their various stages of construction, would generate a visual impact on the surrounding areas and their population. People who would experience this visual impact include residents of the housing estates adjacent to Lei Yue Mun Road, students at St. Antonius Primary School, workers at the industrial units along Ko Fai Road, people using the footpaths along the hill slopes to the east of the bay, people living and working on the north-eastern edge of Hong Kong Island as well as people using boats in the harbour.

Tiu Keng Leng Station and Alignment

7.4.17 The Tiu Keng Leng area is characterised by cottage structures built on small platforms abutting the lower slopes descending towards Tiu Keng Wan to the south. Given that the construction works would start after the clearance of the cottage area and the completion of reclamation works, it is envisaged that there would be little or no impact on the use of this adjacent land during the construction of TKL station.

7.4.18 The proposed alignment from TKL to TKO would pass through commercial and/or residential developments in Areas 73 and 74. These land uses, however, would not be adversely affected by the alignment because they would not be completed by the time the alignment is constructed.

7.4.19 Land cuts and excavation works that would be associated solely with the site for of TKL would involve the loss of approximately 150 temporary houses as well as large areas of mature trees (in excess of 500 trees) from the existing hillside. A section of rocky foreshore, approximately 100 m long, would be lost together with the remaining area of open water located between the village and the existing area of reclamation for the new town of Tseung Kwan O. Reclamation of this area of open water is planned as part of the overall development of the Tiu Keng Leng area and the land cuts will be made as part of a larger redevelopment programme for the Tiu Keng Leng area. This redevelopment programme, as a whole, involves a much greater loss of trees, temporary houses and shoreline. Cut-and-cover excavations, into the existing and proposed areas of reclamation, would be required to construct the section of railway tracks between the station site and Road P2. A tunnel box will be built before Road P2 is constructed and there will be no disruption to Road P2 nor any associated amenity planting). Road D8 would probably be constructed after station construction works are complete.

7.4.20 The existing access road to the industrial buildings at Tiu Keng Leng will be extended to provide a side-link down to the proposed construction site for TKL station. In addition, a works area for the construction of an access tunnel is proposed immediately adjacent and upslope of the existing access road which traverses the hillsides to the west of Tiu Keng Leng. The works areas for the access road and the access tunnel will both involve land-cuts and associated vegetation loss.

7.4.21 The loss of the existing low-rise housing and trees on the hill slopes, the land cuts and excavations associated with the railway and station development, the railway tracks and station structures at their various stages of construction, as well as the construction operations themselves, are all elements that would generate a visual impact on the surrounding areas and their populations. These elements include the ticketing hall and atrium of the station which would protrude above ground level. The people that would potentially be affected by this visual impact include those in the planned residential blocks in Areas 72 and 74 that may be developed and occupied prior to the completion of the railway and station construction works.

TKO Station and Alignment

7.4.22 The proposed TKO alignment and station would pass through future commercial/residential uses in Area 55, TKO town park in Area 45 and G/IC uses in Area 37. It is envisaged that there would be little or no land-use impacts generated by the construction of the TKO station given that it would be constructed soon after the completion of reclamation and in the same time-frame as adjacent proposed developments.

7.4.23 The landscape impacts associated with the development of TKO and its adjacent sections of alignment would primarily be the deep excavations that would be required for construction of both the track and the station itself. There would, in addition, potentially be disruption to Road D1 unless advance works tunnel boxes are provided or road construction works are commenced after track construction works have been completed. Any advance planting of vegetation adjacent to the Roads D1, P2 and D4 prior to the construction works would also be likely to be disturbed.

7.4.24 These excavations, the construction works on the below-grade station and the railway tracks, as well as the associated construction traffic are all elements that would generate visual impacts on the surrounding areas and their populations. In addition, it should be noted that an atrium structure for the station entrance would protrude above ground level and that this structure would also generate, at the various stages of its construction, a visual impact on the surrounding areas and their populations. These visual impacts would affect any people using the G/IC developments that are being built nearby i.e.; the clinic, the indoor recreation centre and the schools which are all under construction approximately 200 m to the north of the station site in Areas 55, 56 and 57. There would also be a visual impact on users of the adjacent Roads P1, P2 and D4.

Hang Hau Station and Alignment

7.4.25 The area around HAH is intended to be developed as a district centre with retail facilities and a major transport interchange similar to Tiu Keng Leng. There are existing developments within Areas 40 and 41 which are located near the proposed station and alignment. Existing public rental/HOS/PSPS housing includes Hau Tak Housing Estate, Fu Ning Garden, On Ning Garden, Chung Ming Court and Yan Ming Court all of which have already been occupied. There are proposed private residential and commercial developments in Areas 37, 38a, and 40 which are likely to be constructed and occupied in the next few years. The proposed railway development would generate land-use impacts on the existing or planned residential developments.

7.4.26 The proposed site for HAH and its adjacent sections of alignment are currently flat, open areas of wasteland. The sites in and around the area set aside for the station contain scattered clumps of self-seeded scrub vegetation and are being used temporarily

for the parking of trucks and cars. The proposed district open space in Area 37g is unlikely to be developed before railway construction works are completed. The railway track alignment corridor in the southern end of this section comprises un-surfaced fill material devoid of any vegetation. Deep excavations would be required in these areas for the construction of the station and associated tracks. Roads in the vicinity of the station site, Sheung Ning Road, Pui Shing Road and Chung Wa Road have been completed. Roads P1 and D1 have yet to be constructed. Tunnel boxes have however been provided under Roads P1 and L3 for the future construction of the railway. Trees and shrubs that have been planted in the amenity strips adjacent to Sheung Ning Road would be disturbed by the proposed works.

7.4.27 Building construction works are in progress in Area 37 (schools and residential buildings), in Area 34 (Ming Tak Estate) and in Area 38A (commercial/residential development). Existing residential developments where residents have close, unobstructed views of the construction site and its adjacent sections of alignment include Yu Ming Court within Area 39, On Ning Garden within Area 40 and Chung Ming Court within Area 41. Wide belts of tree/shrub planting and external recreation facilities, such as children's play areas, tennis courts and basketball courts, are associated with many of these existing residential developments but would not be affected by the proposed works.

7.4.28 Visual impacts resulting from the station and track construction works are predicted on people living in the existing residential areas as well as those people who would use the schools and residential areas that are planned in Area 37 and are likely to be completed and occupied prior to the completion of the construction works on the station.

Po Lam Station and Alignment

7.4.29 The area around POL is similar to Hang Hau in that there are existing housing developments near the station and proposed private residential and commercial developments adjacent to the station and alignment. Existing developments include Well On Gardens and Finery Park, Po Lam Housing Estate, Hong Sing Garden, Tsui Lam Estate, King Ming Court, Ying Ming Court, Yan Ming Court and Ho Ming Court. Private residential and commercial developments within Areas 17 and 19 immediately adjacent to the station are currently undergoing construction. Besides these, there are two schools located adjacent to the railway alignment and future station.

7.4.30 The current intention is to construct the alignment and station at grade for the section of the track located north of road P2. Development of POL would involve construction of a substantial atrium and ticketing hall above these at-grade railway tracks. The vertical alignment of the rail tracks will adopt a gently falling incline heading south from the station. It is planned that the whole section of track between the station and Road P2 would be enclosed for environmental protection reasons and a landscaped pedestrian deck provided above the tracks. It would then descend below-grade approximately 20 m before it passes underneath Road P2.

7.4.31 There would be potential land-use impacts from the construction activities on existing residential, commercial and G/IC uses located in the vicinity of the MTR alignment. For the development sites located in the immediate vicinity of the station, it is envisaged that the timing of the completion of the station and adjacent section of tracks would broadly coincide with the completion of these developments.

7.4.32 Construction works should not result in any landscape impacts on Roads L12 and L12A adjacent to the station site or to the adjacent footpath, cycle track and amenity strip as all

these features are outside the MTR reserve. There would be no disturbance to the existing Road P2 and its associated amenity planting as the proposed railway tracks would pass through an existing box culvert that has already been constructed for this purpose.

7.4.33 The proposed construction operations, station, tracks and enclosure structures are all elements that would, at their various stages of construction, generate visual impacts on the surrounding areas and their population. The sensitive receiver population includes residents of existing residential developments (Yan Ming Court, Ho Ming Court and the King Lam Estate, all located to the east of the site, Ying Ming Court and the Po Lam Estate both located to the north of the site and On Ning Court and Chung Ming Court both located to the south) as well as users of schools and residential blocks that should be built and occupied before construction works on the railway have been completed (i.e.; residential development in Area 19, commercial/residential development in Area 17 and G/IC development in Area 24). Other visually sensitive receivers include users of more distant residential blocks and construction sites, users of the PTI, users of footpaths on the distant surrounding hill slopes as well as users of Roads P2, L12 and L12A.

Evaluation of Impacts

Yau Tong Station and Alignment

7.4.34 It is envisaged that St. Antonius Primary School would be adversely affected by environmental impacts associated with the railway construction activities. The fire station site would be physically encroached upon and potential environmental problems are likely to affect the site. The proposed alignment and station at Cha Kwo Ling Road would affect the existing local road system and pedestrian connections and these may require modifications. In this regard, the unmitigated construction impacts on land uses in Yau Tong are considered to be high.

7.4.35 A high negative impact on the local landscape is predicted as a result of the proposed development and this would be seen in the disruption to the existing road and footpath network in the area.

7.4.36 The potential loss of mature trees located within the grounds of the fire-station at the Cha Kwo Ling Road /Ko Fai Road junction and in the existing amenity open space located at the junction of Cha Kwo Ling Road and Ko Chiu Road would represent a medium negative landscape impact on the local area. The loss of a row of temporary structures located between Cha Kwo Ling Road and Yau Tong Bay is regarded as a low negative impact.

7.4.37 Construction operations, as well as the station box and its associated structures at the various stages in their construction, would all generate a high level of visual intrusion on the surrounding sensitive receivers. These sensitive receivers include users of the local fire-station, students at St. Antonius Primary School, the temporary structures along the water-front, and residential blocks both within the Yau Tong Centre and Yau Tong Estate. A low level of visual intrusion is predicted for those people who would have distant views of the development i.e.; users of the footpaths on the hillsides located both to the north and to the east of the site as well as people using boats and buildings in and around Yau Tong Bay itself and areas of the harbour located further to the west.

7.4.38 Construction works for a tunnel and portal immediately to the south of the EHC toll plaza at Yau Tong, cut and cover excavation works near the toll plaza as well as the

necessary road diversion proposed immediately parallel to Cha Kwo Ling Road would represent a medium negative landscape impact but a low negative visual impact.

7.4.39 The construction of two additional tunnel portals to the north-west of YAT, one leading to QUB and the other to LAT, would also involve medium negative landscape impacts but low negative visual impacts.

7.4.40 The ventilation and works area for tunnel construction required on the site on the former squatter village to the south of Ko Chiu Road Estate would require extensive earth works to flatten the site and this would involve the loss of approximately 0.3 ha of wooded hillside.

7.4.41 The proposed works, at the various stages in their construction, would generate a high visual impact on the surrounding areas and their population. People who would experience this high level of visual impact include the residents of the Yau Tong Housing Estate and the Ko Chiu Road Housing Estate. Medium visual impacts would be experienced by those people using the road network which surrounds the bay as this category of potential viewers would only experience transitory views of the development. Low visual impacts would be experienced by workers at the industrial units along Ko Fai Road, people using the footpaths along the hill slopes to the east of the bay, people living and working on the north-eastern edge of Hong Kong Island as well as people using boats in the harbour.

Tiu Keng Leng Station and Alignment

7.4.42 The proposed alignment from TKL to TKO would pass through commercial and/or residential developments in Areas 73 and 74. These land uses however, would not be adversely affected by the alignment because they would not be completed by the time the alignment is constructed.

7.4.43 The potential loss of approximately 150 temporary houses as well as large areas of mature trees from the existing hillside would represent an impact on the existing landscape. The loss of the remaining stretch of open water and shoreline located in front of the village would result in a change in the character and value of the local landscape. However, the loss of mature trees, temporary housing, shoreline and open water will almost certainly take place as part of a more extensive redevelopment of the Tiu Keng Leng area. In view of this, it is predicted that TKL construction works would represent only a low level of impact on the character and physical elements of the local landscape.

7.4.44 The works required for the construction of an access road down to the station site as well as a construction access tunnel would generate low negative landscape impacts but medium negative visual impacts.

7.4.45 The loss of the existing low-rise housing and trees on the hill slopes and the land cuts, excavation and construction work associated with the railway, are all elements that would generate a visual impact on the surrounding areas and their populations. The people that would be affected by this visual impact include anyone living in the residential blocks that are planned to be developed in Area 72 by the time the railway development works are completed. However, it should be noted that if the proposed station is not built at this location, then the land would almost certainly be used for other developments that would generate a similar level of visual impact on the surrounding areas. In view of this, it is predicted that construction works for the station and associated structures would represent only a low level of visual impact. A low level

of visual impact is also predicted for those people using the footpaths on the surrounding hillsides as those views would be from a distance and would be in the context of a broad panorama of construction works throughout the whole of Tseung Kwan O.

Tseung Kwan O Station and Alignment

7.4.46 It is envisaged that there would be little or no land-use impact generated by the proposed development given that it is unlikely that any planned residential or commercial buildings will be built and occupied by the time the station construction works are complete.

7.4.47 There would be high negative landscape impacts associated with the construction of TKO and its adjacent sections of alignment as a result of the deep excavations that would be required for both the track and the station itself.

7.4.48 These excavations, the construction elements and the associated construction traffic are all features that would generate a high visual impact on the surrounding areas and their populations. However, it should be noted that if the proposed station is not built at this location, then the land would almost certainly be used for other developments that would generate a similar level of visual impact on the surrounding areas. In view of this, it is predicted that construction works on the station and associated structures would represent only a low level of visual impact. This low negative visual impact would be experienced by people using the clinic, the outdoor recreation centre and the schools which are being built to the north of both the station and the railway track alignment in Areas 55, 56, and 57. There would also be a low negative visual impact on users of the adjacent Roads P1, P2 and D4 as these views would be transitory and would be seen in the context of other construction projects in the Tseung Kwan O area.

Hang Hau Station and Alignment

7.4.49 The proposed alignment and station at Hang Hau would be constructed by cut and cover between Roads P1 and P2 except for the section of alignment under Pui Shing Road which may be constructed within an advance works tunnel, or if the design of the advance works tunnel proves unsuitable, a new tunnel . Although HAH is located close to existing and future residential and commercial uses, the likely land-use impacts on these adjacent areas are considered to be low given the large amount of construction work that is on-going in the area.

7.4.50 The deep excavations required for the construction of HAH and its adjacent sections of alignment would represent a high negative impact on the local landscape, especially where the alignment crosses Town Park. The proposed deep excavations into Sheung Ning Road as a result of the station box construction works would also represent a high landscape impact on the road. Alternative vehicular and pedestrian access would have to be provided for residents of On Ning Garden. The potential loss of advance planting of vegetation adjacent to Sheung Ning Road and possibly other surrounding roads is considered to be a low potential landscape impact.

7.4.51 The above excavations, the construction work on the station and the railway tracks, as well as the construction elements and associated construction traffic are all elements that would generate a negative visual impact on nearby areas and their populations. However, it should be noted that if the proposed station is not built at this location, then the land would almost certainly be used for other developments that would generate a similar level of visual impact on the surrounding areas. In view of this, it is predicted

that construction works for the station and associated structures would represent only a low level of visual impact. The people who would experience this low negative visual impact include users of the existing buildings in the immediate vicinity (i.e.; Yu Ming Court within Area 39, On Ning Garden within Area 40 and Chung Ming Court within Area 41) and any users of the schools and residential blocks that are likely to be occupied before railway construction works are completed (Ming Tak Estate in Area 34, schools in Area 37 and residential blocks in Areas 37 and 38A). Users of the local road system would experience a low negative visual impact.

Po Lam

7.4.52 There are a number of existing and future land uses which are situated close to the proposed rail line extension and station. The proposal to construct the alignment and station at-grade may pose impacts on surrounding existing residential developments. Sites immediately adjacent to the proposed rail line and station that are still undeveloped would not be severely affected by the construction activities. Potential land-use impacts resulting from construction activities are, on the whole, considered to be medium for this area.

7.4.53 The planned use of the existing 40 m wide MTR reserve, which is largely devoid of vegetation, together with the relatively small amount of excavation required for this section of the route, means that there are only low potential landscape impacts associated with the development of this section of the route. These impacts include severance of the one pedestrian link across the alignment between Roads L12 and L2 as well as excavations within the MTR reserve. The loss of this pedestrian link is considered to be a medium landuse impact. The excavations within the MTR reserve are considered to represent a low landscape impact.

7.4.54 The station, track-enclosure structures and associated excavations would, at the various stages in their construction, generate high negative visual impacts on the surrounding areas and their population. High visual impacts would be experienced by people living in existing residential blocks (Yan Ming Court, Ho Ming Court and the King Lam Estate, all located to the east of the site, Ying Ming Court and the Po Lam Estate both located to the north of the site and On Ning Court and Chung Ming Court both located to the south) as well as by users of schools and residential blocks that should be built and occupied before construction works on the railway have been completed (residential development in Area 19, commercial/residential development in Area 17 and G/IC development in Area 24).

7.4.55 Low visual impacts would be experienced by users of more distant residential blocks and construction sites, users of footpaths on the distant surrounding hill slopes as well as users of Roads P2, L12 and L12A who would experience limited and transitory views of the development. These more distant views would either be restricted in extent or be seen in the context of a wider panorama of construction works through-out Tseung Kwan O.

Mitigation Measures

Yau Tong

7.4.56 Given that the construction sites are located amidst existing developments, adequate land use mitigation measures should be employed to alleviate impacts on the adjacent sensitive receivers. Measures such as site boundary hoardings and traffic management should be provided to mitigate the potential impacts.

7.4.57 The station box should be integrated into the rock-cut slopes adjacent to Cha Kwo Ling Road so that the visual impact of any new cut slopes is minimised. Soil-cut slopes in the existing amenity open space should be regraded to minimise their visual impact and then planted up to re-establish the vegetation that was removed.

7.4.58 Station entrance structures should be carefully located to ensure that pedestrian movements around the station are not restricted and ample space should be provided for the turning of vehicles at the end of any roads that are severed by the station construction.

7.4.59 Amenity open space should be considered on the podium deck above the proposed station box to replace that which would be lost at the Ko Chiu Road/Cha Kwo Ling Road junction.

7.4.60 As much as possible of the existing vegetation, and in particular the mature trees within the fire-station site and in the amenity open space adjacent to Ko Chiu Road should be fenced off and retained if site area requirements permit. Mature trees lost during construction works should be replaced or, if they are of good form and health, they could be transplanted prior to works commencing and returned to the general area after construction works have been completed.

7.4.61 Footpath and road diversions should be provided to minimise impact on pedestrian and vehicular movements.

7.4.62 The potential for soil erosion should be reduced by minimising the extent of vegetation disturbance on site and by providing a protective cover (eg; plastic sheeting or a grass cover established by hydroseeding) over any exposed ground. All proposed structures should be carefully designed in form, size, and finishes that they are of high visual quality and are visually integrated as far as possible into the surrounding areas.

Tiu Keng Leng

7.4.63 As described above, there are no sensitive land uses that would be adversely affected by construction activities.

7.4.64 Soil-cut slopes on the hillside should be regraded to minimise their visual impact and then planted to re-establish the vegetation cover that was removed. It may be possible to provide podium-deck tree planting to compensate for that lost from the existing hill slopes by construction of the station box. The general mitigation measures proposed for construction works at YAT should also be implemented at this site.

7.4.65 Mature trees lost during construction works should be replaced or, if they are of good form and health, they could be transplanted prior to works commencing and returned to the general area after construction works have been completed.

TKO Station and Alignment

7.4.66 Tunnel boxes should be provided under any roads that are built prior to the completion of TKO Station so that potential disruption associated with the proposed railway construction works may be avoided. The general mitigation measures proposed for construction works at YAT should also be implemented at this site.

Hang Hau

7.4.67 The land-use mitigation measures proposed for the Yau Tong area are appropriate for this site.

7.4.68 Any advance planting of vegetation that is disturbed adjacent to Sheung Ning Road, Pui Shing Road, Roads D1, P1 and P2 as well as in Town Park should be reinstated after completion of the railway construction works. The general mitigation measures proposed for construction works at YAT should also be implemented at this site.

7.4.69 Mature trees lost during construction works should be replaced or, if they are of good form and health, they could be transplanted prior to works commencing and returned to the general area after construction works have been completed.

Po Lam

7.4.70 Given that existing residential and G/IC developments are located some distance away from the main construction areas, some buffer distance exists between sensitive land uses and the construction sites. Other mitigation measures, similar to those recommended for Yau Tong, should be considered for Po Lam.

7.4.71 Provision should be made for the retention of the existing pedestrian route that crosses the station area in an east-west orientation between Roads L12 and L2.

7.4.72 The general mitigation measures proposed for construction works at YAT Station should also be implemented at this site.

7.5 OPERATIONAL IMPACTS

Potential sources of impact

7.5.1 A major portion of the TKE would be constructed underground. In this regard, it is generally perceived that there is unlikely to be any potential environmental impacts on land uses located in the vicinity of these areas.

7.5.2 There are no landscape impacts that would be generated at the operational stage of the project, the potential visual impacts of the TKE at the operational stage would be largely restricted to the effect of the structures that would be built above ground level.

7.5.3 These structures include the YAT, tunnel portals and adjacent sections of track enclosure structures at Yau Tong itself; TKL; the TKO entrance structures at Tseung Kwan O town centre; HAH entrance structures at Hang Hau; and the above-ground station at Po Lam and its structures for the ticketing hall and entrance areas and the landscaped pedestrian deck between the station and Road P2. The sensitive receivers that would be affected by the visual impact of these structures include those people, identified previously, who would experience the visual impact of the structures whilst under construction.

7.5.4 Other development works may take place in the surrounding areas which would expand the sensitive receiver population in the future. However as any such developments are not committed, they cannot be taken into account in the evaluation of potential visual impacts.

Assessment Methodology

7.5.5 A broad outline assessment of existing and potential future uses of the proposed construction sites and adjoining areas has been undertaken to ascertain whether there are any land use impacts when the TKE stations are in operation and the extent of the impacts on surrounding areas when the proposed construction sites are restored to previous uses or redeveloped. Broad references to the statutory and non-statutory planning framework have been undertaken to substantiate the assessment of potential impacts on surrounding land uses.

7.5.6 The method for identifying potential landscape and visual impacts during the operational stage has involved identification of the various elements of the development at this stage. Baseline conditions and sensitive receivers have been established as above by site visits to the study area as well as by inspection of Building and Lands Department maps, Layout Plans, OZPs and aerial photographs.

7.5.7 Potential impacts on the existing landscape as a result of the railway operations have been considered but none have been identified. Areas of the surrounding landscape where views of the completed railway would be possible have then been identified together with the populations that would be affected by those views. The affected populations have been categorised into groups of sensitive receivers. An assessment has been made of the significance of these views to those receiver groups. A series of mitigation measures has then been identified to help reduce the potential impacts.

Prediction of Impacts

Yau Tong Station and Alignment

7.5.8 During the operational phase, the MTR would be serving both existing developments and potential redevelopment sites. The Yau Tong public housing estate, currently undergoing redevelopment would be sensitive to environmental impacts generated when the MTR is in operation. St Antonius Primary School is also a potential sensitive receiver.

7.5.9 In the conceptual layout plans for the Yau Tong redevelopment site, the Housing Authority had proposed single-aspect housing for areas fronting Cha Kwo Ling Road in anticipation of the potential noise problem from the road. However, the revised design for YAT will reroute Cha Kwo Ling Road which will reduce noise impacts. Given that the current design of the railway alignment and station envisage enclosing the rail line and station, the level of impact would be ameliorated. It is thus considered that the perceived environmental impacts on Yau Tong housing estate and other adjacent developments would be very low during the operational phase.

7.5.10 The completed station development at Yau Tong would comprise a station box that would protrude approximately 18 m above grade at the lowest point in Cha Kwo Ling Road. Short sections of the rail track immediately outside the station box would be at-grade before entering tunnel portals located both to the north and to the south of the site. These sections of at-grade track would be enclosed for environmental protection reasons. In addition to the rerouting of Cha Kwo Ling Road, the station box and track enclosure structures would result in the permanent closure of road junctions at both the corner of Ko Fai Road/Cha Kwo Ling Road and at the corner of Yau Tong Road/Cha Kwo Ling Road.

7.5.11 The station box and the adjacent sections of enclosure structures for the railway tracks would generate a visual impact on surrounding areas and their population. This visual impact would be experienced by users of the local road network, users of the local fire-station, students at St. Antonius Primary School, workers at the temporary structures along the water-front, as well as residential blocks both within the Yau Tong Centre and the Yau Tong Estate. More distant views of the structures would be available from hillsides located both to the north and to the east of the site as well as from Yau Tong Bay itself and areas of the harbour located further to the west.

Tiu Keng Leng Station and Alignment

7.5.12 The re-graded and re-vegetated cut-slopes, as well as the above-grade station the ticketing hall and atrium, are all elements that would generate a visual impact on the surrounding areas and their populations. The people that would potentially be affected by these visual impacts include those living in the planned Area 72 and 74 residential blocks that may be developed and occupied by the time that the operational stage of the project commences. There would be little or no impact on surrounding land-uses at the operational stage as the station and adjacent sections of alignment would be enclosed.

Tseung Kwan O Station and Alignment

7.5.13 The completed atrium structure for the station entrance would protrude above ground level and that this structure would generate a visual impact on the surrounding areas and their populations. These visual impacts would affect any people using the G/IC developments that are being built nearby (the clinic, the indoor recreation centre and the schools, approximately 200 m to the north of the station site) in Areas 55, 56 and 57. There would also be visual impacts on users of the adjacent Roads P1, P2 and D4.

Hang Hau Station and Alignment

7.5.14 The completed atrium structure for the station entrance would protrude above ground level and this structure would generate a visual impact on the surrounding areas and their populations. The people who would experience this visual impact include users of the local road system, users of the existing buildings in the area as well as users of those buildings that would be built and occupied by the time that the operational stage of the development commences i.e.; people in Area 37 (schools and residential buildings), in Area 34 (Ming Tak Estate) and in Area 38A (residential development). Existing residential developments, where people would experience visual intrusion include Yu Ming Court within Area 39, On Ning Garden within Area 40 and Chung Ming Court within Area 41. No land-use, landscape or visual impacts are predicted for the sections of alignment located either side of the station as the tracks would be below-grade.

Po Lam Station and Alignment

7.5.15 The final design for the tracks between Road P2 and Po Lam station is within enclosed structures. No landscape or land-use impacts are predicted at operational stage.

7.5.16 It is planned that the completed POL station would comprise a substantial atrium and ticketing hall above the at-grade railway tracks. There would, in addition, be a an enclosed section of track between the station and Road P2 which would have a landscaped pedestrian deck provided on top of the structure.

7.5.17 The station and enclosure structures are elements that would generate visual impacts on the surrounding areas and their population. This potential receiver population includes

residents of existing residential developments (Yan Ming Court, Ho Ming Court and the King Lam Estate, all located to the east of the site, Ying Ming Court and the Po Lam Estate both located to the north of the site and On Ning Court and Chung Ming Court both located to the south) as well as users of schools and residential blocks that should be built and occupied by the time the operational stage of the development commences (residential development in Area 19, commercial/residential development in Area 17 and G/IC development in Area 24). Other visually sensitive receivers include users of more distant residential blocks and construction sites, users of footpaths on the distant surrounding hill slopes as well as users of Roads P2, L12 and L12A.

Evaluation of Impacts

Yau Tong Station and Alignment

7.5.18 There are a number of existing and proposed land uses which may be affected by the proposed MTR extension to Yau Tong. The current design, which assumes enclosure of the alignment and station, will with the exception of impacts on the surrounding road network substantially mitigate the potential impacts on these land-uses.

7.5.19 The closure of Cha Kwo Ling Road and the road junctions at both the corner of Ko Fai Road/Cha Kwo Ling Road and the corner of Yau Tong Road/Cha Kwo Ling Road, at operational stage as well as construction stage would represent a high level of disturbance to vehicular movements in the area.

7.5.20 The station box and the adjacent sections of enclosure structures for the railway tracks would generate a high visual impact on some of the surrounding areas and their population. This high visual impact would be experienced by students at St. Antonius Primary School, as well as people living in the residential blocks both within the Yau Tong Centre and the Yau Tong Estate. More distant views of the structures would be available from hillsides located both to the north and to the east of the site as well as from Yau Tong Bay itself and areas of the harbour located further to the west. Viewers at these distant locations, together with users of the adjacent road system, users of the local fire-station as well as workers at the temporary structures along the water-front, would experience a low visual impact.

Tiu Keng Leng Station and Alignment

7.5.21 The re-graded and re-vegetated cut-slopes adjacent to the station box would generate a visual impact on the surrounding areas and their populations. However, other developments which would probably have an equal or greater visual impact, would almost certainly be built on this site if a station is not developed here. In view of this and the fact that the station would be part of the Tseung Kwan O urban area, it is predicted that the cut-slopes and station structures, which include the ticketing hall and atrium, would generate only a low visual impact. The people that would potentially be affected by this low visual impact include those living in the residential blocks planned in Areas 72, 73 and 74. There would be a low visual impact on users of the adjacent roads as these users would only experience transitory views of the completed development.

Tseung Kwan O Station and Alignment

7.5.22 It is predicted that the impacts on adjacent land uses would be low as the proposed railway and much of the station would be below ground.

7.5.23 The station structure would protrude above ground level at this site. However, other developments which would probably have an equal or greater visual impact, would almost certainly be built on this site if it a station is not developed here. In view of this and the fact that the station would be part of the Tseung Kwan O urban area, it is predicted that the station structure would generate only a low visual impact. This low visual impact would affect any people using the G/IC developments that are being built nearby (the clinic, the indoor recreation centre and the schools, approximately 200 m to the north of the station site) in Areas 55, 56 and 57. There would be a low visual impact on users of the adjacent Roads P1, P2 and D4 as these users would only experience transitory views of the completed development.

Hang Hau Station and Alignment

7.5.24 It is predicted that the impacts on adjacent land uses would be low as the proposed railway and much of the station would be below ground.

7.5.25 The completed atrium structure for the station entrance would protrude above ground level and this structure would generate a visual impact on the surrounding areas and their populations. However, other developments which would probably have an equal or greater visual impact, would almost certainly be built on this site if a station is not developed here. In view of this and the fact that the station would be part of the Tseung Kwan O urban area, it is predicted that the station structure would generate only a low visual impact. The people who would experience this low visual impact include users of the local road system, users of the existing buildings in the area as well as users of those buildings that would be built and occupied by the time that the operational stage of the development commences (people in Area 37 (schools and residential buildings), in Area 34 (Ming Tak Estate) and in Area 38A (residential development)). Existing residential developments, where people would experience visual intrusion include Yu Ming Court within Area 39, On Ning Garden within Area 40 and Chung Ming Court within Area 41. There would be a low visual impact on users of the adjacent roads as these users would only experience transitory views of the completed development.

Po Lam Station and Alignment

7.5.26 There would be minimal land use impacts during the operational phase as tracks and station structure would be enclosed.

7.5.27 POL will comprise a substantial atrium and ticketing hall above the at-grade railway tracks. There would, in addition, be a an enclosed section of track between the station and Road P2 which may have a landscaped pedestrian deck provided on top of the structure.

7.5.28 The station and enclosure structures are elements that would generate visual impacts on the surrounding areas and their population. However, it should be noted that if the proposed station is not built at this location, then the land would almost certainly be used for other developments that would have a similar visual impact on the surrounding areas. In view of this and the fact that the station would be part of the Tseung Kwan O urban area, it is predicted that the station and associated structures would generate only a low visual impact.

7.5.29 This potential receiver population, which would experience a low visual impact, includes residents of existing residential developments (Yan Ming Court, Ho Ming Court and the King Lam Estate, all located to the east of the site, Ying Ming Court and the Po Lam Estate both located to the north of the site and On Ning Court and Chung

Ming Court both located to the south) as well as users of schools and residential blocks that should be built and occupied by the time the operational stage of the development commences (residential development in Area 19, commercial/residential development in Area 17 and G/IC development in Area 24). Visually sensitive receivers who would also experience a low visual impact include users of more distant residential blocks and construction sites, users of footpaths on the distant surrounding hill slopes as well as users of Roads P2, L12 and L12A.

Mitigation Measures

7.5.30 Appropriate measures must be implemented to mitigate potential impacts on both existing and proposed land-uses surrounding the railway development sites. As described above, the completed station boxes, entrance structures, tunnel portals and sections of enclosed track would all generate visual impacts on the surrounding areas and their population. The external appearance of all above-ground structures should be appropriately detailed so that these structures are visually integrated as much as possible into the surrounding urban area. The potential visual impact of these structures may be further reduced by the planting of vegetation in the spaces around these structures.

7.6 CONCLUSIONS

7.6.1 On the whole, the potential impacts on existing and proposed land uses surrounding the stations and alignment are predicted to be low as the rail extension will be constructed below ground or enclosed. Except for Yau Tong, areas surrounding the proposed development sites are generally not adversely affected by the proposed alignment and station development as adequate reserves have been provided. Suggested mitigation measures for the Yau Tong area would ensure alleviation of negative environmental impacts on sensitive land uses in the vicinity.

7.6.2 Construction of the TKE would generate low to high landscape and visual impacts on the proposed sites, the surrounding areas and their populations, although these would be temporary. The recommended mitigation measures should be implemented to help reduce these potential impacts. There would be large losses of existing mature trees as a result of station construction works at Tiu Keng Leng. There are opportunities for the re-provision of any lost amenity open space by developing podium-deck facilities above the station boxes. The stations must be appropriately designed to reduce their potential visual impacts and to visually integrate them into the surrounding urban areas. No landscape impacts would be generated at operational stage and the potential visual impacts at this stage would generally be low.

7.6.3 Where the areas around the stations remain the responsibility of the MTRC, the success of landscape restoration measures should be monitored and maintained by the MTRC for at least the first two years after the completion of the construction works.

8 ENVIRONMENTAL MONITORING AND AUDIT

8.1 INTRODUCTION

8.1.1 In this Section, recommendations for the TKE EM&A are outlined, taking account of the findings of the DEIA and the environmental protection criteria requirements to be incorporated into the Detailed Design and Construction contracts.

8.1.2 This DEIA has identified that EM&A will only be necessary for air quality and noise impacts during the construction of the TKE. No water sensitive receivers are predicted to be affected during either the construction or operation of the TKE and any potential impacts on the local drainage system will be controlled by the requirements of the wastewater discharge licence. No adverse impacts have been identified during the operational phase which cannot be effectively controlled through, as in the case of vent locations, specified design criteria.

8.1.3 The MTRC will undertake the EM&A work required during the construction of the TKE. 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.

8.1.4 *Figure 8.1a* shows the inter-relationships between the implementation of mitigation measures, the EM&A programme and the ECPs roles of each of these respective elements is further discussed below.

8.1.5 More detailed recommendations for the EM&A programme, including monitoring locations and equipment and monitoring and audit protocols, are set out in the accompanying initial version of the TKE EM&A Manual. The Manual follows the recommendations of the *Generic Environmental Monitoring and Audit Manual, Environmental Protection Department, May 1996.* The EM&A Manual is based on the current information available from the TKE Preliminary Design and it is expected to undergo a number of revisions as the DEIA is completed and engineering designs are revised by the Detailed Design Consultants.

8.2 ENVIRONMENTAL MONITORING AND AUDIT

8.2.1 The overall objectives of the EM&A programme which will be undertaken during the construction and operation of the TKE 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 the 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 TKE may be determined; and
- to verify the environmental impacts predicted in the TKE DEIA.

8.2.2 The monitoring will be undertaken by MTRC site staff under the direction of the Construction Manager (CM) and will consist of:

- In the construction phase, the DEIA has identified sensitive receivers near the TKE worksites where noise and dust monitoring will be required. Impacts on water sensitive receivers will not be monitored, however, site discharges will be monitored, as necessary, in accordance with the site discharge licences.

- In the operational phase only noise, and in emergencies, exhaust air from the ventilation systems have been identified as potential adverse impacts. These are not predicted to affect sensitive receivers and will not need to be monitored as part of the EM&A programme, as their effects will be checked against the established criteria during plant commissioning.

8.2.3 The monitoring locations will be selected to represent the sensitive receivers identified in the preceding *Sections* of the DEIA. Preliminary locations for the monitoring stations have been identified in the accompanying initial version of the TKE EM&A Manual and these will be confirmed as the development programmes for the receivers become available.

8.2.4 Other monitoring will be undertaken by MTRC during the construction of the TKE, although this will not relate directly to the EM&A programme. During blasting for tunnelling works, vibration monitoring will be carried out to ascertain that no damage to structures is being caused and water quality monitoring may be required for the waste water discharge licence.

8.2.5 In order that the environmental monitoring may be audited, MTRC will establish strict procedures and protocols for carrying out, recording and reporting this work in the tender requirements. These procedures, protocols and reporting formats will be set out in an EM&A Manual.

8.3 EVENT CONTINGENCY PLANS

8.3.1 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 TKE 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.

8.3.2 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 TKE 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.

8.4 *REPORTING*

8.4.1 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 significance 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.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

9.1.1 The impacts identified in this DEIA were derived from information contained in the TKE Preliminary Design for construction sites, methodologies and equipment, which are likely to be subject to change, being dependent on the preferred methodology of the successful Tenderer. However, the current findings clearly demonstrate that practicable mitigation measures are available to control the worst case scenarios identified in *Sections 2-7*.

9.1.2 Whilst varying levels of construction impacts have been predicted, no insurmountable environmental problems have been identified at any of the locations considered in this assessment. No adverse operational impacts have been identified, largely due to the primarily underground location of the TKE.

9.2 CONCLUSIONS

Air Quality

9.2.1 Since the tunnel and station construction sites will be located in a developed or developing urban area, and the majority of land uses are close to the potential sites are residential and educational, dust impacts are unavoidable. However, sufficient mitigation measures and control can be incorporated in the planning and design stage in order to reduce the likely dust impacts on the ASRs to within the acceptable limits of the AQO.

9.2.2 1-hour TSP predictions at a number of ASRs exceed the recommended limit of 500 $\mu g\ m^{-3}$, however, additional mitigation measures for improved dust control, which will reduce levels to below the established criterion, have been identified.

9.2.3 Adverse impacts on air quality during the operation of the TKE are not expected as no likely sources were identified.

Noise and Vibration

9.2.4 This assessment has predicted that unmitigated construction noise associated with the TKE would cause adverse noise impacts at the nearby NSRs. Mitigation has been recommended to alleviate the high levels of construction noise to within the ProPECC guidelines.

9.2.5 There will be no adverse noise impacts at the NSRs from fixed plant noise during the operational phase of the TKE provided that the recommended maximum noise levels are incorporated into the design of the fixed plant.

Water Quality

9.2.6 Based on the separation distance of the alignment and station work sites from Victoria Harbour and the few local watercourses, it is considered that there will be no impacts upon WSRs from either the construction or operation of the TKE.

9.2.7 One area of concern is the potential for the discharge of waste wasters with excessive SS loadings that may disrupt the local drainage system. It is considered that the quantities of water involved can be readily controlled by the recommended measures, such that the quality of waste water leaving the site will be of a sufficient standard to meet the discharge licence requirements.

9.2.8 Operational water quality impacts could be readily mitigated through the installation and maintenance of appropriate interceptors and drainage. Provided there is compliance with the WPCO effluent discharge standards, there will be no unacceptable water quality impacts associated with the TKE.

Waste

9.2.9 Provided that the recommendations put forward in this report are followed, no unacceptable waste related environmental impacts as a result of the storage, handling, collection, transport, and disposal of wastes arising from the TKE construction and operation are predicted. Available capacity, in excess of the project requirements, has been identified both at public dumps and fill sites, ensuring that disposal of excavated materials will not be a problem.

9.2.10 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 wastes. Industrial and chemical waste from maintenance activities will be limited to station maintenance and the disposal of these wastes will have to meet the requirements of the relevant legislation.

9.2.11 The source/pathway/target analysis in the *Sai Tso Wan Landfill Interim Qualitative Risk Assessment, ERM, July 1997* (IQRA) has identified the overall risk from landfill gas migration from Sai Tso Wan Landfill to be *medium* to *high* for the westbound tunnel and *medium* for the eastbound tunnel. In order to ensure the safe operation of the tunnels, therefore, recommendations have been made for a number of protection measures to be included in the design of the tunnels and for their operation. Similarly, comprehensive precautionary measures have been recommended to ensure that the tunnels can be constructed in safety. Provided that these recommendations are followed, there should be minimal risk of landfill gas affecting the railway.

9.2.12 The potential environmental impacts from landfill gas following venting of the exhaust air from the tunnels are considered to be negligible taking into account the expected initial low concentrations and the amount of dilution that will occur.

9.2.13 The IQRA also assessed the overall risk from leachate migration within groundwater from the Sai Tso Wan Landfill to either tunnel as being *very low* to *low*. However, a number of precautionary and protection measures have been recommended to further reduce any potential risks.

9.2.14 A further 5 months of landfill gas and groundwater monitoring will be undertaken after which the findings of the IQRA will be reviewed and a Final Report produced.

Ecology

9.2.15 This study has revealed that, with the exception of the areas around the YAT-TKL tunnel portals and associated construction sites, there are no ecological concerns for the project. Where possible, protective measures are recommended, however, based on

these preliminary findings, unacceptable impacts to ecological resources are not anticipated.

Landuse and Visual Impacts

9.2.16 Although temporary, the land use impacts of the proposed construction sites are generally high, due to the proximity of sensitive land uses; for some sites there will also be traffic issues to be considered and mitigation measures should be introduced to alleviate these impacts. Wherever possible, construction sites should be restored to their previous uses which are generally compatible with the existing developments in the vicinity. There will be, however, no mitigation measures needed during the operational stage as the TKE will be entirely enclosed or in tunnel.

9.2.17 The proposed construction works will generate a high level of temporary visual impacts irrespective of which sites are selected for the works, however, a number of opportunities exist to mitigate these impacts. No significant potential impacts are predicted at the operational stage of the project.

9.3 RECOMMENDATIONS

9.3.1 It is proposed that the successful Tenderer be required to produce an Environmental Management Plan (EMP) which will address the potential impacts and necessary mitigation measures identified in the DEIA (see *Table 9.3a*) in the light of any changes the status of nearby land uses and the Contractor's preferred construction programme. In addition, this DEIA has identified a series of environmental protection criteria which the Contractor will be required to achieve and with which the MTRC will be able to monitor environmental quality through a rigorous EM&A programme.

9.3.2 Recommendations for the EMP and EM&A Manual are provided below.

Air Quality

9.3.3 Air quality impacts will need to be reassessed in the light of any changes to the construction programme and methodology described in the DEIA. The following updated and definitive information will then be required for the EMP:

- location and layout of construction sites including portal positions;
- construction schedules and plant inventories;
- quantities of excavated material;
- identification of all ASRs; and
- records of wind speed and direction and background TSP levels.

Noise and Vibration

9.3.4 Noise impacts will also need to be reassessed in the light of any changes in the final construction programme and methodology. The following information will then be required for the EMP:

- location and layout of construction sites including portal positions;
- construction schedules and plant inventories;
- identification of all NSRs; and
- local background noise levels.

Table 9.3a Implementation of Mitigation Measures

Mitigation Measure	Site Preparation	Excavation	Structures	Reinstatement	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	HAH	HAH	HAH	HAH	-
Blast Suppression	-	YAT & TKL Portals	-	-	-
Vent Orientation	-	-	-	-	All sites
Noise					
Use of Quiet Plant	POL	POL	-	POL	-
Quiet Plant and Moveable Barriers	TKO	TKO	TKO & POL	TKO	-
Quiet Plant, Moveable Barriers and Limited Numbers of Plant	YAT & HAH	YAT & HAH	YAT & HAH	YAT & HAH	-
Glazing for Schools	YAT, HAH & POL	YAT, HAH & POL	YAT, HAH & POL	YAT, HAH & POL	-
Acoustic Control of Vents	-	-	-	-	Stations
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	-
Station and Tunnel Drainage	-	-	-	-	Stations
Landuse and Visual					
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

Details will also be required of the precise location and orientation of vent louvres to check operational noise and emergency ventilation impacts.

9.3.5 It has not been possible at this stage to undertake detailed predictions of the impacts which may be caused by vibration from the operational railway, due to a lack of detailed information on the locations and nature of existing foundations and other sub-surface structures along the proposed alignment. This aspect will need to be addressed in detail by the successful Tenderer although experience with the current MTR indicates that this will not result in adverse impacts.

Water Quality

9.3.6 It is considered that further water quality assessment work will be required for the EMP to develop the necessary control and treatment systems to meet the wastewater discharge licence requirements.

Waste Management

9.3.7 Further refinement of the recommendations for waste management during construction and operation will be possible in the EMP when more accurate information on waste arisings will be available. The necessary construction phase information requirements are detailed above for air quality. It is envisaged that the operational requirements will be developed by the MTRC a later stage, when better information will be available on the numbers and activities of interchange users.

Ecology

9.3.8 It is recommended that a survey of the works areas is undertaken by the Contractor to determine and map the distribution and abundance of vegetation types and to locate large trees and other vegetation which should be protected or replaced. This mapping will provide the basis for site restoration.

Landuse and Visual Impact

9.3.9 The options for the mitigation of landuse and visual impacts during the construction phase will need to be reassessed when the construction sites and methodologies have been confirmed. Operational impacts will be controlled by the appropriate design and planning of the stations and associated infrastructure to become an integral part of the new towns along the alignment.

Mitigation Measures

9.3.10 Mitigation measures to control air quality, noise, water quality, waste, ecological, landuse and visual impacts have been identified and put forward in the DEIA, based upon the Preliminary Design of the TKE. These are listed in the initial version of the TKE EM&A Manual for guidance, but will be subject to change, before the construction works commence, to reflect the General and Particular Specifications of the DDC and D&C contracts and the proposals of the successful Contractor's EMP.

Environmental Monitoring and Audit

9.3.11 An initial version of the TKE EM&A Manual has been produced as part of the DEIA and this document will be updated by the MTRC, to accompany the Contractor's EMP. The EM&A Manual will concentrate on the monitoring of TSP and noise impacts during

construction works as other adverse impacts are not anticipated. The basic requirements for the EM&A Manual have been set out in *Section 8.0*, these include:

- representative TSP and noise monitoring locations for all sensitive receivers;
- the types of monitoring equipment to be used; and
- the recommended EM&A procedures.

9.3.12 It is also recommended that auditing of waste streams should be planned to determine if wastes are being managed in accordance with approved procedures and the site waste management plan and if waste reduction targets are being achieved and could be improved. Audits should look at all aspects of waste management including waste generation, storage, recycling, treatment, transport, and disposal.

Annex A

Glossary of Abbreviations used in the DEIA

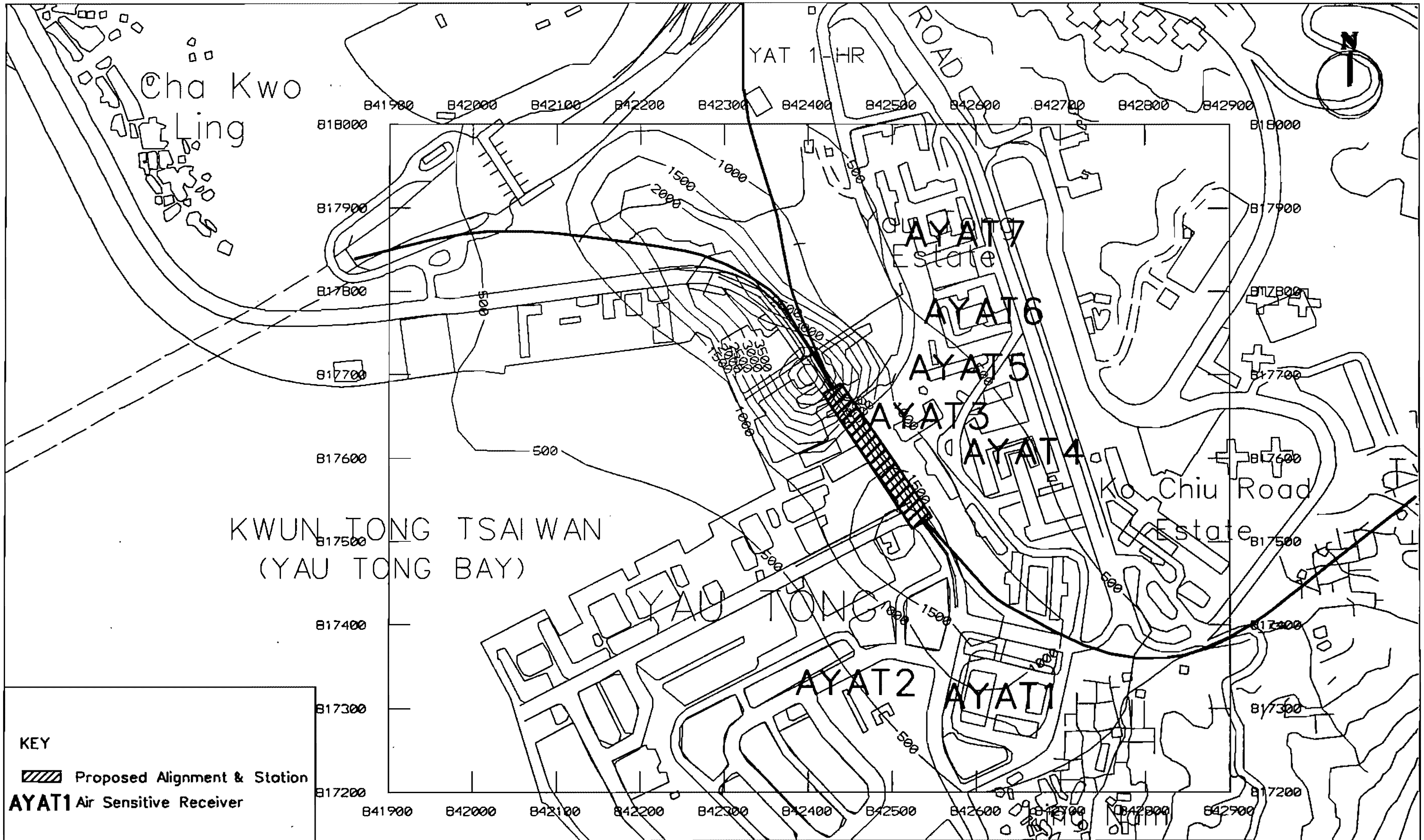
GLOSSARY

AIR	Asbestos Inspection Report
ANL	Acceptable Noise Level
AP-42	Compilation of Air Pollutant Emission Factors, 5th Edition, US Environmental Protection Agency, 1996
APC(A)O	Air Pollution Control (Amendment) Ordinance No 13, 1993, Part IX, Sections 69 to 73
APCO	Air Pollution Control Ordinance (Cap 311)
AQO	Air Quality Objective
ASR	Air Sensitive Receiver (*Section* 2)/Area Sensitivity Rating (*Section* 3)
BNL	Basic Noise Levels
BOD_5	5 day biological oxygen demand
CDG	completely decomposed granite
CDV	completely decomposed volcanics
CED	Civil Engineering Department
CLP	China Light and Power Company
CM	Construction Manager
CNL	Corrected Noise Level
CNP	Construction Noise Permit
CoP	Code of Practice
CWTF	Central Waste Treatment Facility
D&C	Design and Construct
DDC	Detailed Design Consultancy
DEIA	Detailed Environmental Impact Assessment
DO	Dissolved Oxygen
ECP	Event Contingency Plan
EFS	Environmental Feasibility Study
EHC	Eastern Harbour Crossing
EM&A	Environmental Monitoring and Audit
EPD	Environmental Protection Department
FDM	Fugitive Dust Model
FMC	Fill Management Committee
GI/C	Government/Institution/Community
HAH	Hang Hau Station
HKIL	Hong Kong Island Line
HKHA	Hong Kong Housing Authority
HKPSG	Hong Kong Planning Standards and Guidelines
HOS	Home Ownership Scheme
KTL	Kwun Tong Line
LAR	Lantau and Airport Railway
LAT	Lam Tin Station
M&Q	Mines and Quarries Division
MN9T	Tseung Kwan O Extension Final Preliminary Design and Cost Estimates, Maunsell et al, May 1996
MTRC	Mass Transit Railway Corporation

NCO	Noise Control Ordinance
NSR	Noise Sensitive Receiver
OZP	Outline Zoning Plan
PME	Powered Mechanical Equipment
PNL	Predicted Noise Level
POL	Po Lam Station
ppV	peak particle velocity
ProPECC	Professional Persons Environmental Consultative Committee
PSPS	Private Sector Participation Scheme
PTI	Public Transport Interchange
RCP	Refuse Collection Point
RSP	Respirable Suspended Particulates
SENT	South East New Territories Landfill
SS	Suspended Solids
SSSI	Site of Special Scientific Interest
SWL	Sound Power Level
TKE	Tseung Kwan O Extension
TKO	Tseung Kwan O Station
TM	Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
TM1	Technical Memorandum on Noise From Construction Work Other Than Percussive Piling
TM2	Technical Memorandum on Noise From Percussive Piling
TM3	Technical Memorandum on Noise from Construction Work in Designated Area
TM4	Technical Memorandum on Noise from Places Other Than Domestic Premises, Public Places or Construction Sites
TSP	Total Suspended Particulates
WCR	Western Coast Road
WCZ	Water Control Zone
WDO	Waste Disposal Ordinance
WPCO	Water Pollution Control Ordinance
WQO	Water Quality Objective
WSD	Water Supplies Department
WSR	Water Sensitive Receiver

Annex B

Construction Dust Contour Maps



PREDICTED 1 HR AVERAGED TSP CONCENTRATIONS AT YAU TONG

$\mu g\ m^{-3}$

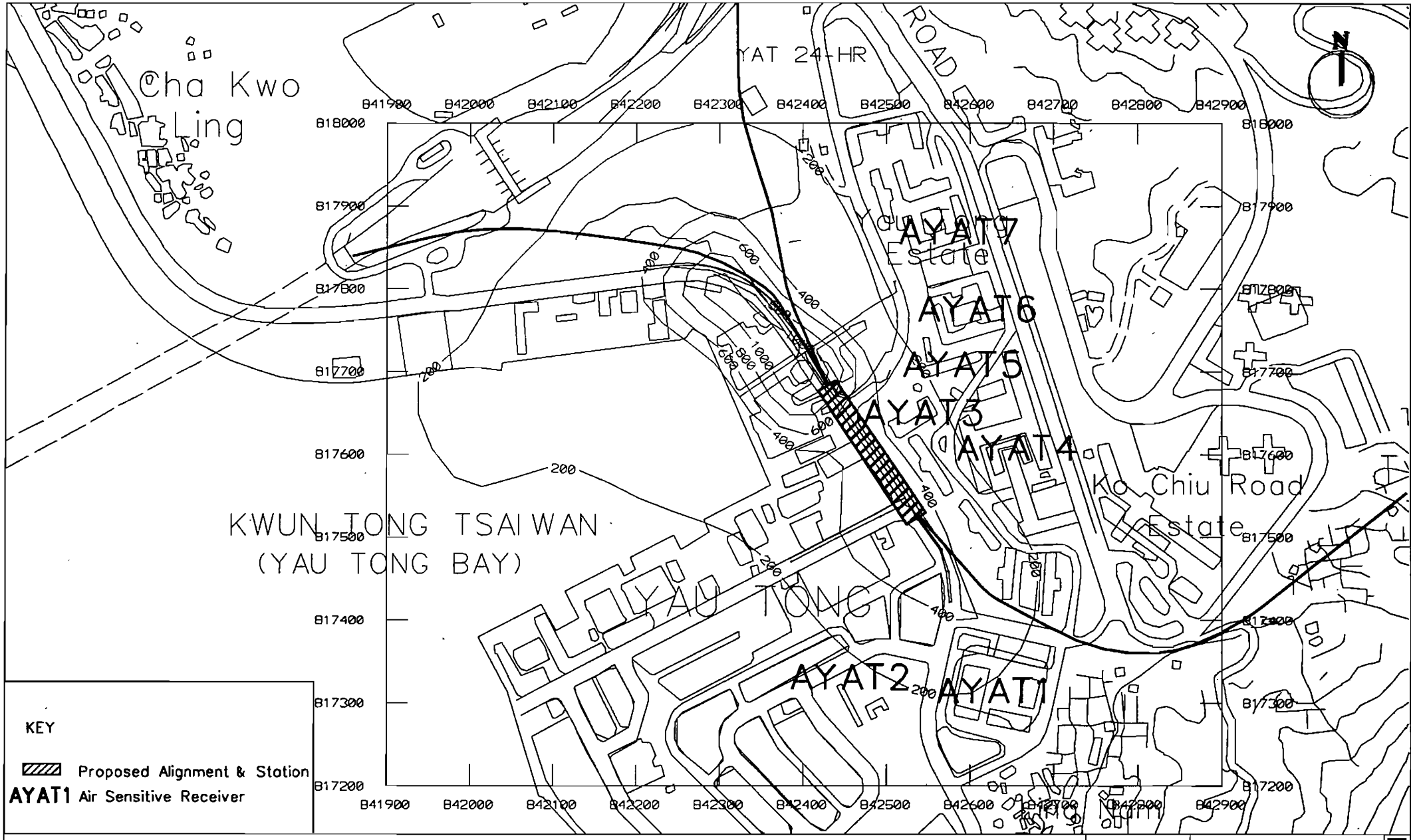
MAUNSELL CONSULTANTS ASIA LTD

DATE: AUG 96

SCALE: NTS

FIGURE No. B1.1a

Maunsell

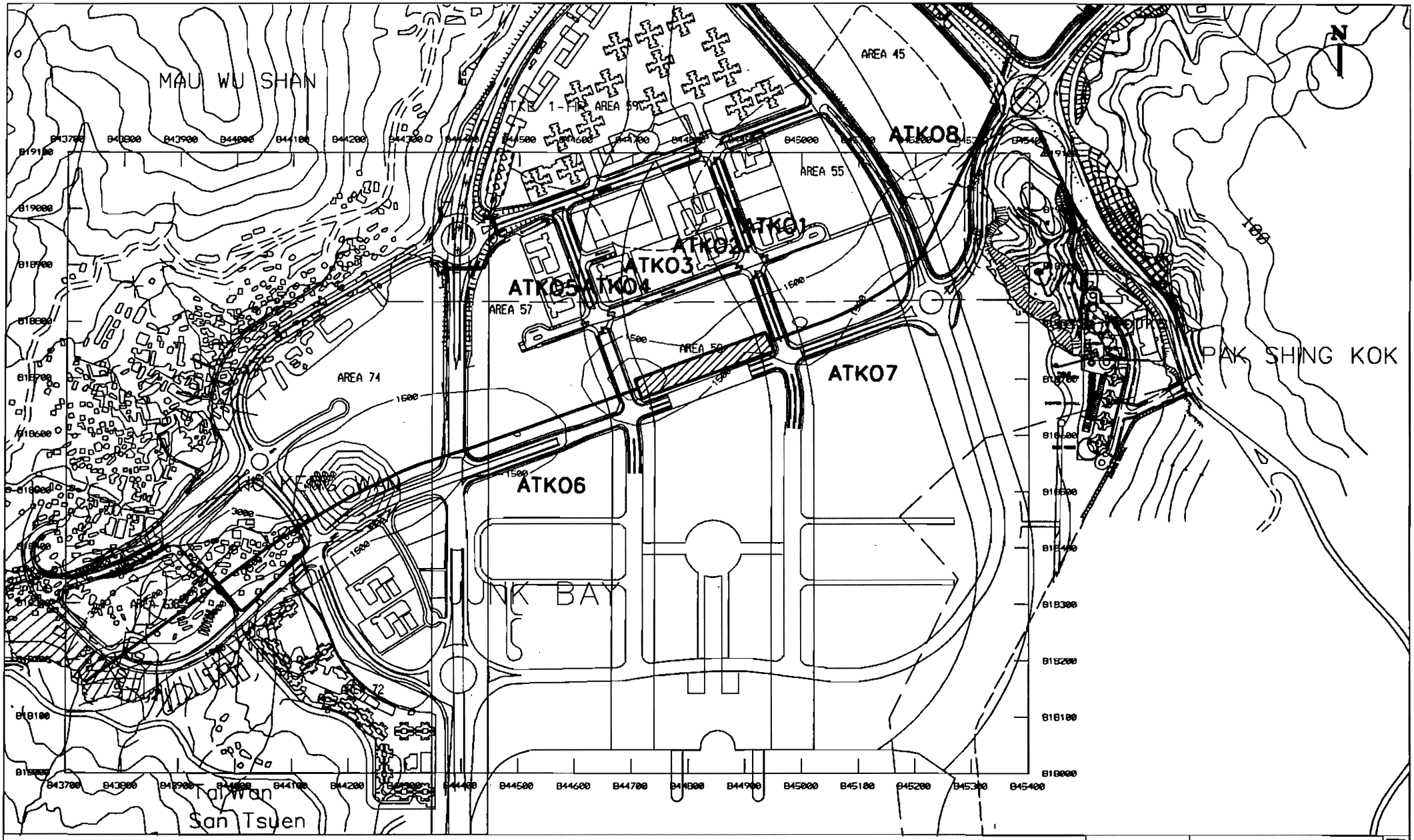


MAUNSELL CONSULTANTS ASIA LTD
茂盛工程顧問有限公司

PREDICTED 24 HR AVERAGED TSP CONCENTRATIONS AT YAU TONG
$\mu g\ m^{-3}$

DATE: AUG 96
SCALE: NTS
FIGURE No. B1.1b

Maunsell



Proposed Alignment & Station

ATKO1 Air Sensitive Receiver

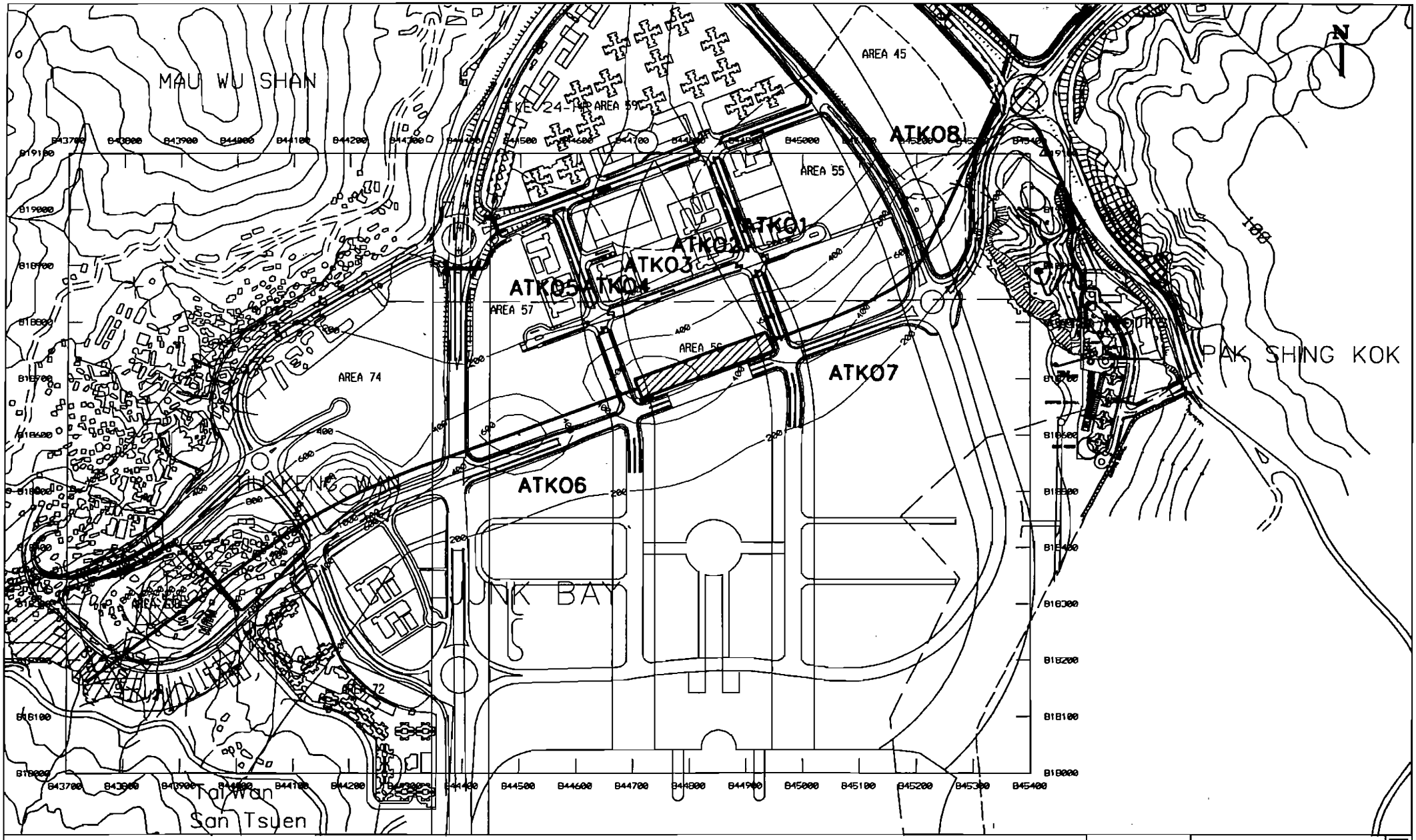
PREDICTED 1 HR AVERAGED TSP CONCENTRATIONS AT TSEUNG KWAN O

MAUNSELL CONSULTANTS ASIA LTD

DATE: NOV 95

SCALE: NTS

FIGURE No. B1.1c



Proposed Alignment & Station

ATK01 Air Sensitive Receiver

PREDICTED 24 HR AVERAGED TSP CONCENTRATIONS AT TSEUNG KWAN O

MAUNSELL CONSULTANTS ASIA LTD

DATE: NOV 95

SCALE: NTS

FIGURE No. B1.1d

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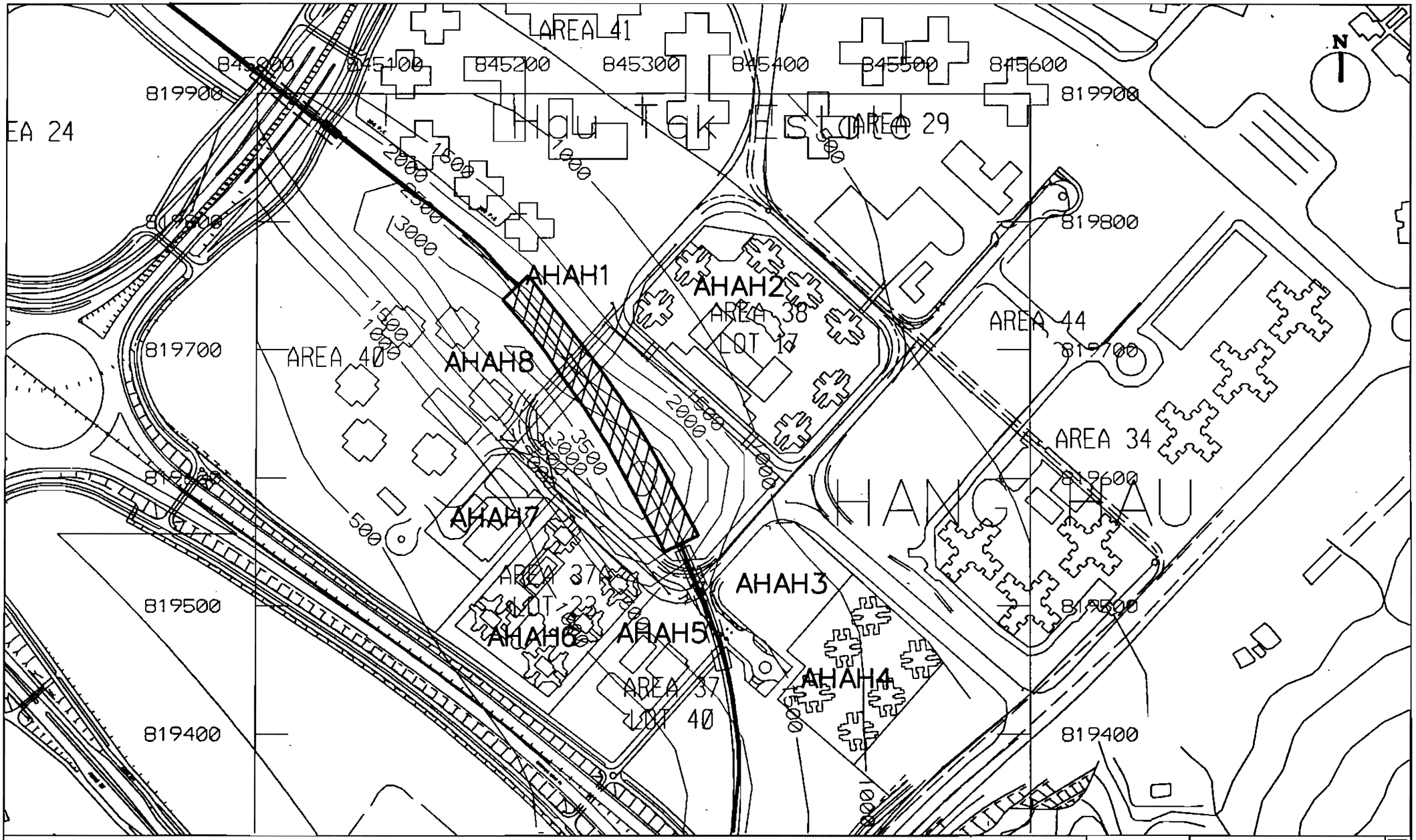


Proposed Alignment & Station

AHAH1 Air Sensitive Receiver

PREDICTED 1 HR AVERAGED TSP CONCENTRATIONS AT HANG HAU

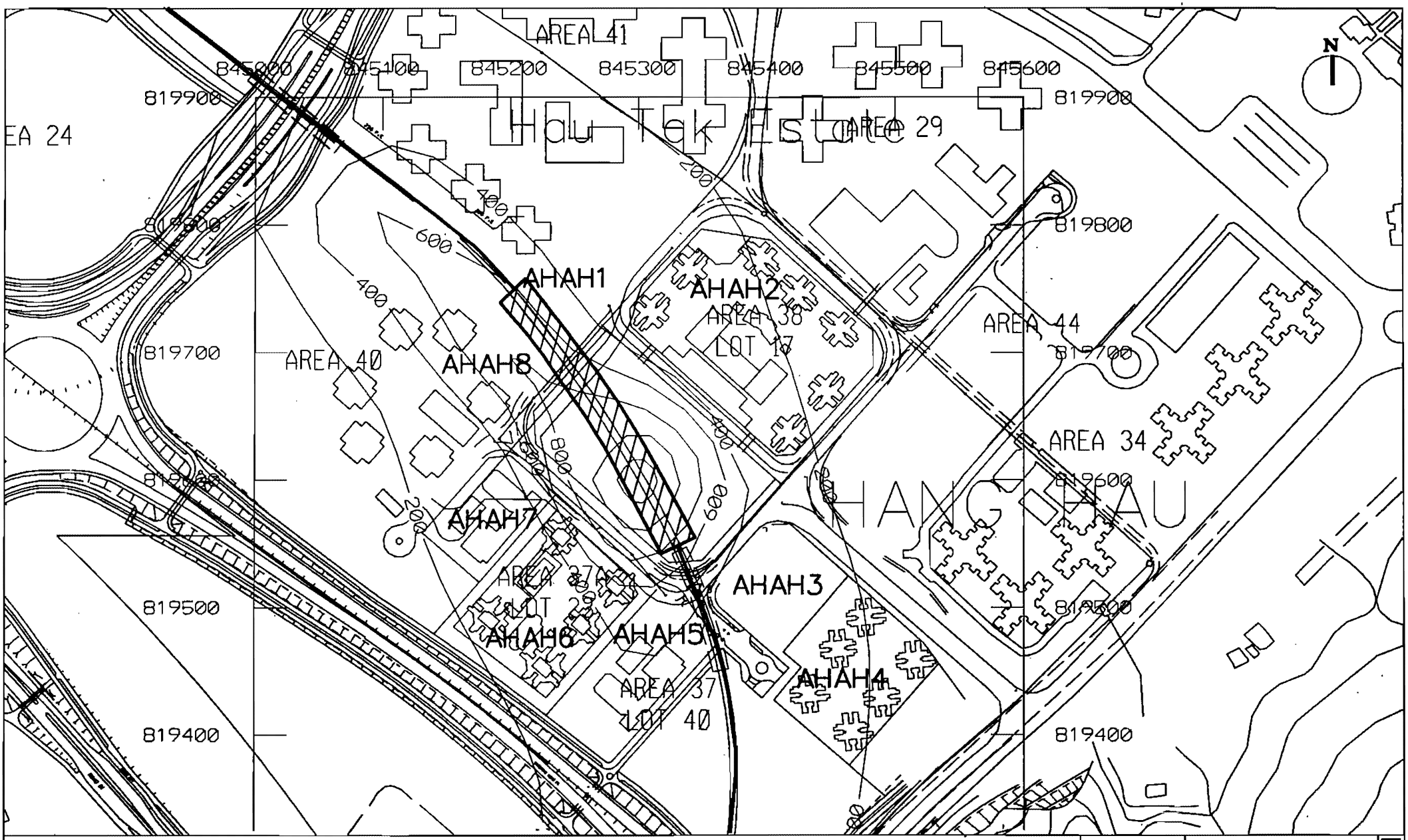
MAUNSELL CONSULTANTS ASIA LTD

DATE: AUG 95

SCALE: NTS

FIGURE No. B1.1e

Maunsell



Proposed Alignment & Station

APOL1 Air Sensitive Receiver

PREDICTED 1 HR AVERAGED TSP CONCENTRATIONS AT PO LAM

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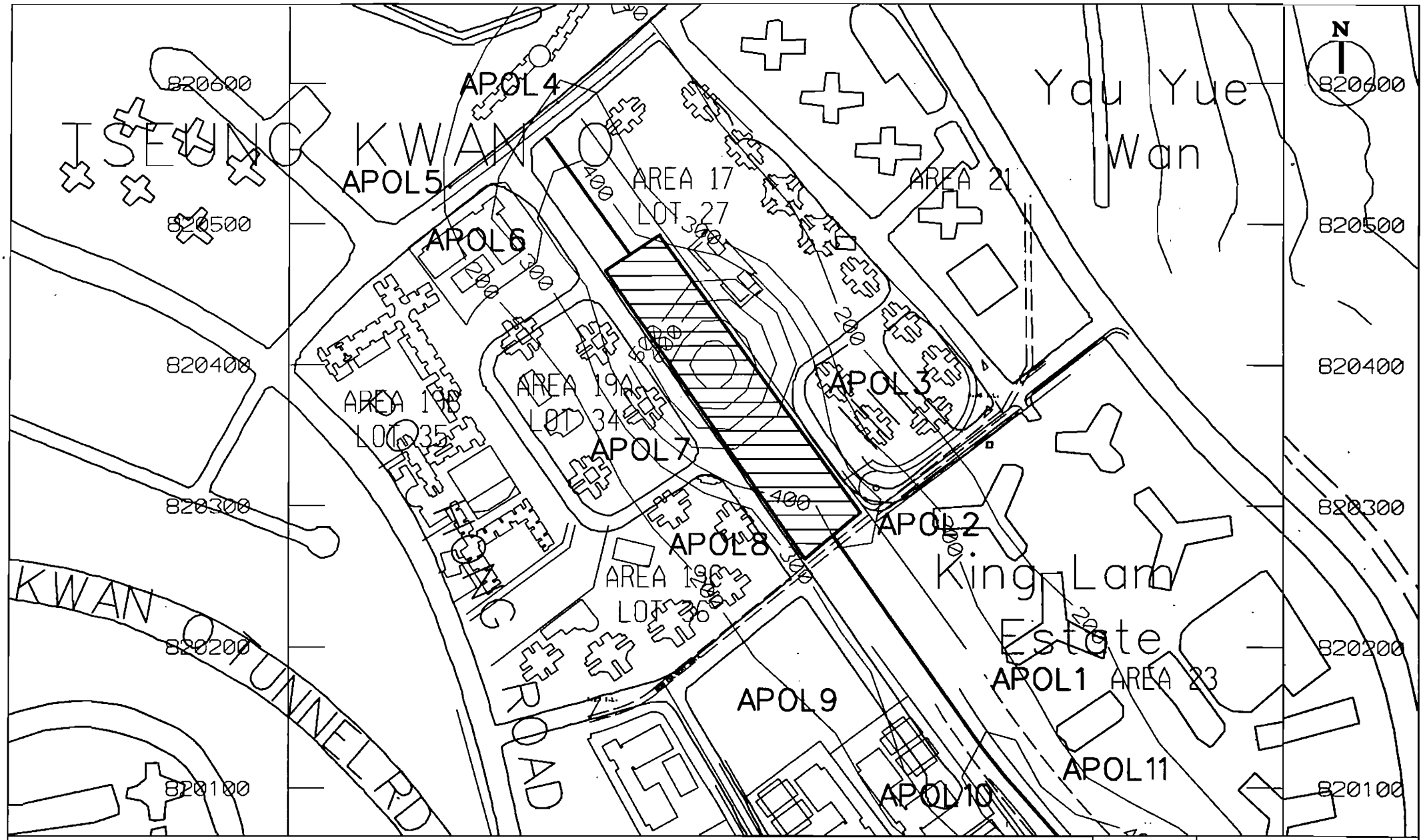
SCALE: NTS

FIGURE No. B1.1g

Maunsell



Proposed Alignment & Station

APOL1 Air Sensitive Receiver

PREDICTED 24 HR AVERAGED TSP CONCENTRATIONS AT PO LAM

MAUNSELL CONSULTANTS ASIA LTD

DATE: NOV 95

SCALE: NTS

FIGURE No. B1.1h

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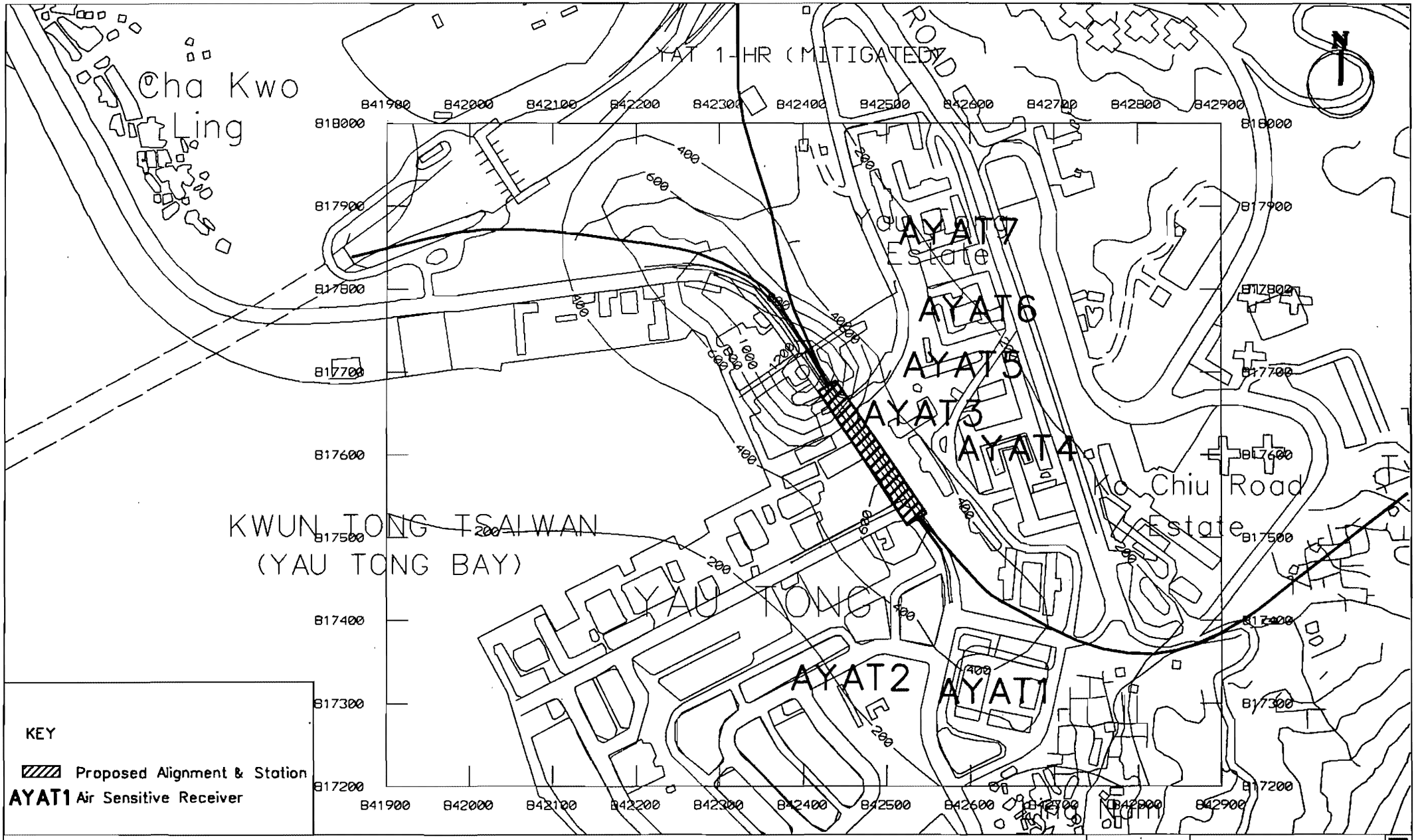
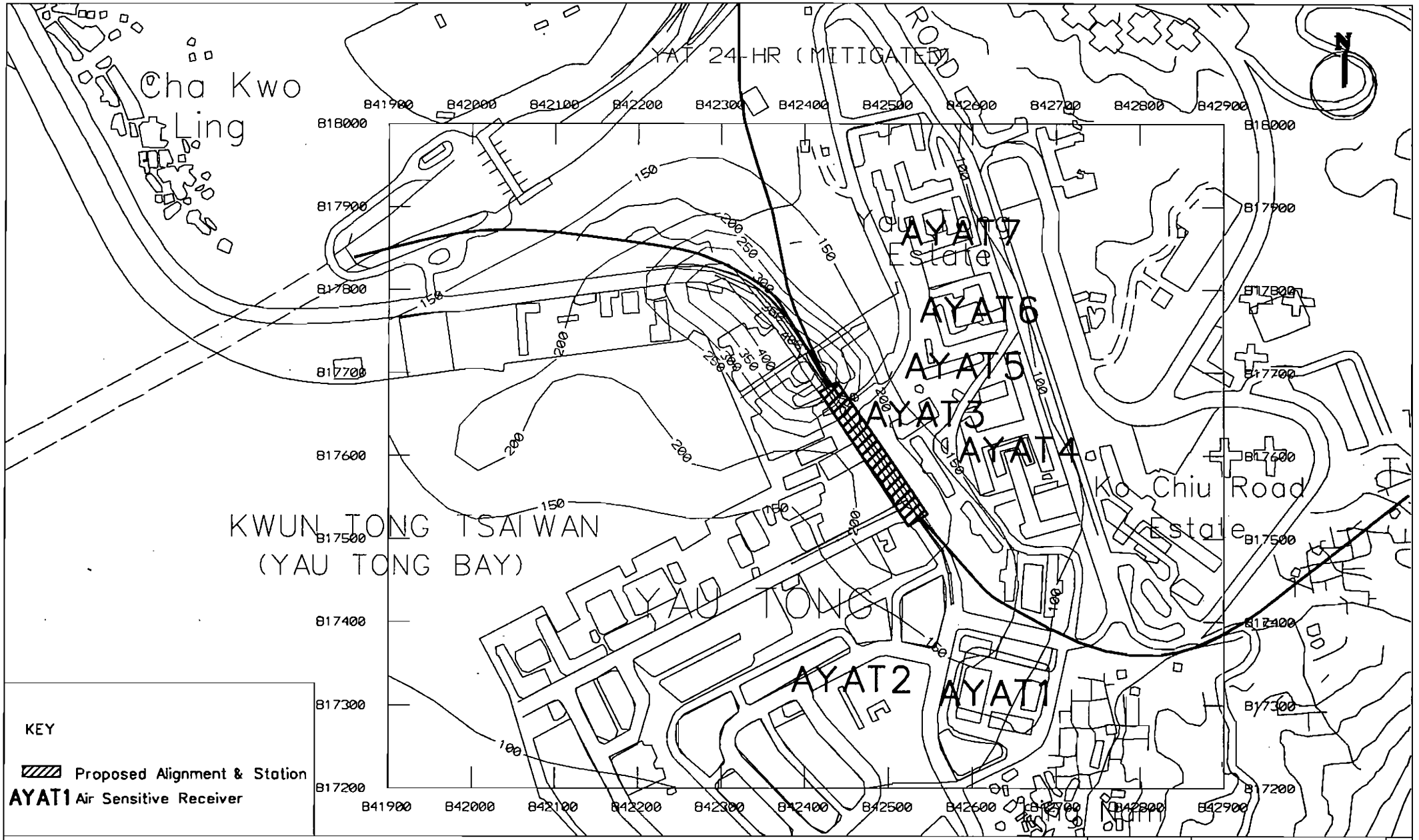


PREDICTED 1 HR AVERAGED TSP CONCENTRATIONS AT YAU TONG
WITH MITIGATION
$\mu g\ m^{-3}$

MAUNSELL CONSULTANTS ASIA LTD
DATE: AUG 96
SCALE: NTS
FIGURE No. B1.1i



PREDICTED 24 HR AVERAGED TSP CONCENTRATIONS AT YAU TONG
WITH MITIGATION
$\mu g\ m^{-3}$

MAUNSELL CONSULTANTS ASIA LTD
茂盛工程顧問有限公司

DATE: AUG 96
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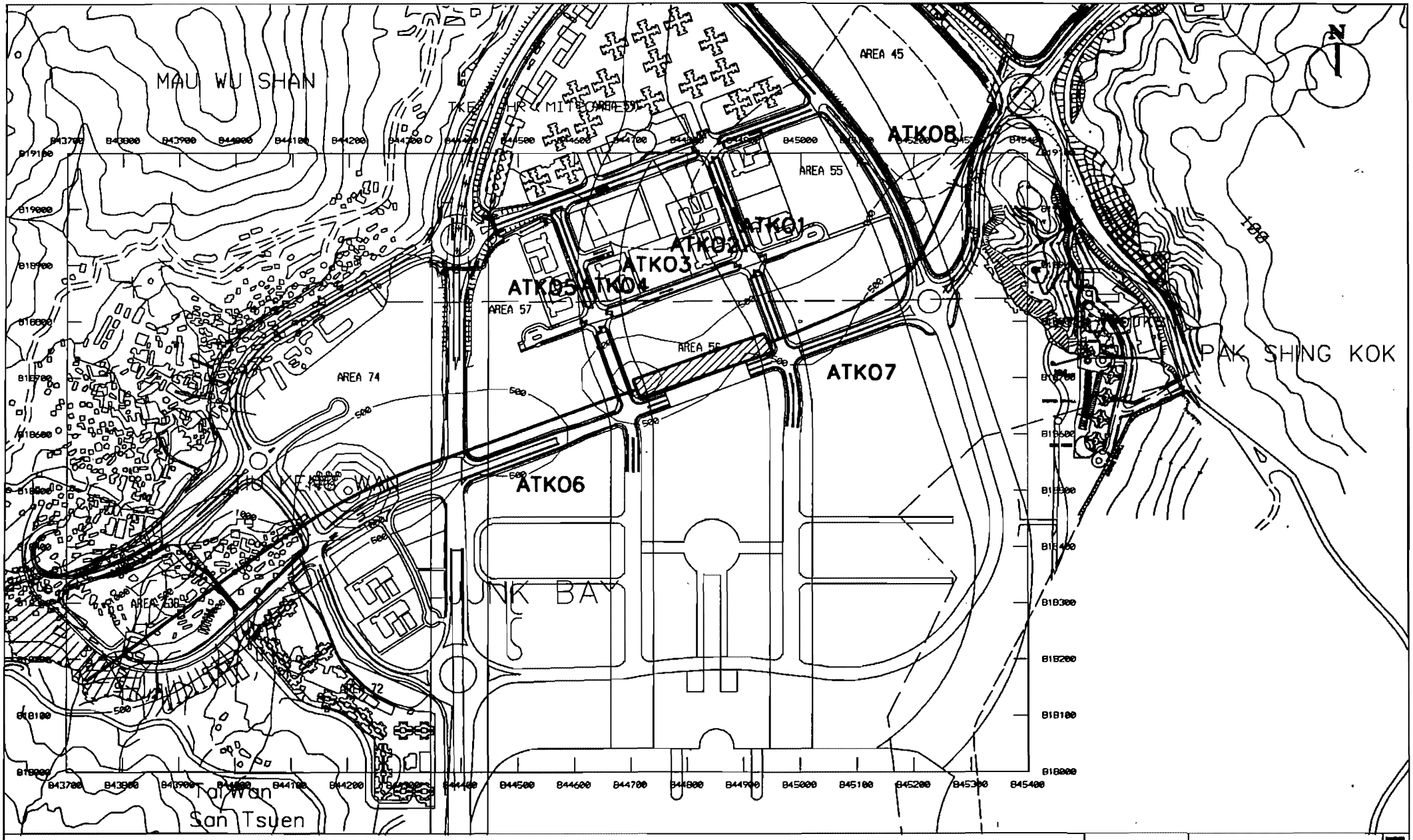
FIGURE No. B1.1j

Maunsell



Proposed Alignment & Station

ATKO1 Air Sensitive Receiver

PREDICTED 1 HR AVERAGED TSP CONCENTRATIONS AT TSEUNG KWAN O WITH MITIGATION

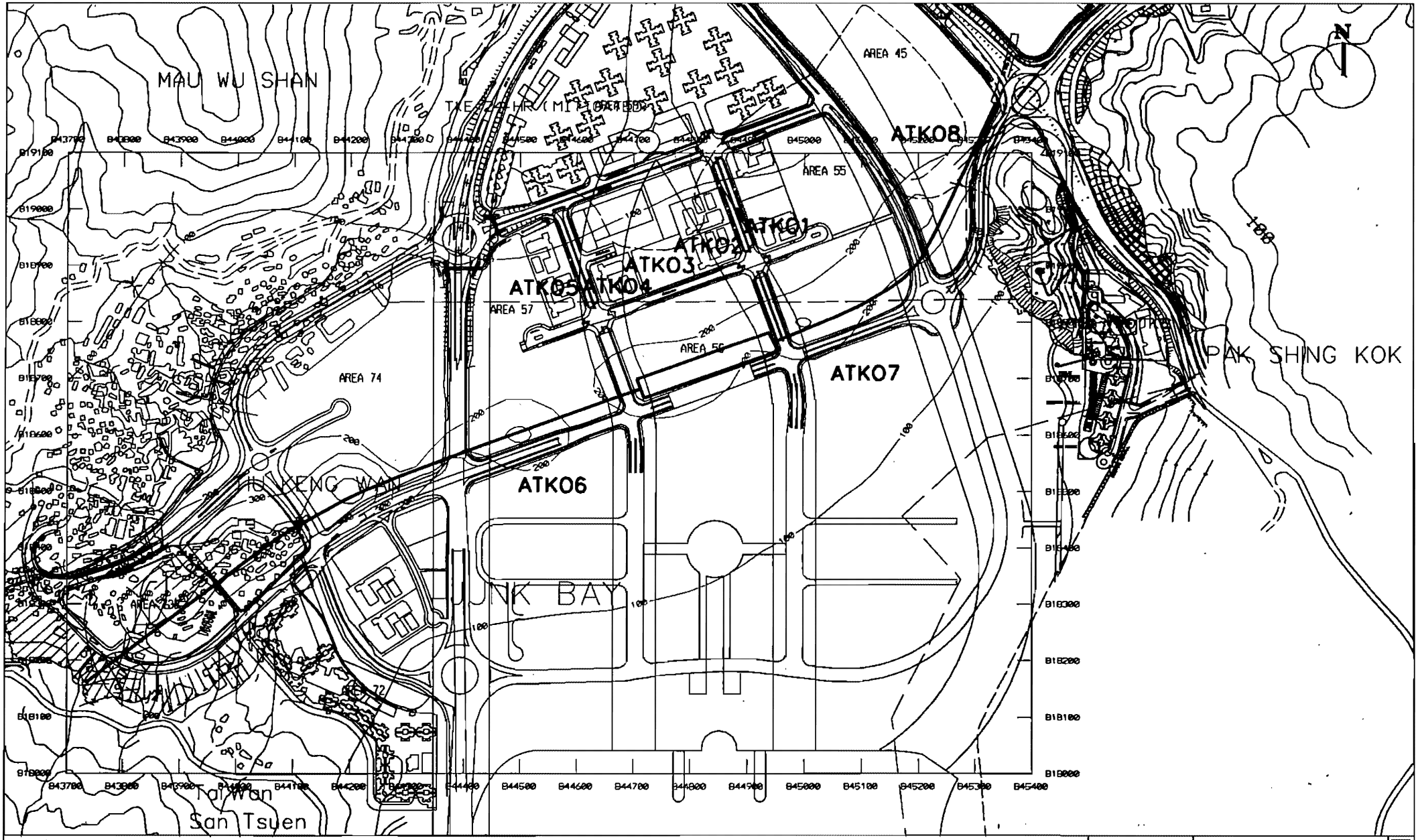
MAUNSELL CONSULTANTS ASIA LTD
茂盛工程顧問有限公司

DATE: NOV 95

SCALE: NTS

FIGURE No. B1.1k

Maunsell



Proposed Alignment & Station

ATKO1 Air Sensitive Receiver

PREDICTED 24 HR AVERAGED TSP CONCENTRATIONS AT TSEUNG KWAN O WITH MITIGATION

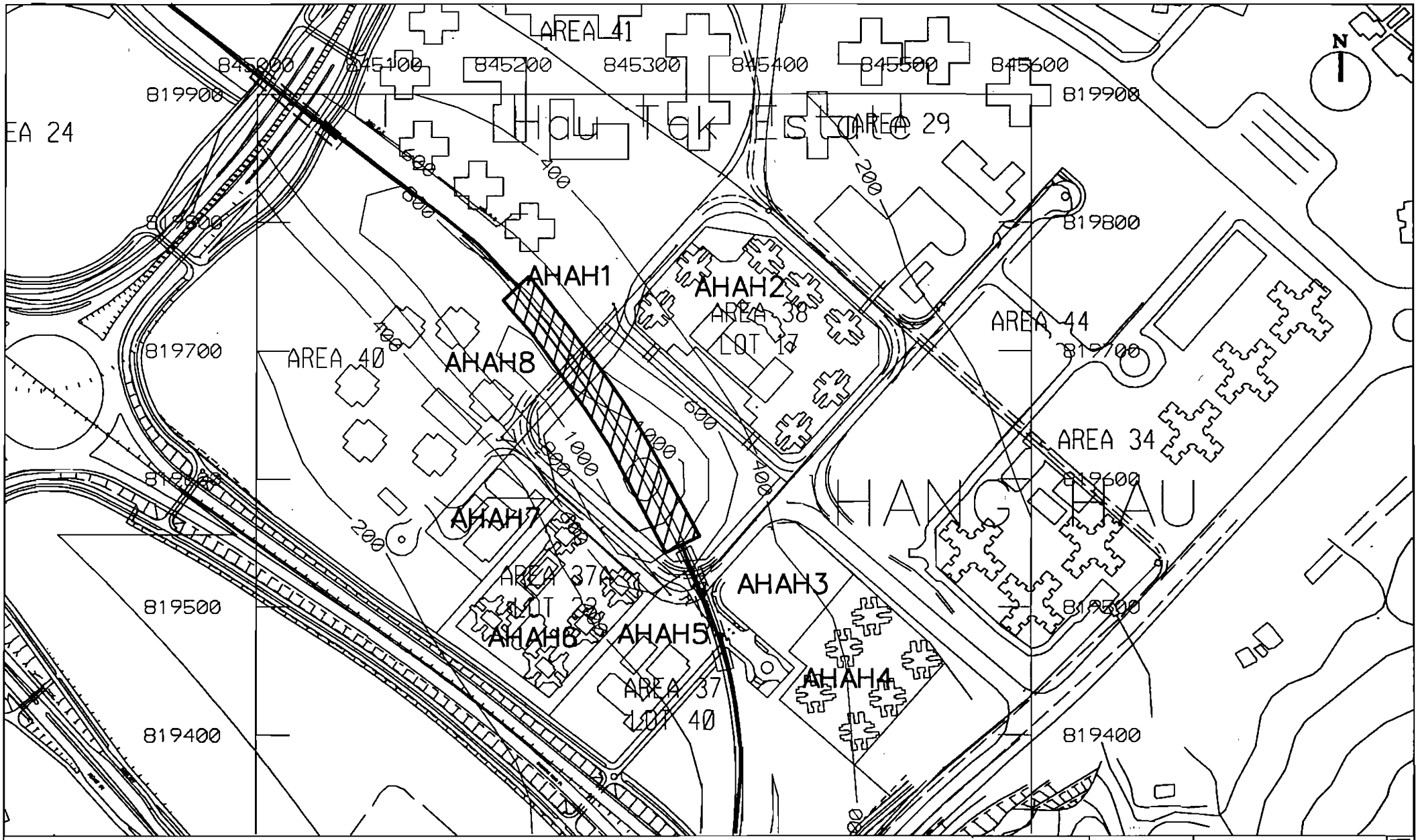
MAUNSELL CONSULTANTS ASIA LTD 茂盛工程顧問有限公司

DATE: NOV 95

FIGURE No. B1.11

SCALE: NTS

Maunsell



Proposed Alignment & Station

AHAH1 Air Sensitive Receiver

PREDICTED 1 HR AVERAGED TSP CONCENTRATIONS AT HANG HAU WITH MITIGATION

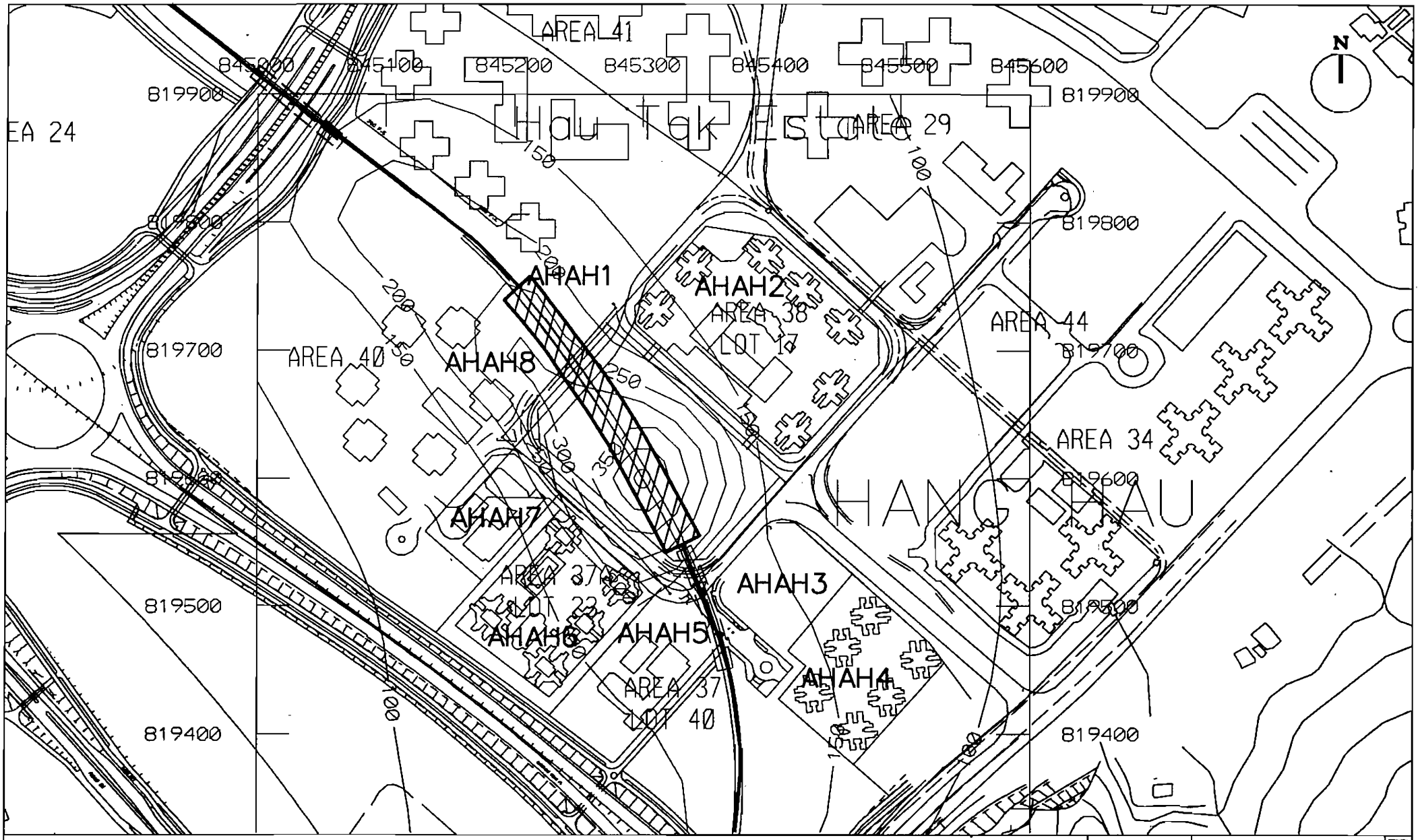
MAUNSELL CONSULTANTS ASIA LTD 茂盛工程顧問有限公司

DATE: AUG '95

FIGURE No. B1.1m

SCALE: NTS

Maunsell



Proposed Alignment & Stotion

AHAH1 Air Sensitive Receiver

PREDICTED 24 HR AVERAGED TSP CONCENTRATIONS AT HANG HAU WITH MITIGATION

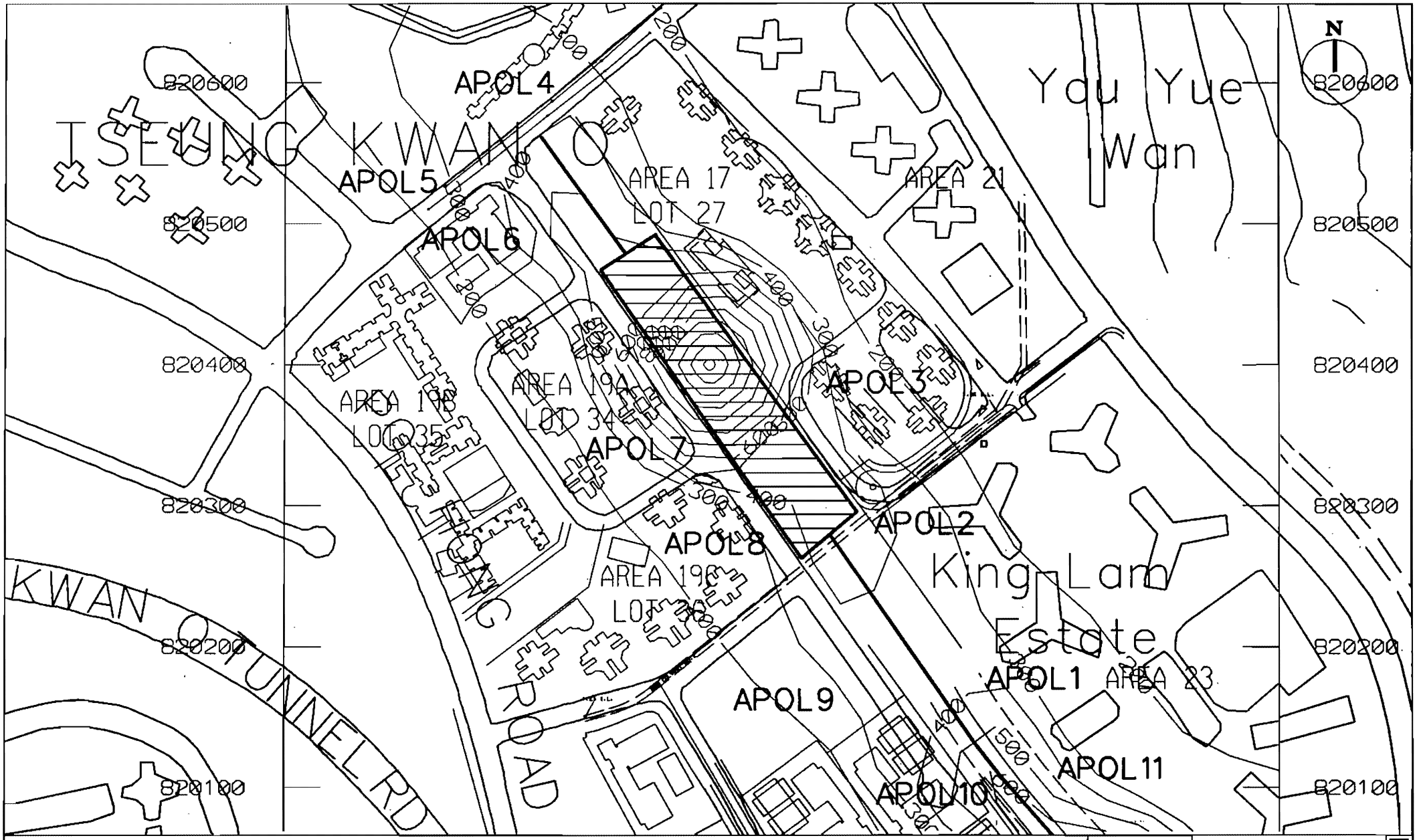
MAUNSELL CONSULTANTS ASIA LTD

DATE: AUG 95

SCALE: NTS

FIGURE No. B1.1n

Maunsell



Proposed Alignment & Station

APOL1 Air Sensitive Receiver

PREDICTED 1 HR AVERAGED TSP CONCENTRATIONS AT PO LAM WITH MITIGATION

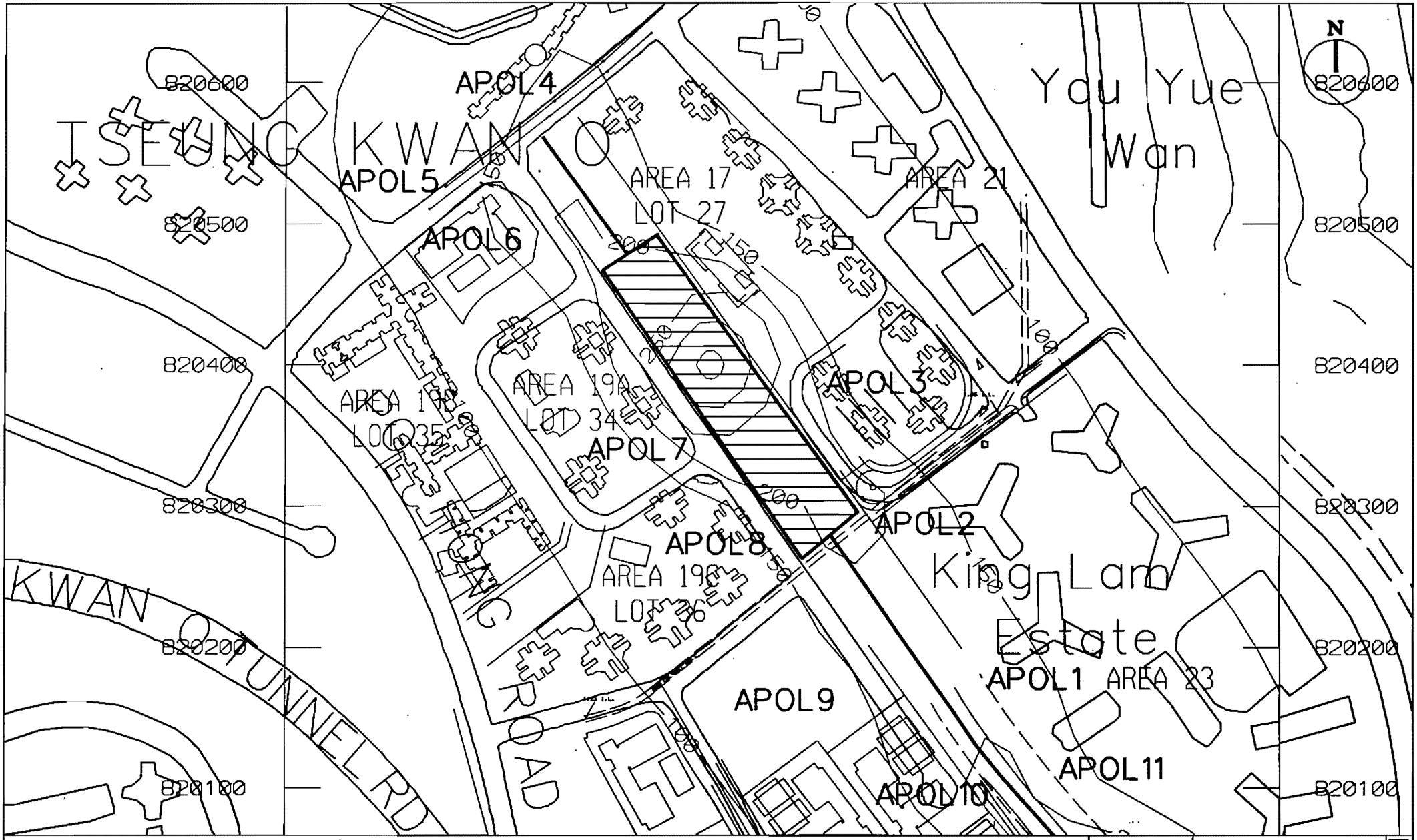
MAUNSELL CONSULTANTS ASIA LTD 萬宜工程顧問有限公司

DATE: NOV 95

SCALE: NTS

FIGURE No. B1.1o

Maunsell



Proposed Alignment & Station

APOL1 Air Sensitive Receiver

PREDICTED 24 HR AVERAGED TSP CONCENTRATIONS AT PO LAM WITH MITIGATION

MAUNSELL CONSULTANTS ASIA LTD 茂盛工程顧問有限公司

DATE: NOV 95

SCALE: NTS

FIGURE No. B1.1p

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Annex C

Construction Plant Lists

Table C1.1a - No mitigation					
Activities					
Site clearance	**(Depot)**				
a1. Demolition works	Noise Source	TM ref	UNIT	SWL	sub-SWL
	excavator-mounted breaker	CNP027	1	122	122
	excavator	CNP081	1	112	112
	lorry	CNP141	2	112	115
				PHASE TOTAL SWL	**123**
Station construction (all stations)					
b1. Site Establishment	Noise Source	TM ref	UNIT	SWL	sub-SWL
	generator	CNP101	1	108	108
	compressor	CNP003	1	104	104
	breaker, handheld	CNP024	1	108	108
	excavator	CNP081	2	112	115
	lorry	CNP141	2	112	115
				PHASE TOTAL SWL	**119**
b2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	2	115	118
	bentonite filter	CNP162	1	105	105
	generator	CNP101	1	108	108
	compressor	CNP003	1	104	104
	water pumps	CNP282	1	103	103
	concrete mixer	CNP046	1	96	96
	vibrator	CNP170	1	113	113
				PHASE TOTAL SWL	**120**
b3. Excavation (initial)	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	108	108
	lorry	CNP141	2	112	115
	mobile crane	CNP048	1	112	112
	compressor	CNP003	1	104	104
	excavator	CNP081	1	112	112
	loader	CNP081	1	112	112
	generator	CNP101	1	108	108
	vent fan	CNP241	1	108	108
	water pump	CNP282	1	103	103
				PHASE TOTAL SWL	**120**
b4. Excavation (final)	Noise Source	TM ref	Unit	SWL	otal - SW
	lorry	CNP141	2	112	115
	mobile crane	CNP048	1	112	112
	loader	CNP081	1	112	112
	vent fan	CNP241	1	108	108
	water pump	CNP282	1	103	103
				PHASE TOTAL SWL	**119**

b5. Station Box Construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP164	2	115	118
	breaker, handheld	CNP026	2	114	117
	excavator	CNP081	2	112	115
	compressor	CNP003	2	104	107
	generator	CNP101	2	108	111
	concrete pump	CNP047	1	109	109
	concrete lorry mixer	CNP044	1	109	109
	bentonite filter	CNP162	1	105	105
	mobile crane	CNP048	2	112	115
	lorry	CNP141	2	112	115
				PHASE TOTAL SWL	**124**
b6. Structures	Noise Source	TM ref	Unit	SWL	otal - SW
	concrete mixer lorry	CNP044	4	109	115
	mobile crane	CNP048	1	112	112
	vibrator	CNP170	2	113	116
	circular saw	CNP201	2	108	111
	water pump	CNP282	1	103	103
				PHASE TOTAL SWL	**120**
b7. Reinstatement	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	108	108
	lorry	CNP141	2	112	115
	mobile crane	CNP048	1	112	112
	compressor	CNP003	1	104	104
	excavator	CNP081	1	112	112
	generator	CNP101	1	108	108
				PHASE TOTAL SWL	**119**
Alignment Construction (all sections)					
c1. Site Establishment	Noise Source	TM ref	UNIT	SWL	sub-SWL
	concrete pump	CNP047	1	109	109
	concrete lorry mixer	CNP044	1	109	109
	bentonite filter	CNP162	1	105	105
	mobile crane	CNP048	2	112	115
	lorry	CNP141	2	112	115
				PHASE TOTAL SWL	**119**
c2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	2	115	118
	bentonite filter	CNP162	1	105	105
	generator	CNP101	1	108	108
	compressor	CNP003	1	104	104
	water pumps	CNP282	1	103	103
	concrete mixer	CNP046	1	96	96
	vibrator	CNP170	1	113	113
				PHASE TOTAL SWL	**120**

c3. Excavation (initial)	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	108	108
	lorry	CNP141	2	112	115
	mobile crane	CNP048	1	112	112
	compressor	CNP003	1	104	104
	excavator	CNP081	1	112	112
	loader	CNP081	1	112	112
	generator	CNP101	1	108	108
	vent fan	CNP241	1	108	108
	water pump	CNP282	1	103	103
				PHASE TOTAL SWL	**120**
c4. Excavation (final)	Noise Source	TM ref	Unit	SWL	otal - SW
	lorry	CNP141	2	112	115
	mobile crane	CNP048	1	112	112
	loader	CNP081	1	112	112
	vent fan	CNP241	1	108	108
	water pump	CNP282	1	103	103
				PHASE TOTAL SWL	**119**
c5. Structures	Noise Source	TM ref	Unit	SWL	otal - SW
	concrete mixer lorry	CNP044	4	109	115
	mobile crane	CNP048	1	112	112
	vibrator	CNP170	2	113	116
	circular saw	CNP201	2	108	111
	water pump	CNP282	1	103	103
				PHASE TOTAL SWL	**120**
c6. Reinstatement	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	108	108
	lorry	CNP141	2	112	115
	mobile crane	CNP048	1	112	112
	compressor	CNP003	1	104	104
	excavator	CNP081	1	112	112
	generator	CNP101	1	108	108
				PHASE TOTAL SWL	**119**
d1. portal construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	generator	CNP101	1	108	108
	breaker	CNP024	1	108	108
	excavator	CNP081	1	112	112
	poker vibrator	CNP170	1	113	113
	lorry	CNP141	1	112	112
	concrete lorry mixer	CNP044	1	109	109
	concrete pump	CNP047	1	109	109
				PHASE TOTAL SWL	**119**

d2. spoil removal	Noise Source	TM ref	Unit	SWL	otal - SW
	lorry	CNP141	3	112	117
	mobile crane	CNP048	1	112	112
	excavator	CNP081	2	112	115
	vent fan	CNP241	1	108	108
	generator	CNP101	1	108	108
				PHASE TOTAL SWL	**120**
Reclamation	**(for Yau Tong Depot)**				
e1. Dredging	Noise Source	TM ref	UNIT	SWL	sub-SWL
	grab dredgers	CNP063	2	112	115
	hopper dredgers		4	104	110
	tug boats	CNP221	1	110	110
				PHASE TOTAL SWL	**117**
e2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	2	115	118
	generator	CNP101	1	108	108
	compressor	CNP003	1	104	104
	water pumps	CNP282	1	103	103
	concrete mixer	CNP046	1	96	96
	vibrator	CNP170	1	113	113
				PHASE TOTAL SWL	**120**
e3. Ground Floor Construct	Noise Source	TM ref	UNIT	SWL	sub-SWL
	tower crane	CNP049	1	95	95
	concrete pump	CNP047	1	109	109
	vibrators	CNP170	1	113	113
	concrete lorry mixer	CNP044	1	109	109
	barge	CNP061	1	104	104
				PHASE TOTAL SWL	**116**
e4. Sink cassions	Noise Source	TM ref	UNIT	SWL	sub-SWL
	tower crane	CNP049	1	95	95
	barge	CNP061	1	104	104
				PHASE TOTAL SWL	**105**
	Noise Source	TM ref	UNIT	SWL	sub-SWL
e5. Backfilling	bottom dump barge		2	104	107
	dredger	CNP063	1	112	112
	excavator	CNP081	2	112	115
				PHASE TOTAL SWL	**117**
	Noise Source	TM ref	UNIT	SWL	sub-SWL
e6. Seawall construction	derrick barge	CNP061	2	104	107
	hopper barge		2	104	107
	flat barge		2	104	107
	tugboat	CNP221	2	110	113
				PHASE TOTAL SWL	**115**

e7. Depot construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	piliing, oscillator	CNP165	1	115	115
	excavator	CNP081	1	112	112
	mobile crane	CNP048	1	112	112
	compressor	CNP003	1	104	104
	generator	CNP101	1	108	108
				PHASE TOTAL SWL	**119**
e8. Super structure	Noise Source	TM ref	UNIT	SWL	sub-SWL
	concrete lorry mixer	CNP044	1	109	109
	vibrator	CNP170	1	113	113
	concrete pump	CNP047	1	109	109
	compressor	CNP003	1	104	104
	generator	CNP101	1	108	108
				PHASE TOTAL SWL	**116**

Table C1.1b - Mitigation 1 Quiet Plant					
Activities					
Site clearance	**(Depot)**				
a1. Demolition works	Noise Source	TM ref	UNIT	SWL	sub-SWL
	excavator-mounted breaker	CNP027	1	122	122
	excavator	CNP081	1	105	105
	lorry	CNP141	2	105	108
		PHASE TOTAL SWL			**122**
Station construction (all stations)					
b1. Site Establishment	Noise Source	TM ref	UNIT	SWL	sub-SWL
	generator	CNP102	1	100	100
	compressor	CNP001	1	100	100
	breaker, handheld	CNP024	1	108	108
	excavator	CNP081	2	105	108
	lorry	CNP141	2	105	108
		PHASE TOTAL SWL			**113**
b2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	2	110	113
	bentonite filter	CNP162	1	105	105
	generator	CNP102	1	100	100
	compressor	CNP001	1	100	100
	water pumps	CNP281	1	88	88
	concrete mixer	CNP046	1	96	96
	vibrator	CNP170	1	110	110
		PHASE TOTAL SWL			**116**
b3. Excavation (initial)	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	108	108
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	105	105
	compressor	CNP001	1	100	100
	excavator	CNP081	1	105	105
	loader	CNP081	1	105	105
	generator	CNP102	1	100	100
	vent fan	CNP241	1	108	108
	water pump	CNP281	1	88	88
		PHASE TOTAL SWL			**115**
b4. Excavation (final)	Noise Source	TM ref	Unit	SWL	otal - SW
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	105	105
	loader	CNP081	1	105	105
	vent fan	CNP241	1	108	108
	water pump	CNP281	1	88	88
		PHASE TOTAL SWL			**113**

b5. Station Box Construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP164	2	110	113
	breaker, handheld	CNP026	2	114	117
	excavator	CNP081	2	105	108
	compressor	CNP001	2	100	103
	generator	CNP102	2	100	103
	concrete pump	CNP047	1	105	105
	concrete lorry mixer	CNP044	1	109	109
	bentonite filter	CNP162	1	105	105
	mobile crane	CNP048	2	105	108
	lorry	CNP141	2	105	108
		PHASE TOTAL SWL			**120**
b6. Structures	Noise Source	TM ref	Unit	SWL	otal - SW
	concrete mixer lorry	CNP044	4	109	115
	mobile crane	CNP048	1	105	105
	vibrator	CNP170	2	110	113
	circular saw	CNP201	2	108	111
	water pump	CNP281	1	88	88
		PHASE TOTAL SWL			**118**
b7. Reinstatement	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	108	108
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	105	105
	compressor	CNP001	1	100	100
	excavator	CNP081	1	105	105
	generator	CNP102	1	100	100
		PHASE TOTAL SWL			**113**
Alignment Construction (all sections)					
c1. Site Establishment	Noise Source	TM ref	UNIT	SWL	sub-SWL
	concrete pump	CNP047	1	105	105
	concrete lorry mixer	CNP044	1	109	109
	bentonite filter	CNP162	1	105	105
	mobile crane	CNP048	2	105	108
	lorry	CNP141	2	105	108
		PHASE TOTAL SWL			**114**
c2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	2	110	113
	bentonite filter	CNP162	1	105	105
	generator	CNP102	1	100	100
	compressor	CNP001	1	100	100
	water pumps	CNP281	1	88	88
	concrete mixer	CNP046	1	96	96
	vibrator	CNP170	1	110	110
		PHASE TOTAL SWL			**116**

c3. Excavation (initial)	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	108	108
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	105	105
	compressor	CNP001	1	100	100
	excavator	CNP081	1	105	105
	loader	CNP081	1	105	105
	generator	CNP102	1	100	100
	vent fan	CNP241	1	108	108
	water pump	CNP281	1	88	88
		PHASE TOTAL SWL			**115**
c4. Excavation (final)	Noise Source	TM ref	Unit	SWL	otal - SW
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	105	105
	loader	CNP081	1	105	105
	vent fan	CNP241	1	108	108
	water pump	CNP281	1	88	88
		PHASE TOTAL SWL			**113**
c5. Structures	Noise Source	TM ref	Unit	SWL	otal - SW
	concrete mixer lorry	CNP044	4	109	115
	mobile crane	CNP048	1	105	105
	vibrator	CNP170	2	110	113
	circular saw	CNP201	2	108	111
	water pump	CNP281	1	88	88
		PHASE TOTAL SWL			**118**
c6. Reinstatement	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	108	108
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	105	105
	compressor	CNP001	1	100	100
	excavator	CNP081	1	105	105
	generator	CNP102	1	100	100
		PHASE TOTAL SWL			**113**
d1. portal construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	generator	CNP102	1	100	100
	breaker	CNP024	1	108	108
	excavator	CNP081	1	105	105
	poker vibrator	CNP170	1	110	110
	lorry	CNP141	1	105	105
	concrete lorry mixer	CNP044	1	109	109
	concrete pump	CNP047	1	105	105
		PHASE TOTAL SWL			**115**

d2. spoil removal	Noise Source	TM ref	Unit	SWL	otal - SW
	lorry	CNP141	3	105	110
	mobile crane	CNP048	1	105	105
	excavator	CNP081	2	105	108
	vent fan	CNP241	1	108	108
	generator	CNP102	1	100	100
		PHASE TOTAL SWL			**114**
Reclamation	**(for Yau Tong Depot)**				
e1. Dredging	Noise Source	TM ref	UNIT	SWL	sub-SWL
	grab dredgers	CNP063	2	112	115
	hopper dredgers		4	104	110
	tug boats	CNP221	1	110	110
		PHASE TOTAL SWL			**117**
e2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	2	110	113
	generator	CNP102	1	100	100
	compressor	CNP001	1	100	100
	water pumps	CNP281	1	88	88
	concrete mixer	CNP046	1	96	96
	vibrator	CNP170	1	110	110
		PHASE TOTAL SWL			**115**
e3. Ground Floor Construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	tower crane	CNP049	1	95	95
	concrete pump	CNP047	1	105	105
	vibrators	CNP170	1	110	110
	concrete lorry mixer	CNP044	1	109	109
	barge	CNP061	1	104	104
		PHASE TOTAL SWL			**114**
e4. Sink cassions	Noise Source	TM ref	UNIT	SWL	sub-SWL
	tower crane	CNP049	1	95	95
	barge	CNP061	1	104	104
		PHASE TOTAL SWL			**105**
	Noise Source	TM ref	UNIT	SWL	sub-SWL
e5. Backfilling	bottom dump barge		2	104	107
	dredger	CNP063	1	112	112
	excavator	CNP081	2	105	108
		PHASE TOTAL SWL			**113**
	Noise Source	TM ref	UNIT	SWL	sub-SWL
e6. Seawall construction	derrick barge	CNP061	2	104	107
	hopper barge		2	104	107
	flat barge		2	104	107
	tugboat	CNP221	2	110	113
		PHASE TOTAL SWL			**115**

e7. Depot construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	piliing, oscillator	CNP165	1	110	110
	excavator	CNP081	1	105	105
	mobile crane	CNP048	1	105	105
	compressor	CNP001	1	100	100
	generator	CNP102	1	100	100
		PHASE TOTAL SWL			**113**
e8. Super structure	Noise Source	TM ref	UNIT	SWL	sub-SWL
	concrete lorry mixer	CNP044	1	109	109
	vibrator	CNP170	1	110	110
	concrete pump	CNP047	1	105	105
	compressor	CNP001	1	100	100
	generator	CNP102	1	100	100
		PHASE TOTAL SWL			**114**

Table C1.1c - Mitigation 2 Quiet Plant + Barrier					
Activities					
Site clearance	**(Depot)**				
a1. Demolition works	Noise Source	TM ref	UNIT	SWL	sub-SWL
	excavator-mounted breaker	CNP027	1	117	117
	excavator	CNP081	1	100	100
	lorry	CNP141	2	105	108
			PHASE TOTAL SWL		**118**
Station construction (all stations)					
b1. Site Establishment	Noise Source	TM ref	UNIT	SWL	sub-SWL
	generator	CNP102	1	90	90
	compressor	CNP001	1	90	90
	breaker, handheld	CNP024	1	103	103
	excavator	CNP081	2	100	103
	lorry	CNP141	2	105	108
			PHASE TOTAL SWL		**110**
b2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	2	100	103
	bentonite filter	CNP162	1	95	95
	generator	CNP102	1	90	90
	compressor	CNP001	1	90	90
	water pumps	CNP281	1	78	78
	concrete mixer	CNP046	1	86	86
	vibrator	CNP170	1	105	105
			PHASE TOTAL SWL		**108**
b3. Excavation (initial)	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	103	103
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	excavator	CNP081	1	100	100
	loader	CNP081	1	100	100
	generator	CNP102	1	90	90
	vent fan	CNP241	1	98	98
	water pump	CNP281	1	78	78
			PHASE TOTAL SWL		**111**
b4. Excavation (final)	Noise Source	TM ref	Unit	SWL	otal - SW
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	100	100
	loader	CNP081	1	100	100
	vent fan	CNP241	1	98	98
	water pump	CNP281	1	78	78
			PHASE TOTAL SWL		**110**

b5. Station Box Construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP164	2	100	103
	breaker, handheld	CNP026	2	111	114
	excavator	CNP081	2	100	103
	compressor	CNP001	2	90	93
	generator	CNP102	2	90	93
	concrete pump	CNP047	1	95	95
	concrete lorry mixer	CNP044	1	104	104
	bentonite filter	CNP162	1	95	95
	mobile crane	CNP048	2	100	103
	lorry	CNP141	2	105	108
		PHASE TOTAL SWL			**116**
b6. Structures	Noise Source	TM ref	Unit	SWL	otal - SW
	concrete mixer lorry	CNP044	4	104	110
	mobile crane	CNP048	1	100	100
	vibrator	CNP170	2	105	108
	circular saw	CNP201	2	98	101
	water pump	CNP281	1	78	78
		PHASE TOTAL SWL			**113**
b7. Reinstatement	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	103	103
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	excavator	CNP081	1	100	100
	generator	CNP102	1	90	90
		PHASE TOTAL SWL			**110**
Alignment Construction (all sections)					
c1. Site Establishment	Noise Source	TM ref	UNIT	SWL	sub-SWL
	concrete pump	CNP047	1	95	95
	concrete lorry mixer	CNP044	1	104	104
	bentonite filter	CNP162	1	95	95
	mobile crane	CNP048	2	100	103
	lorry	CNP141	2	105	108
		PHASE TOTAL SWL			**111**
c2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	2	100	103
	bentonite filter	CNP162	1	95	95
	generator	CNP102	1	90	90
	compressor	CNP001	1	90	90
	water pumps	CNP281	1	78	78
	concrete mixer	CNP046	1	86	86
	vibrator	CNP170	1	105	105
		PHASE TOTAL SWL			**108**

c3. Excavation (initial)	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	103	103
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	excavator	CNP081	1	100	100
	loader	CNP081	1	100	100
	generator	CNP102	1	90	90
	vent fan	CNP241	1	98	98
	water pump	CNP281	1	78	78
		PHASE TOTAL SWL			**111**
c4. Excavation (final)	Noise Source	TM ref	Unit	SWL	otal - SW
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	100	100
	loader	CNP081	1	100	100
	vent fan	CNP241	1	98	98
	water pump	CNP281	1	78	78
		PHASE TOTAL SWL			**110**
c5. Structures	Noise Source	TM ref	Unit	SWL	otal - SW
	concrete mixer lorry	CNP044	4	104	110
	mobile crane	CNP048	1	100	100
	vibrator	CNP170	2	105	108
	circular saw	CNP201	2	98	101
	water pump	CNP281	1	78	78
		PHASE TOTAL SWL			**113**
c6. Reinstatement	Noise Source	TM ref	Unit	SWL	otal - SW
	breaker	CNP024	1	103	103
	lorry	CNP141	2	105	108
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	excavator	CNP081	1	100	100
	generator	CNP102	1	90	90
		PHASE TOTAL SWL			**110**
d1. portal construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	generator	CNP102	1	90	90
	breaker	CNP024	1	103	103
	excavator	CNP081	1	100	100
	poker vibrator	CNP170	1	105	105
	lorry	CNP141	1	105	105
	concrete lorry mixer	CNP044	1	104	104
	concrete pump	CNP047	1	95	95
		PHASE TOTAL SWL			**111**

d2. spoil removal	Noise Source	TM ref	Unit	SWL	otal - SW
	lorry	CNP141	3	105	110
	mobile crane	CNP048	1	100	100
	excavator	CNP081	2	100	103
	vent fan	CNP241	1	98	98
	generator	CNP102	1	90	90
		PHASE TOTAL SWL			**111**
Reclamation	**(for Yau Tong Depot)**				
e1. Dredging	Noise Source	TM ref	UNIT	SWL	sub-SWL
	grab dredgers	CNP063	2	112	115
	hopper dredgers		4	104	110
	tug boats	CNP221	1	110	110
		PHASE TOTAL SWL			**117**
e2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	2	100	103
	generator	CNP102	1	90	90
	compressor	CNP001	1	90	90
	water pumps	CNP281	1	78	78
	concrete mixer	CNP046	1	86	86
	vibrator	CNP170	1	105	105
		PHASE TOTAL SWL			**107**
e3. Ground Floor Construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	tower crane	CNP049	1	95	95
	concrete pump	CNP047	1	95	95
	vibrators	CNP170	1	105	105
	concrete lorry mixer	CNP044	1	104	104
	barge	CNP061	1	104	104
		PHASE TOTAL SWL			**109**
e4. Sink cassions	Noise Source	TM ref	UNIT	SWL	sub-SWL
	tower crane	CNP049	1	95	95
	barge	CNP061	1	104	104
		PHASE TOTAL SWL			**105**
	Noise Source	TM ref	UNIT	SWL	sub-SWL
e5. Backfilling	bottom dump barge		2	104	107
	dredger	CNP063	1	112	112
	excavator	CNP081	2	100	103
		PHASE TOTAL SWL			**113**
	Noise Source	TM ref	UNIT	SWL	sub-SWL
e6. Seawall construction	derrick barge	CNP061	2	104	107
	hopper barge		2	104	107
	flat barge		2	104	107
	tugboat	CNP221	2	110	113
		PHASE TOTAL SWL			**115**

e7. Depot construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	piliing, oscillator	CNP165	1	100	100
	excavator	CNP081	1	100	100
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	generator	CNP102	1	90	90
		PHASE TOTAL SWL			**105**
e8. Super structure	Noise Source	TM ref	UNIT	SWL	sub-SWL
	concrete lorry mixer	CNP044	1	104	104
	vibrator	CNP170	1	105	105
	concrete pump	CNP047	1	98	98
	compressor	CNP001	1	90	90
	generator	CNP102	1	90	90
		PHASE TOTAL SWL			**108**
Vent Building					
f1. Vent building construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	piliing, oscillator	CNP165	1	100	100
	excavator	CNP081	1	100	100
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	generator	CNP102	1	90	90
		PHASE TOTAL SWL			**105**
f2. Super structure	Noise Source	TM ref	UNIT	SWL	sub-SWL
	concrete lorry mixer	CNP044	1	104	104
	vibrator	CNP170	1	105	105
	concrete pump	CNP047	1	95	95
	compressor	CNP001	1	90	90
	generator	CNP102	1	90	90
		PHASE TOTAL SWL			**108**

Table 1.1d - Mitigation 3 Quiet Plant + Barrier + Reducing number of Plant Type to One					
Activities					
Site clearance	**(Depot)**				
a1. Demolition works	Noise Source	TM ref	UNIT	SWL	sub-SWL
	excavator-mounted breaker	CNP027	1	117	117
	excavator	CNP081	1	100	100
	lorry	CNP141	1	105	105
			PHASE TOTAL SWL		**117**
Station construction (all stations)					
b1. Site Establishment	Noise Source	TM ref	UNIT	SWL	sub-SWL
	generator	CNP102	1	90	90
	compressor	CNP001	1	90	90
	breaker, handheld	CNP024	1	103	103
	excavator	CNP081	1	100	100
	lorry	CNP141	1	105	105
			PHASE TOTAL SWL		**108**
b2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	1	100	100
	bentonite filter	CNP162	1	95	95
	generator	CNP102	1	90	90
	compressor	CNP001	1	90	90
	water pumps	CNP281	1	78	78
	concrete mixer	CNP046	1	86	86
	vibrator	CNP170	1	105	105
			PHASE TOTAL SWL		**107**
b3. Excavation (initial)	Noise Source	TM ref	Unit	SWL	Total - SW
	breaker	CNP024	1	103	103
	lorry	CNP141	1	105	105
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	excavator	CNP081	1	100	100
	loader	CNP081	1	100	100
	generator	CNP102	1	90	90
	vent fan	CNP241	1	98	98
	water pump	CNP281	1	78	78
			PHASE TOTAL SWL		**110**
b4. Excavation (final)	Noise Source	TM ref	Unit	SWL	Total - SW
	lorry	CNP141	1	105	105
	mobile crane	CNP048	1	100	100
	loader	CNP081	1	100	100
	vent fan	CNP241	1	98	98
	water pump	CNP281	1	78	78
			PHASE TOTAL SWL		**108**

b5. Station Box Construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP164	1	100	100
	breaker, handheld	CNP026	1	111	111
	excavator	CNP081	1	100	100
	compressor	CNP001	1	90	90
	generator	CNP102	1	90	90
	concrete pump	CNP047	1	95	95
	concrete lorry mixer	CNP044	1	104	104
	bentonite filter	CNP162	1	95	95
	mobile crane	CNP048	1	100	100
	lorry	CNP141	1	105	105
			PHASE TOTAL SWL		**113**
b6. Structures	Noise Source	TM ref	Unit	SWL	Total - SW
	concrete mixer lorry	CNP044	1	104	104
	mobile crane	CNP048	1	100	100
	vibrator	CNP170	1	105	105
	circular saw	CNP201	1	98	98
	water pump	CNP281	1	78	78
			PHASE TOTAL SWL		**109**
b7. Reinstatement	Noise Source	TM ref	Unit	SWL	Total - SW
	breaker	CNP024	1	103	103
	lorry	CNP141	1	105	105
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	excavator	CNP081	1	100	100
	generator	CNP102	1	90	90
			PHASE TOTAL SWL		**109**
Alignment Construction (all sections)					
c1. Site Establishment	Noise Source	TM.ref	UNIT	SWL	sub-SWL
	concrete pump	CNP047	1	95	95
	concrete lorry mixer	CNP044	1	104	104
	bentonite filter	CNP162	1	95	95
	mobile crane	CNP048	1	100	100
	lorry	CNP141	1	105	105
			PHASE TOTAL SWL		**109**
c2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	1	100	100
	bentonite filter	CNP162	1	95	95
	generator	CNP102	1	90	90
	compressor	CNP001	1	90	90
	water pumps	CNP281	1	78	78
	concrete mixer	CNP046	1	86	86
	vibrator	CNP170	1	105	105
			PHASE TOTAL SWL		**107**

c3. Excavation (initial)	Noise Source	TM ref	Unit	SWL	Total - SW
	breaker	CNP024	1	103	103
	lorry	CNP141	1	105	105
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	excavator	CNP081	1	100	100
	loader	CNP081	1	100	100
	generator	CNP102	1	90	90
	vent fan	CNP241	1	98	98
	water pump	CNP281	1	78	78
			PHASE TOTAL SWL		**110**
c4. Excavation (final)	Noise Source	TM ref	Unit	SWL	Total - SW
	lorry	CNP141	1	105	105
	mobile crane	CNP048	1	100	100
	loader	CNP081	1	100	100
	vent fan	CNP241	1	98	98
	water pump	CNP281	1	78	78
			PHASE TOTAL SWL		**108**
c5. Structures	Noise Source	TM ref	Unit	SWL	Total - SW
	concrete mixer lorry	CNP044	1	104	104
	mobile crane	CNP048	1	100	100
	vibrator	CNP170	1	105	105
	circular saw	CNP201	1	98	98
	water pump	CNP281	1	78	78
			PHASE TOTAL SWL		**109**
c6. Reinstatement	Noise Source	TM ref	Unit	SWL	Total - SW
	breaker	CNP024	1	103	103
	lorry	CNP141	1	105	105
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	excavator	CNP081	1	100	100
	generator	CNP102	1	90	90
			PHASE TOTAL SWL		**109**
d1. portal construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	generator	CNP102	1	90	90
	breaker	CNP024	1	103	103
	excavator	CNP081	1	100	100
	poker vibrator	CNP170	1	105	105
	lorry	CNP141	1	105	105
	concrete lorry mixer	CNP044	1	104	104
	concrete pump	CNP047	1	95	95
			PHASE TOTAL SWL		**111**

d2. spoil removal	Noise Source	TM ref	Unit	SWL	Total - SW
	lorry	CNP141	1	105	105
	mobile crane	CNP048	1	100	100
	excavator	CNP081	1	100	100
	vent fan	CNP241	1	98	98
	generator	CNP102	1	90	90
			PHASE TOTAL SWL		**108**
Reclamation	**(for Yau Tong Depot)**				
e1. Dredging	Noise Source	TM ref	UNIT	SWL	sub-SWL
	grab dredgers	CNP063	1	112	112
	hopper dredgers		1	104	104
	tug boats	CNP221	1	110	110
			PHASE TOTAL SWL		**115**
e2. Piling	Noise Source	TM ref	UNIT	SWL	sub-SWL
	bored piling	CNP165	1	100	100
	generator	CNP102	1	90	90
	compressor	CNP001	1	90	90
	water pumps	CNP281	1	78	78
	concrete mixer	CNP046	1	86	86
	vibrator	CNP170	1	105	105
			PHASE TOTAL SWL		**106**
e3. Ground Floor Construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	tower crane	CNP049	1	95	95
	concrete pump	CNP047	1	95	95
	vibrators	CNP170	1	105	105
	concrete lorry mixer	CNP044	1	104	104
	barge	CNP061	1	104	104
			PHASE TOTAL SWL		**109**
e4. Sink cassions	Noise Source	TM ref	UNIT	SWL	sub-SWL
	tower crane	CNP049	1	95	95
	barge	CNP061	1	104	104
			PHASE TOTAL SWL		**105**
	Noise Source	TM ref	UNIT	SWL	sub-SWL
e5. Backfilling	bottom dump barge		1	104	104
	dredger	CNP063	1	112	112
	excavator	CNP081	1	100	100
			PHASE TOTAL SWL		**112**
	Noise Source	TM ref	UNIT	SWL	sub-SWL
e6. Seawall construction	derrick barge	CNP061	1	104	104
	hopper barge		1	104	104
	flat barge		1	104	104
	tugboat	CNP221	1	110	110
			PHASE TOTAL SWL		**112**

e7. Depot construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	piliing, oscillator	CNP165	1	100	100
	excavator	CNP081	1	100	100
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	generator	CNP102	1	90	90
			PHASE TOTAL SWL		**105**
e8. Super structure	Noise Source	TM ref	UNIT	SWL	sub-SWL
	concrete lorry mixer	CNP044	1	104	104
	vibrator	CNP170	1	105	105
	concrete pump	CNP047	1	98	98
	compressor	CNP001	1	90	90
	generator	CNP102	1	90	90
			PHASE TOTAL SWL		**108**
Vent Building					
f1. Vent building construction	Noise Source	TM ref	UNIT	SWL	sub-SWL
	piliing, oscillator	CNP165	1	100	100
	excavator	CNP081	1	100	100
	mobile crane	CNP048	1	100	100
	compressor	CNP001	1	90	90
	generator	CNP102	1	90	90
			PHASE TOTAL SWL		**105**
f2. Super structure	Noise Source	TM ref	UNIT	SWL	sub-SWL
	concrete lorry mixer	CNP044	1	104	104
	vibrator	CNP170	1	105	105
	concrete pump	CNP047	1	95	95
	compressor	CNP001	1	90	90
	generator	CNP102	1	90	90
			PHASE TOTAL SWL		**108**

Annex D

Responses to Comments on the Draft DEIA

Annex D

Responses to Comments on the Draft DEIA

Response to Comments
Tseung Kwan O Extension Draft Detailed EIA Report R9T

No.	Department	Reference	Comments	Consultants' Response
1	TDD/K M Chung 22 October 1996		As far as this office is concerned, I have no particular comment on the above draft report.	Noted.
2	DSD/C M Chan 16 October 1996		I have no comment on your above report.	Noted.
3	LD/LS&R/Florence Tsang 29 October 1996		Regarding Tseung Kwan O station, please also take note that the grant of a residential site in Area 55, namely TKOTL 50, was executed in January this year. The development is anticipated to be completed in mid-1988. The above-mentioned development should also be taken into account in the assessment. I enclose copy of a plan showing its location for your reference.	Impacts have been modelled for the proposed school in Area 55 (ATKO1/NTKO1). Should sensitive receivers closer to the alignment be occupied before the construction of the TKE, the Contractor will be required to develop appropriate mitigation measures as part of the Environmental Management Plan required by the MTRC.
4	KTDO/Alison Kung 25 October 1996	Section 3 - Noise and Vibration	According to the data provided in Table 3.4e, some of the NSRs in Yau Tong, one of which is a primary school, will be exposed to noise level above criteria even after application of considerable mitigation measures. To reduce the unacceptable noise impact to these NSRs, additional measures are required and the successful tender should comply strictly with these requirements. Please provide details of the additional measures and advise to what extent they can further mitigate the noise impact.	Para 3.4.59 relates to the school (St Antonius Primary School) and additional mitigation in the form of secondary glazing and air conditioning has been proposed to reduce noise levels to within the recommended criterion. It should also be noted that the predicted noise exceedance described in the first sentence of this paragraph should read 9 dB(A) not 19 dB(A). Para 3.4.60 describes further mitigation measures to control residual impacts at the NYAT4.
5	PD/KDPO/Paulina Y L Kwan 28 October 1996	General	It is noticed that the subject report is largely similar to the Draft Environmental Feasibility Study Report (R7T) issued December 1995. As such my comments on Report R7T via my memo to DEP ref. K(CR) C/MTR/2 dated 4.10.1996 are applicable to the subject report.	

No.	Department	Reference	Comments	Consultants' Response
		General	The subject EIA is based on an assumption that the stabling depot for TKE will be located at Yau Tong Bay. However, the need for locating the depot at Yau Tong Bay is yet to be established. I gathered that MTRC is currently considering another option to locate the depot in Tseung Kwan O (TKO). It is suggested that the option of locating the depot in TKO Bay should also be assessed so that a comparison between these two options, in terms of environmental impact, is possible.	The DEIA is based on the Tseung Kwan O Extension Final Preliminary Design, Maunsell et al, August 1996 which includes the stabling depot at Yau Tong. Alternative depot locations are not within the current design scope.
		General	It is stated in the report that "Po Chiu College is expected to be resumed due to the Yau Tong Station construction works". In this regard, D of E should be consulted as soon as possible. For your information, there is a shortage of 2 primary schools in the school zone for Yau Tong. Identification of suitable sites for school use in the district is extremely difficult.	Noted.
		Para 2.3.3	There is no firm proposal to redevelop the existing Yau Tong industrial area which is a subject of study for an on-going case study under the Central and East Kowloon Development Statement. It seems not prudent at this stage to assume that "the air quality in the future is less likely to be affected by industrial emissions .....' For the purpose of assessment, it appears more appropriate to adopt a worse case scenario by including the industrial area.	The DEIA has been undertaken using the current worst case assumptions, including the presence of the industrial area. The text was referring to the EPD's continuing success in controlling industrial emissions. Para 2.3.3 will be revised to reflect the fact that there are currently no firm plans for the redevelopment of the area.
		Para 3.3.1	The revised planning brief for comprehensive redevelopment of Ko Chiu Road and Yau Tong Estates approved by the then DPC on 1.7.95 is going to be revised shortly in the light of MTRC's proposal for TKE. The said redevelopment will <u>not</u> commence in 1996.	The final sentence of para 3.3.1 will be deleted. The change in timetable will not materially affect the findings of the DEIA
		Para 3.4.59	It is noticed that while a 19 dB noise exceedance is predicted at St. Antonius Primary School, the type I double-glazed windows with mechanical ventilation can only provide up to 10 dB(A) reduction in noise inside the school. Please clarify whether the noise level will still exceed the acceptable level even with the suggested mitigation measure. D of E's view should be sought in this regard.	This is a typographic error, the predicted exceedance is 9 dB(A) which will be effectively controlled by the proposed additional mitigation measures.

No.	Department	Reference	Comments	Consultants' Response
		Para 7.2.1	The statutory planning implications of the development of structures associated with TKE have not been identified. According to the Notes of the OZP for Cha Kwo Ling, Yau Tong, Lei Yue Mun (No. S/K15/7), development of Mass Transit vent shaft and/or other structures above ground level other than entrances requires planning permissions from the Town Planning Board.	The statutory planning implications are addressed in separate planning study reports produced as part of overall Feasibility Study and Preliminary Design. The MTRC will take responsibility for the submission of planning applications.
		Para 7.3.4	As a policy support for the WCR to follow a coastal alignment has already been granted, this paragraph needs to be updated.	The options for the WCR are still under consideration and the current paragraph accurately reflects the present situation as no decision has yet been made.
		Para 7.4.5	Since the Yau Tong Fire Station would be physically encroached, D of FS should be consulted. No comment on Vol. 3.	Noted.
		Paras 7.4.11, 7.4.16 & 7.4.38	It is noticed that a lot of mature trees and shrubs would be affected. Views from DAF and DUS should be sought at an early stage so as to minimize the adverse effect.	Noted.
6	DLO/SK/Maggie Au 28 October 1996	Paras 7.3.18 and 7.4.50	The land grant for two sites, namely TKOTL 57 and TKOTL 58 in Areas 57 and 55 respectively, will be completed in the near future. It is expected that commercial/residential development will begin on these sites shortly thereafter. In view of this, the assumption in paras 7.3.18 and 7.4.50 in the report that no residential or commercial buildings will be built and occupied in these areas by the time the Tseung Kwan O station construction works are complete may not be valid.	Impacts have been modelled for the proposed schools in Area 55 (ATKO1/NTKO1) and Area 57 (ATKO5/NTKO3) as the proposed locations of these receivers are known. Should sensitive receivers closer to the alignment be occupied before the construction of the TKE, as a result of future land grants or exchanges, the Contractor will be required to develop appropriate mitigation measures as part of the Environmental Management Plan required by the MTRC.
		Para 2.4.3	The land exchange transaction for the residential development in Area 72 is under active negotiation between the Government and the developer. Although it is still unknown at this stage as to the timing for completion of the negotiation, it is envisaged that once an agreement can be reached, the transaction will be completed very soon and the development will start shortly after. Therefore the assumption in para 2.4.3 in the report that this residential development will not be completed before the construction of the TKE may not be true. Having said the above, it would be advisable to make suitable assumptions to take the above-mentioned developments into account in the assessment.	Should, as a result of future land grants or exchanges, sensitive receivers closer to the alignment be occupied before the construction of the TKE, the MTRC's Contractor will be required to assess potential impacts and develop appropriate mitigation measures as part of the Environmental Management Plan (EMP) required by the MTRC.
7	TD/K K Sin 28 October 1996		I have no comment on Volumes II & III of the captioned draft EIA report.	Noted.

No.	Department	Reference	Comments	Consultants' Response
8	EPD/Alan Au 28 October 1996	*Air Quality* Table 2.5k, p.21	Based on Table 2.5k, p.21, the mitigated 1-hour TSP levels at some ASRs in Hang Hau still exceed 1-hour TSP guideline levels and in S.2.5.38, p.21, the report proposed further mitigation measures without further assessing their effectiveness. Air quality modelling must be carried out to verify the effectiveness of the proposed further mitigation measures, i.e. dust impact on ASRs can be further reduced to acceptable level.	The likelihood of exceedances of the recommended hourly TSP limit are discussed in para 2.5.38 and appropriate additional mitigation measures discussed in the following paragraph. Given the actual frequency of the necessary conditions and the fact that these occur during the first and last hours of the working day, when construction activities will not be at their peak, it is highly unlikely that the predicted levels will arise. Nevertheless, the MTRC will require the Contractor to develop mitigation measures which meet the established criteria as part of their Environmental Management Plan.
		Table 2.5l, p.22	Based on Table 2.5l, p.22, the mitigated 1-hour TSP level at APOL4 marginally exceeds 1-hour TSP guideline level. The report must also propose further mitigation measures so as to bring down dust impact at it to acceptable level.	The previous response applies to this comment as well. However, as discussed in para 2.5.39, further mitigation measures are not considered necessary as the conditions required to generate the predicted impact (100% activity of the dustiest activities for the entire hour) will not occur during the first and last hours of the working day. However, the text will be amended to include further mitigation measures.
		S.2.5.13, p.12	It is noted in S.2.5.13, p.12 that drilling will be the major dusty construction activity. However, there is no assessment of dust impact due to drilling. The report should also assess dust impact due to drilling.	Drilling in preparation for blasting is identified as one of the major dusty activities. As with blasting, the duration of drilling events are limited and the potential impacts are less than those from blasting itself with the mitigation proposed in para 2.5.33. An additional paragraph will be included in the report to this effect which will also describe the appropriate mitigation measures.
			A set of model files for each of the four study areas for the mitigated scenario must be submitted for our review and reference.	These files have now been submitted.
		S.2.5.23, p.15	The report should confirm with justification that the adopted dust emission rate for blasting is appropriate for this project.	Since the AP-42 emission rate factors were acceptable for the additional Quarry Bay Working Papers they were also adopted for use in the TKE DEIA.

No.	Department	Reference	Comments	Consultants' Response
		S.2.5.5, p.11	As stated in your previous responses to comments on Environmental Feasibility Report, there will be separate study which will address the air quality impact arising from landfill gas during construction and operational phases. However, there is no mention of this in the report. Please confirm if it is necessary to have such separate study. If it is necessary, then the report should state clearly that there is separate study to address air quality impact arising from landfill gas and the findings of the separate study should be addressed in this report.	The railway will operate in rock tunnels a considerable distance from Sai Tso Wan Landfill. It is not expected that impacts from landfill gas during construction or operation will cause adverse impacts. Nonetheless, the Consultants will provide a qualitative assessment of potential environmental impacts as part of the DEIA. If necessary, potential air quality impacts will be addressed in more detail in an Annex to the Landfill Gas Hazard Assessment and appropriate mitigation measures identified, once the necessary monitoring data is available.
		Noise S.3.4.24	POL station would be constructed above ground level. Please clarify if there is any operational noise impact from trains. If so, what mitigation measures would you recommend?	The above ground section between Hang Hau and Po Lam will be fully enclosed within a concrete structure and there will be no operational noise impacts from the movement of trains. An additional paragraph will be included before para 3.3.14 to explain this matter.
		S.3.4.59	The noise exceedance for normal school and examination periods would be respectively 19 dB and 24 dB. However, noise reduction from Type I glazing, as estimated in the report, would be 10 dB only which is not adequate to reduce the construction noise impact. Please advise whether there are any alternative mitigation measures that can further reduce the noise impact.	This is a typographic error, the predicted exceedance is 9 dB(A) which will be effectively controlled by the proposed additional mitigation measures. Further restrictions on plant operation may be necessary during examination periods if these coincide with the noisiest construction phases.
		Water Quality	We find that the findings in the report are very general and very superficial. For instance, the statement "appropriate mitigation measures should be implemented to minimise water quality" was used in the report quite often (eg; Sections 4.4.25, 4.4.29 & 4.4.30). Please elaborate on "what appropriate mitigation measures" they are recommending since this is a detailed EIA report.	The paras referred to are within the section of the report describing the predicted impacts. Detailed mitigation measures are presented in the following section in paras 4.4.32 - 4.4.49 and, for operational impacts, in paras 4.5.10 - 4.5.13
			In addition, as pointed out in all of our previous comments on the Environmental Feasibility Study, we have great reservation on the proposal if the proposed alignment will disturb the existing landfill site. However, in this Detailed EIA Report is only stated in S.4.6.1 that "The LAT to YAT tunnel is not expected to pass close enough to Sai Tso Wan Landfill for leachate impact to impinge on the TKE, however, this will be investigated as part of the Sai Tso Wan Landfill Hazards Study". This is certainly not adequate. The findings of the Sai Tso Wan Landfill Hazards Study must be discussed in this detailed EIA stage.	As the Landfill Gas Hazards Study is primarily concerned with safety considerations, and as the finding s will not be available in the near future, the Consultants will review the available data on the landfill status and the relative location of the TKE tunnels. This will provide a qualitative assessment of the likelihood of leachate being encountered and an opportunity to identify appropriate mitigation measures. A more detailed assessment can, if necessary, be completed as an Annex to the Landfill Gas Hazards Study once the necessary monitoring data is available.

No.	Department	Reference	Comments	Consultants' Response
			In S.4.4.21, similar "inconclusive" finding is also drawn for the proposed Yau Tong Bay reclamation for the future depot. More specific quantitative assessment should be carried out at this detailed EIA stage. Among others, please clarify whether drained reclamation method will be adopted in this site. The use of such reclamation method should be explored as far as possible.	The Consultant's will undertake a more detailed qualitative assessment of the potential effects of dredging of marine muds for the depot sea wall foundations and reducing the area of Yau Tong Bay as part of the DEIA.
		Contaminated Land Assessment at Yau Tong Bay	I understand that there is a Contaminated Land Assessment currently being undertaken by you. As I have raised to your Ms. Caroline Cook in my letter in the same series dated 15.10.96, please explain why such Contaminated Land Assessment does not form part of this Detailed EIA Report.	An initial desk top study has been completed, however, no on site investigations have been undertaken. The DEIA has, therefore, assumed a worst case scenario and identified mitigation measures accordingly.
		Air Quality Table 2.4a, p.8	In Table 2.3a, EFS, April 1996, proposed Lei Yue Mun Housing site is identified as ASR. However, this not included in Table 2.4a. Please explain why the subject site is not considered as ASR.	Three ASRs identified in the EFS have not been included in the DEIA. Po Chiu College is expected to be resumed. The tunnel portal location has been confirmed since the EFS and Ko Chiu Road Estate and the proposed Lei Yue Mun Estate are no longer the nearest sensitive receivers to the work sites. *Figure 2.4a* will be revised to show the location of the tunnel portals.
		Table 2.4a-2.4d	It is noted that the distances between ASRs and work sites are different from that in EFS, April 1996. Please explain for the discrepancy.	The TKE alignment has undergone a series of revisions during the course of the study and the final alignment is not the same as that used for the EFS.
		S.2.5.1, p.10	Please state clearly the source of odour during construction.	The reference to odours was included in error and will be deleted.
		Table 2.5b, p.13	Please explain why the percentage emission due to various dust size categories from those proposed earlier and used in Quarry Bay Extension Detailed EIA.	The proportion of emissions by particle size given in AP-42 do not include the 30-100 $\mu g\ m^{-3}$ group. In the TKE DEIA the additional particle size group has been included in the modelling to give a more accurate result. For the QBR DEIA the proportion of 30-100 $\mu g\ m^{-3}$ particles was distributed amongst the other size groups which tends to produce higher TSP levels as no allowance is made for the quicker settling of larger particles. It should also be noted that the values in *Table B1.3d* of the QBR DEIA were presented in reverse order although the modelling inputs were correct, this will be corrected in the final Report.

No.	Department	Reference	Comments	Consultants' Response
		S.2.5.18, p.14	Please justify the view in the third sentence which begins with 'The 24-hour....".	In calculating the 24-hour TSP levels the model assumes 24-hour working, whereas the working day is only 12 hours. It is, therefore, necessary to include an element in the calculations to allow for the fact that construction activities only take place for 50% of the 24-hour period.
		S.2.5.28, p.17	Based on Table 2.5f, p.16, the 24-hour TSP levels are in range 172-342 μ g/m^3, not as that given in S.2.5.28.	The Consultants have checked *Table 2.5f* and para 2.5.28 and the 24-hour TSP levels appear to be the same, please clarify.
		S.2.5.33, p.18	Please confirm if the proposed dust mitigation measures are acceptable to site engineers and ensure that the measure will be incorporated in contract specification.	The TKE DEIA has already been thoroughly reviewed by the engineers of Maunsell Consultant's and the MTRC. All engineering elements, including mitigation measures have, therefore, been agreed.
		S.2.5.37, p.21	i) Please confirm if use of a 3m hoarding during construction is practical and acceptable to site engineer. ii) 'Table 2.4k' should read as 'Table 2.5k'.	Please see previous comment. The *Table* number reference will be amended as advised.
		Noise S.3.4.30	The 4th line, "*Annex B*" should read "*Annex C*".	Noted, the text will be amended as advised.
		S.3.4.35	The 5th line, "Table *3.5a*" should read "*Table 3.4a*".	Noted, the text will be amended as advised.
		S.3.4.37	The 2nd line "Table *3.5b-d*" should read "*Table 3.4b-d*".	Noted, the text will be amended as advised.
		S.3.4.39	The 1st line "*Table 3.5a*" should read "*Table 3.4a*".	Noted, the text will be amended as advised.
		S3.4.60	By restricting no two noisy equipment operating simultaneously within a distance of 60m of NTAT 4, would there be any noise level exceedance?	The further mitigation measure of limiting active plant to one item to prevent cumulative impacts from construction plant on the same site will achieve the necessary noise reduction.
		S3.4.65	By restricting no two noisy equipment operating simultaneously within a distance of 15-30m at NHAH, would there be any noise level exceedance?	Please see previous response.
		S.3.4.67	The 1st line, "*16 dB(A)*" should read "*12 dB(A)*".	Noted, the text will be amended as advised.
		S.3.5.6	The 2nd line, "*Table 3.6a*" should read "*Table 3.5a*".	Noted, the text will be amended as advised.
9	CED/R P Martin 29 October 1996	S.4.2.3	The disposal of marine sediments is covered by WBTC 22/92 not EPD's technical circular no. 1-1-92.	Noted, the text will be amended as advised.

No.	Department	Reference	Comments	Consultants' Response
		S.4.4.5	Given that only 425,000 m^3 of marine fill is anticipated over a period of 18 months, it is likely that pelican sand barges rather than an hydraulic dredger will be used to deliver the fill to the site.	Noted, the final choice of equipment will be up to the Contractor, however, where this differs from that used in the DEIA he will be required to demonstrate the suitability of his choice, in terms of meeting the performance criteria, in his Environmental Management Plan.
		S.4.4.35	At first bullet, delete "as recommended by Fill Management Committee (FMC)" and replace with "as recommended by WBTC 22/92." Please note that the actual survey will have to be agreed with EPD.	Noted, the text will be amended as advised.
		S5.3.31	The public dumping capacity during 1997 and 1998 should be as follows: *Public Dump* — *Capacity during 1997 and 1998 (m^3)* Tseung Kwan O Town Centre Phase III, Stage I — 925,000 Tseung Kwan O Area 137 Stage I — 1,000,000 Tseung Kwan O Area 38 Stage I — 1,300,000 Tuen Mun Area 38 Stage I — 750,000 Tuen Mun Area 38 Stage II — 1,020,000 Pak Shek Kok Reclamation — 1,060,000	Noted, *Table 5.4c* will be amended as advised.
		S5.3.32	The last sentence should be amended to read as follows: "The majority of the inert excavated materials should go to fill sites, *while those construction and demolition materials which do not meet the requirements for fill sites but fulfil the requirements of the dumping license will be disposed of in public dumps.*"	Noted, the text will be amended as advised.
		S 5.3.36	The last sentence should be amended to read as follows: *"Such inert wastes should be sorted out. The non-inert construction wastes should be disposed of at landfills. The inert construction wastes should be disposed of at public dumps, where they have the added benefit of offsetting the need for removal of materials from terrestrial borrow areas for reclamation purposes."*	Noted, the text will be amended as advised.

No.	Department	Reference	Comments	Consultants' Response
10	SKDO/Manda Chan 29 October 1996		Given the eminent environmental impact of the MTR Tseung Kwan O Extension, I am of the view that the proposed mitigation measures should be strictly implemented or the construction and operation of the Extension would become sources of frequent complaints from local residents.	Noted. The MTRC will ensure sufficient mitigation measures are applied by requiring the contractor to meet the standards and criteria set out in the DEIA.
			Meanwhile, I am concerned that the 1-hour TSP levels at On Ning Garden, the proposed school in Area 37D and the small household block at Po Lam still exceed the EPD recommended level even after mitigation measures are implemented. I am also concerned that NHAH1 and NHAH9 in Hang Hau will still feature noise exceedances of the daytime criteria after the recommended mitigation C package is implemented. Further measures should be explored to mitigate the respective air quality and noise impact to the acceptable levels.	The DEIA explains why the predicted dust exceedances are unlikely to occur and that additional mitigation measures have been suggested to meet the criteria for both dust and noise. As noted above, the Contractor will be obliged to design and implement specific mitigation measures to ensure that all the established criteria are met, drawing upon the advice provided in the DEIA.
			I suggest the EIA findings and the proposed mitigation measures be presented to the Sai Kung District Board (SKDB) as the SKDB members are keen to know the different issues in relation to the Extension.	Noted
11	HyD RD RDO/ T M Lui 30 October 1996	General	By copy of this, will MTRC please confirm that an EIA report will be submitted on the combined environmental impact arising from the associated property development and the construction of Tseung Kwan O Extension should the former be carried out by the Corporation or agents on their behalf while the construction of the latter is underway.	Under the present construction plans, the construction of the property developments cannot commence until after the completion of the railway construction works. Impacts from the property developments are addressed under the relevant planning applications.
		Para 2.5.13	Will MTRC confirm the validity of the assumption made by their consultant that no batching plant would be required within any of the contractor's work sites for the construction of the TKE.	The MTRC have advised that it is their understanding that no batching plants will be required on site for the TKE construction works.
		Para 7.4.53	This paragraph suggests a section of the railway would be built within an advance works tunnel under Pui Shing Road. This appears contradictory to MTRC's proposal in their Feasibility Study (Feb 96) requiring the demolition and reconstruction of said box tunnel under option C3. Para 5.11.5 refers.	The current status of the box tunnel will be checked and the para revised accordingly.
12	WSD, CE/MSE M T Tse 30 October 1996		I have no comment on the Tseung Kwan O Extension Draft Detailed Environmental Impact Assessment Report R9T referred to in your memo under reference.	Noted.

No.	Department	Reference	Comments	Consultants' Response
13	DPO SKI (Sai Kung Office) F Lung 6 November 1996	General	The EIA report assumed that the stabling depot will be located at Yau Tong Bay. Indeed a decision on its location has not yet been made. Should an alternative depot site be identified, say in Tseung Kwan O, a supplementary EIA will be required to assess its environmental impact.	Noted.
		Specific Para 2.4.4 and Table 2.4b	Area 56 is reserved for the development of both a clinic and government offices, while Areas 65 and 67 are for PSPS.	Noted, the text will be amended as advised.
		Para 2.7.4	It is envisaged that lots of construction works in various parts of Tseung Kwan O will take place concurrently with that of the MTR construction. A more detailed analysis on the cumulative imapct is required and it is unsatisfactory to leave the issue to the future contractor.	The Consultants recognise that a full assessment of cumulative impacts is necessary. However, the details of other works in terms of locations, activities and timetable are not yet available and cannot, therefore, be included in this DEIA. The MTRC will require the contractor, using suitably qualified staff, to reassess the findings of the DEIA in the light of the then available information and to develop his own effective mitigation measures before he is permitted to start construction. This will provide more appropriate mitigation than could be achieved by attempting to estimate cumulative impacts at this stage.
		Chapter 7	The assessment only focusses on the visual impact of the MTR station and its alignment, but fails to include that of the mass transit vent shafts and other structures above ground level. Please note that "mass transit vent shaft and/or other structure above ground level other than entrances" ia a column 2 use in almost all zones in the approved Tseung Kwan O OZP and planning permission from the Town Planning Board is required for its construction.	The TKE vent shafts have been included in the assessment as they are an integral part of the station structures. The above ground structure over the alignment north of Hang Hau is also discussed.
			Please note I have no comment on Volume III: EM&A Manual.	Noted.

No.	Department	Reference	Comments	Consultants' Response
14	AFD, K W Cheung 4 November 1996	Section 6.2.5	In the last sentence "In addition .... relevant to" is incomplete and irrelevant to the Ordinance mentioned. It should be deleted.	Noted, the text will be amended as advised.
		Section 6.3.12	Does the "Sai Kung area" mentioned in this Section include the study areas in Yau Tong and Tseung Kwan O? Is there any information regarding the distribution of the two protected plants outside Sai Kung area.	The Sai Kung area mentioned does include Tseung Kwan O, the pspecies was not identified in the Yau Tong area. Ecologists at HKU have advised that both of the species mentioned in the report are not uncommon in grassland and low scrubland on granitic rock in Hong Kong, althrough no territorial-wide studies on their distribution pattern have been conducted. Observations have been reported in Kowloon Peak, Ma On Shan, Lantau Island and Lamma Island.
		Section 6.4.3, fifth bullet point	In selecting plant species for replanting, factors such as toughness, survival rate, compatibility with the surrounding, availability of seedlings, etc should be considered. The reference quoted is a general reference only and not related to the selection of plant species for replanting. It would be more appropriate to refer to references with proper plant selection matrices.	Noted. The list provided was intended as a general reference for the landscaping program, the text will be amended to include recommendations for the use of selection matrices by the Landscape Architects.
		R9T Vol. III	As the captioned report dealt with the monitoring of air quality and noise impact, I have no comment.	Noted.
15	RSD, B Chan 7 November 1996		Please be informed that this Department has no further comment on the captioned report.	Noted.

C1365/RTC/JKC/68268
25 August 1997

Response to Comments
Feasibility Study & Preliminary TKE/QBE (Draft DEIA Report)

No.	Department	Reference	Comments	Consultants' Response
1.	EPD/21 July 97	f( ) in Annex (10) to EP1/G/72	Para 2.5.38 A typo was found in the newly added para. The last one of the two new paras. should be read as "The main source of fugitive ... A reduction in the number of concrete mixer trucks from two to one per hour ..." Para 3.4.51	Noted, the text will be amended as advised.
			para 3.4.51 The noise levels for modern breakers, modern saw, kick ripper, bursting system, crusher, pipe jacking and non-explosive chemical agent should refer to SPL at 7 m.	Noted, the text will be amended as advised.
			para 3.4.59 In the responses to comments given in your fax of 4.11.97 (ref. C1365\46713\CONSULT), it is stated that "further restrictions on plant operation may be necessary during examination periods if these coincide with the noisiest construction phases". This should be clearly spelt out in report.	Noted, the text will be revised as requested.
2.	TD/Stella lp/18 July 97	TBCR2/2/1016/89(97) Pt.9	para 3.3.1 Replace "Po Chiu College" by "both schools" in Line 5.	The text will be amended as advised.
			para 3.4.59 To be deleted since SAP will need to be demolished anyway.	Noted.
			para 4.4.21/4.4.22 To be revised/deleted as appropriate in view of the latest development in Yau Tong.	Noted.

No.	Department	Reference	Comments	Consultants' Response
3.	EPD/Terence Tsang/17 July 97	f( ) in Annex (5) to EP1/G/72	I refer to the proposed revisions to the TKE DEIA Draft Final Report enclosed in you fax and our telephone conversation today. In light of recent development with respect to the alternative depot site for the TKE, please delete all the references made in the report to Yau Tong Bay depot and its associated reclamation. In the last paragraph under the heading of *Sai Tso Wan Landfill*, please include a summary of the conclusion of the interim QRA and the recommendations.	All references to a depot at Yau Tong Bay will be deleted. The conclusions of the interim QRA will be included.
4.	HyD/Lui Tat Ming/21 July 97	RD 6/2/6	My comments on the amended pages of the above-mentioned are: a. Para 3.3.1 refers. The TKE construction works will require the resumption of both schools, i.e. Po Chiu College and St. Antonius Primary School.	Noted.
			b. Para 3.4.59 refers. St. Antonius Primary School will be relocated prior to the commencement of TKE construction work.	Noted.
			c. Proposed revised paras to replace paras 4.4.21 and 4.4.22 refer. As noted in the first paragraph of your MUR, this project will entail no reclamation in Yau Tong Bay in the light of MTRC's recent decision to relocate the railway depot to Tseung Kwan O south.	Noted.
			ERM may not be aware of MTRC's current proposal which has now shifted Yau Tong Station slightly north-westwards clear of the Cha Kwo Ling Road. Therefore, it may be prudent to ask if ERM has satisfied himself that this shifting Yau tong Station north-west would not affect his earlier findings which were based on the assumption with Yau Tong Station encroaching upon (part of) Cha Kwo Ling Road.	The minor change in the location of Yau Tong Station will not materially affect the findings of the DEIA.

No.	Department	Reference	Comments	Consultants' Response
5.	Planning Dept/Paulina Y L Kwan/21 July 97	( ) in K-C/MTR/2	<u>para 3.3.1</u> a. Please note that the according to MTRC's latest proposed alignment for the TKE, Po Chiu College and St. Antonius Primary School are required to be demolished for the construction of the proposed Yau Tong MTR Station. In addition, the "G/IC" cum "Open Space" site situated east of the EHC portal has been agreed by the CPLD for housing development to accommodate about 20,000 persons. Hence, the consultant should be required to revise the report with due regards to the latest changes in the planning context in Yau Tong Area.	It is not considered necessary to revise the DEIA as the Contractor will be required to take all changes in the status of sensitive receivers into account in preparing the Environmental Management Plan.
			b. I gather that both the layout and development phasing of the Ko Chiu Road and Yau Tong Estates Redevelopment have been revised. The consultants are advised to confirm with D of H whether the conclusions on Yau Tong Estate are still valid.	Please see previous comment.
6.	WSD/M T Tse/21 July 97	(11) in WSD/MSE 1744/1343/96 Pt.3	As advised by the Director of Environmental Protection in his memo of 19 July 1997 ref. Annex(10) to EP 1/G/72, the original proposal to locate the depot in Yau Tong would no longer be pursued and that there would be no reclamation works in the Yau Tong Bay under the captioned project. Under the such circumstance, I have no objection to the endorsement of the above Drat Final Report.	Noted.