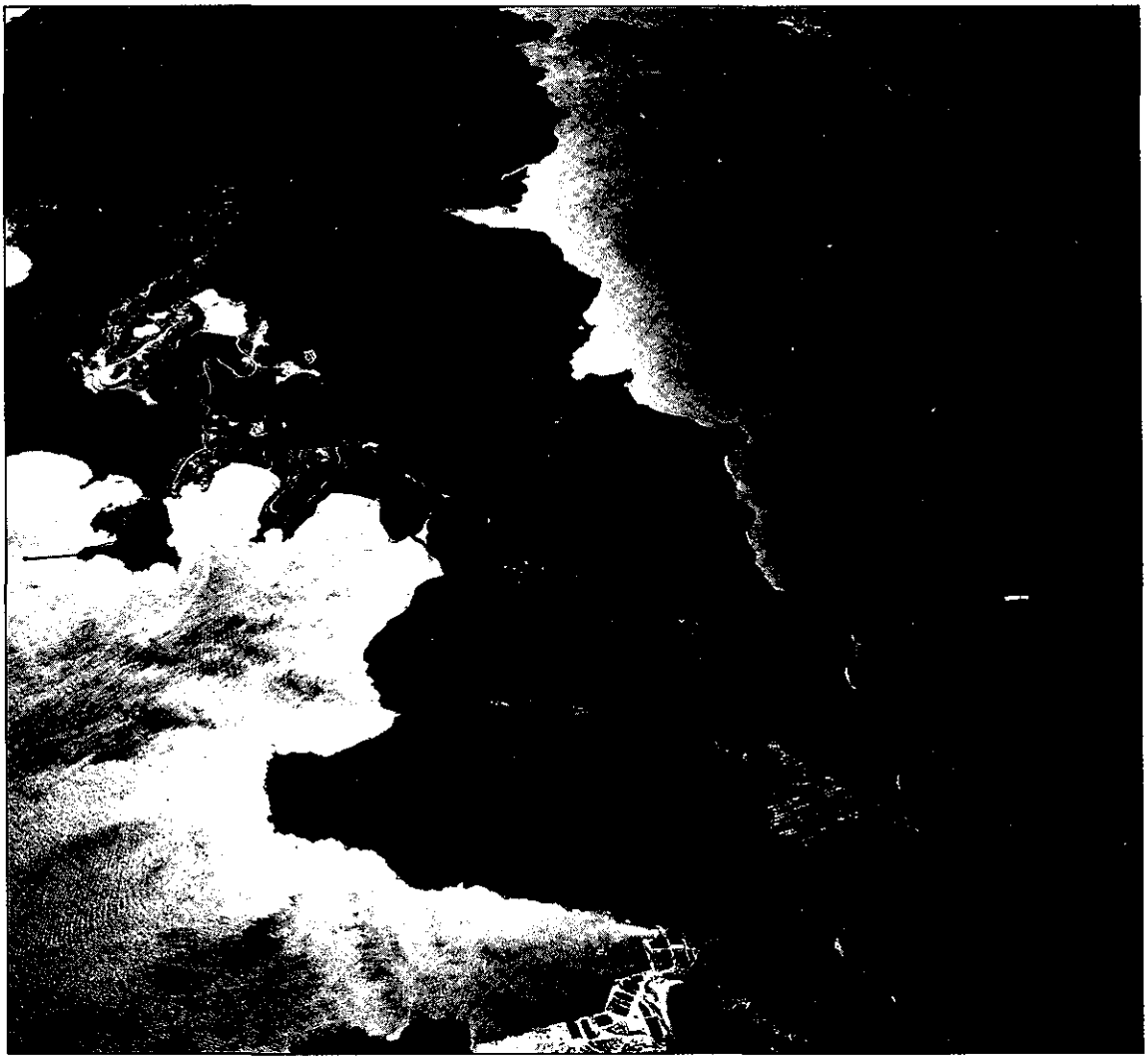
Government of Hong Kong
Highways Department

NORTH LANTAU EXPRESSWAY



Environmental Assessment Report
Tung Chung Section
Final Report
Agreement No. CE/18/81

Mott MacDonald Hong Kong Ltd.
in association with
Harris & Sutherland (Far East)
L. G. Mouchel & Partners (Asia)

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ENVIRONMENTAL ASSESSMENT REPORT

TUNG CHUNG SECTION

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1. INTRODUCTION

1. INTRODUCTION

1.1 Background

The North Lantau Expressway and the Airport Railway (NLE) are critical components of the new airport at Chek Lap Kok and the development of North Lantau. Under agreement No. CE/18/81, Mott MacDonald Hong Kong Ltd are undertaking the detailed design of the NLE. This environmental assessment has been executed in conjunction with the detailed design work to ensure that environmental aspects have been appropriately considered in the design, construction and operation of the scheme. The Study Brief for the environmental assessment is provided in Appendix A.

As shown in Figure 1.1, the route of the NLE will follow approximately 13.5km of the north Lantau shoreline, built partially upon reclamation at the toe of the hillsides and partially in large cuttings into the slopes.

The NLE will comprise a dual three lane expressway with a design speed of 100km/h and a high speed railway with a design speed of 135km/h. In addition, a utility service road will run the whole length of the NLE accommodating essential utilities. A 'baseline' cross section of the NLE is illustrated in Figure 1.2. This cross section will be modified where appropriate to suit the alignment of the road and rail, to improve the visual aspect of the scheme and to accommodate noise barriers. Figure 1.3 shows the proposed cross section through the New Town in Tung Chung. There will be road interchanges at Ta Shui Wan for the Port Peninsula Road, at Tai Ho Wan where development is being considered under the North Lantau Development Study (NLDS), at Tung Chung and at the New Airport. The railway will have an interchange at Tai Po when the Lantau Line (LAL) separates from the Airport Line (ARL).

The NLE is being considered in three separate contract packages as follows:

(a) Yam O Section from Sham Shui Kok to the Lantau Fixed Crossing.

(b) Tai Ho Section from Sham Shui Kok to Kei Tau Kok.

(c) Tung Chung Section from Kei Tau Kok to Tung Chung and Chek Lap Kok.

This report is only concerned with the Tung Chung section of the NLE. This is the most westerly section extending from Kei Tau Kok via Tai Po and across the North Lantau Development (NLD) Phase One reclamation area. The NLE will be then be connected to the New Airport by two bridges spanning the sea channel running between the New Airport and NLD reclamations. One bridge will accommodate the expressway and the other bridge the railway. The length of this section is approximately three kilometres.

The Yam O and Tai Ho Wan sections have been separately assessed and reported upon in April 1991.

1.2 Purpose Of The Environmental Assessment

The purpose of this environmental assessment is to assess the potential environmental impact of the proposed development of the Tung Chung section of the NLE. The assessment has also determined suitable measures to be incorporated into the design, construction and operation of the scheme for the mitigation of any adverse impacts to a level which is considered acceptable. The environmental assessment addresses the following:

(a) noise,
(b) air quality,
(c) water quality,
(d) visual intrusion and land use,
(e) ecology.

1.3 Objectives

The objectives of the Final Assessment Report are to:

(a) fully evaluate and quantify potential environmental impacts identified from the project;

(b) consider the acceptability of the impacts and recommend mitigation measures where appropriate to reduce impacts to an acceptable level;

(c) consider constraints on development alongside the NLE;

(d) propose compliance and post project audit programmes to monitor the success of adopted mitigation measures and ensure their effectiveness; and

(e) propose conditions for inclusion in construction contracts to minimise impacts from construction activities.

The study brief does not include the assessment of cumulative impacts from, for example, in during on the airport island and in the new town. However, it is crucial to view the impacts arising from the NLE in the context of all the other development proposals for North Lantau.

1.4 The North Lantau Development Study

This environmental assessment and report consider the impacts from the NLE. However the assessment of the NLE cannot be considered in isolation from the other development projects being carried out on North Lantau and in particular the North Lantau Development Study (NLDS). There has been a time lag between the two studies and the assessment of the NLE has been carried out in advance of the completion of the Recommended Outline Development Plan (RODP) for the NLDS. This has been beneficial to the development of the RODP in that the NLDS has been able to take account of the impacts from the NLE; these have been a significant constraint in the preparation of the RODP. However the time lag has meant that it has not been possible to fully discuss the impacts from the NLE on the surrounding uses in this assessment since the layout for these was not available at the time that the assessment was carried out.

The present report therefore focuses on presenting the constraints that the NLE offers to development in the Tung Chung area of North Lantau. These constraints are presented using the latest layout plans that were available from the NLDS Consultants at the time that the assessment was carried out. Those layout plans have subsequently been further developed to take account, inter alia, of the constraints on development identified in this report. Reports from the NLDS should be referred to for details of the final RODP and the mitigation for environmental impacts from the NLE that has been incorporated. Specific references are the NLDS Final Report and Topic Report TR20, "Environmental Development Manual".

Specific mitigation measures for noise impacts from the NLE that have been included in the NLDS RODP are a package of the following:-

(a) residential uses are set back from the edge of the expressway;

(b) noise barriers will be built alongside the expressway;

(c) the road will have sound absorbent surfacing; and

(d) residential blocks will have a restricted angle of view of the road.

Wherever possible residential uses have been set back from the expressway by a sufficient distance such that the HKPSG noise standards will be achieved. The set backs have been calculated assuming that properties facing the NLE will have no more than a 120° angle of view of the road. This assumption needs to be taken into account in the preparation of detailed layout plans and should be stated in the lease conditions for any private developments. The 120° angle of view is not to be considered an absolute criterion since developers should be allowed flexibility in meeting the standards. For example a wider field of view would be acceptable if the buildings are set back further or if there is some screening from other buildings. A narrower field of view, or additional screening by other buildings, would allow a smaller setback.

Noise barriers will be necessary alongside parts of the expressway to allow the package of mitigation measures to achieve the noise standards. The location and design of these have been determined by the NLDS Consultants and details are given in the NLD reports referred to above. The noise barriers will be 6m high earth bunds with 3m high solid barriers on top.

Noise from the railway has not generally been a constraint on NLDS RODP since set backs for the railway are generally less than those for the expressway. In addition much of the LAL through Tung Chung will be underground. However mitigation of noise from the railway will be necessary in places. The NLDS Consultants have defined locations for noise barriers based on the criteria presented in this report. Noise barriers have been assumed to be 1.5m high absorbent barriers and their location are shown in the NLDS reports referred to above. Responsibility for constructing these barriers will lie with the operator of the railway and a final decision on their form and location will depend on details of the train frequencies and rolling stock design, neither of which are available at the present time. Further studies will therefore be needed by the railway operator.

Air quality constraints from the NLE have been accommodated in the NLDS RODP by planning any uses which could be sensitive to air quality away from the zones that have been identified in this report as having poor air quality. Impacts from the NLE have also been taken into account in the air quality modelling carried out by the NLDS Consultants.

The visual impact of the NLE on the new town in Tung Chung will be significant. In addition the noise barriers to be built alongside the NLE will have a significant visual impacts on users of the NLE and residents of the new town. The noise barriers have been designed to reduce this impact as far as possible and the lower 6m of the 9m barrier will be an earth mound. Further mitigation in the form of landscaping is also recommended.

Figure 1.1
Alignment of the North Lantau Expressway

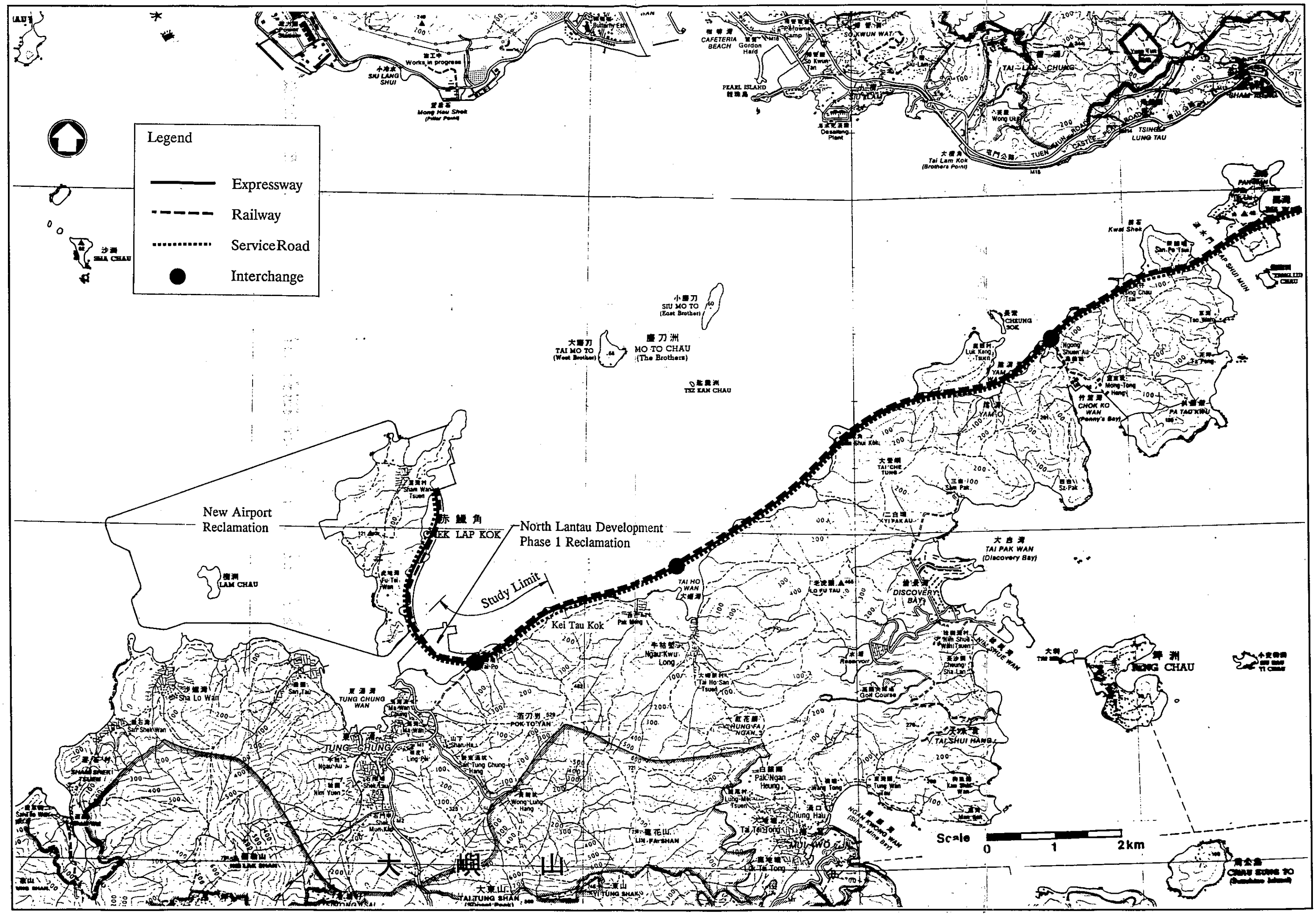


Figure 1.2
Typical Cross Section of the NLE

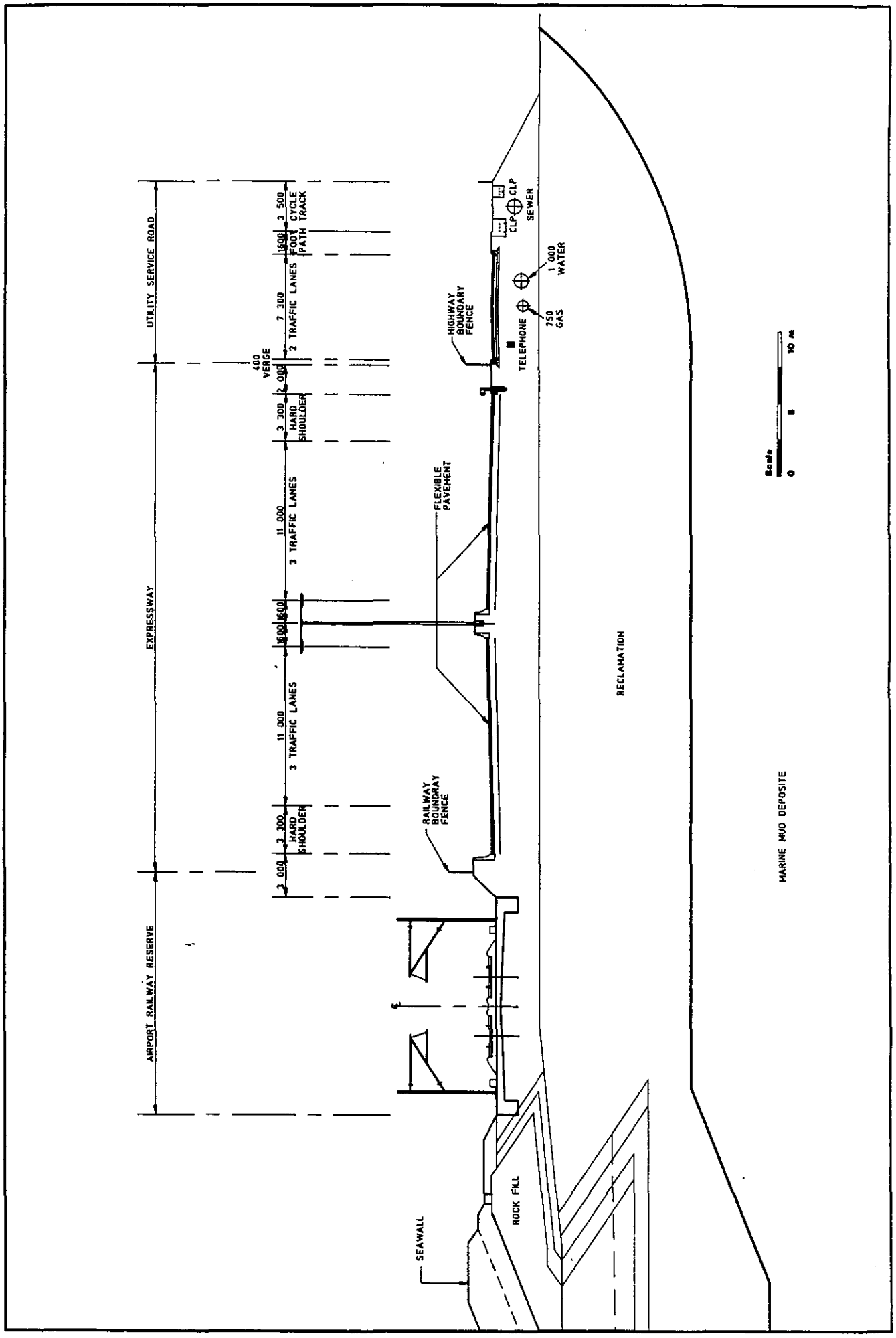
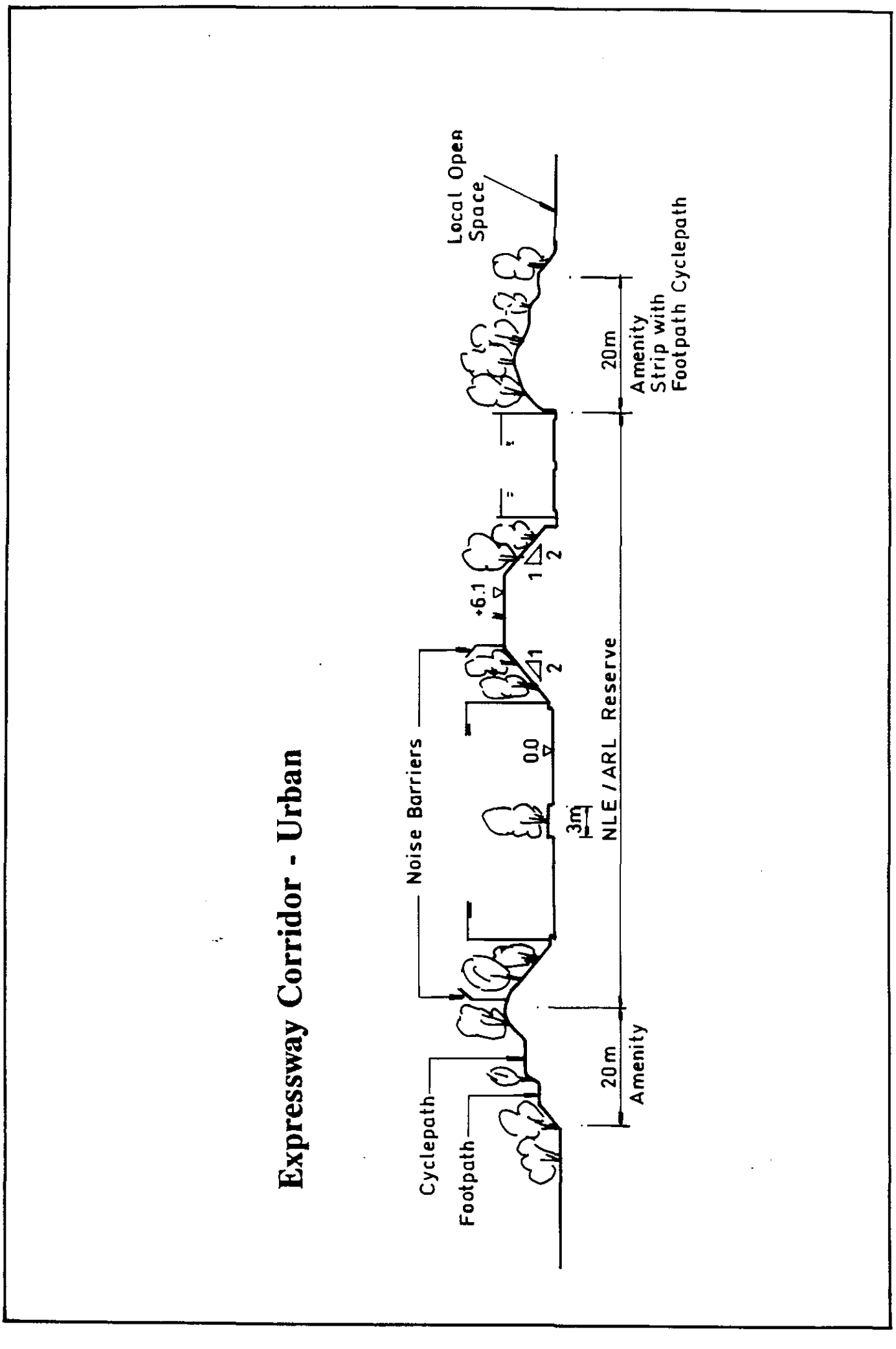


Figure 1.3
NLE Cross Section through Tung Chung



2. CONSTRUCTION ACTIVITIES

2. CONSTRUCTION ACTIVITIES

2.1 Introduction

A description of the construction activities is provided below and the construction programme is illustrated in Figure 2.1.

2.2 Excavation And Cutting

The detailed design of excavation and cutting has yet to be completed but it is currently estimated that there will be about 1.0 M cu m of excavation, with a currently unassessed split between rock and colluvium, from the hillsides to reduce them to formation level for the NLE between Tai Po and Kei Tau Kok.

The period of excavation is currently anticipated to be from August 1993 to late 1994; it is not expected that working outside of a normal 12 hour working day will be necessary on this size of contract.

The rate of rock excavation is not expected to exceed 50,000 cu m per week. Blasting will be required for excavation, but the quantities to be excavated are not expected to necessitate blasting more than once a day. The excavation will be terraced to provide the required length of face and to facilitate the loading and removal of the blasted rock.

The excavated material could be loaded onto trucks for transport to the point of disposal at an assumed rate of 15 tonnes per load entailing approximately 50 loads per hour. The number of trucks required will be dependent on the length of travel, resulting cycle time and rates of excavation.

A crushing plant may be required to break the product down to suitable sizes.

2.3 Dredging And Reclamation

The major dredging and reclamation works to carry the expressway through Tung Chung will be undertaken by the Territory Development Department and are discussed in the NLDS Topic Report TR18.

Minor dredging and reclamation works to be discussed in this report will take place along the coastline from Kei Tau Kok to Tai Po and are currently expected to commence in August 1993 and complete in late 1994. Working outside the normal 12 hour working day is not currently anticipated although this could be necessary to meet contract completion deadlines. In addition contractors may request to work at night for financial reasons.

Initially the marine muds will be dredged from the proposed reclamation area and excavated material will probably be used to fill the reclamation, backed up with some rock core. Rock armouring will be placed along the outer edge of the seawall on top of the rock core.

The following estimated quantities are expected to be required:-

(a) about 250,000 cu m of marine muds will be dredged requiring a six cu m grab dredger, capable of removing about 20,000 cu m per week, and no more than two barges and one tug. Each barge will make two or three round trips per day to and from the disposal site. The location of the dumping ground is still under

consideration at this stage but is likely to be the gazetted area to the south of Cheung Chau;

(b) about 250,000 cu m of excavated material will be required to fill in the dredged area to form the reclamation site. The excavated material could be transported by truck or conveyor belt;

(c) about 50,000 cu m rock core, also from the excavation, will be needed to provide the core fill to the seawall. Rock core will be placed by grab from barges and may require crushing to appropriate sizes before use; and

(d) approximately 25,000 cu m of rock armour will be needed. It has been assumed that this material will be obtained from commercial quarries outside of Hong Kong waters. Rock armour will be placed from barges.

2.4 Concrete

Concrete will be supplied to all works from mid 1993 to mid 1996. It is unlikely that the contractor will have his own batching facilities as it is envisaged that a commercial centralised concrete batching facility will be available located on the NLD phase one reclamation. The total volume of concrete to be used in the construction of the Tung Chung section of the NLE has been estimated to be about 75,000 cu m.

2.5 Bridges And Viaducts

These will comprise a 200m sea channel expressway bridge, a 200m sea channel railway bridge, and an elevated interchange at Tai Po.

The construction period for these structures is currently expected to be within the period of mid 1993 to mid 1996, using a 12 hour working day.

It is expected that the expressway bridge, from Tung Chung to Chek Lap Kok, will take the form of a three span cantilever construction. However, this has not yet been firmly established. The railway bridge will be similar to the expressway bridge but will carry a twin track railway. The design of the railway deck units is to be based upon in-situ construction although precast alternatives may be possible.

Both bridges will be constructed using deep piles 40m to 50m below sea level. Piling will be during the early part of the contract and a number of piling rigs, mobile cranes, concrete pumps, and concrete vibrators will be used.

The total volume of concrete to be used in construction of the bridges has been estimated to be in the order of 22,500 cu m. Individual concrete pours for the bridges and interchange may range in size from 20 cu m to 30 cu m and up to 500 cu m when larger pours are executed. Major pours will generally occur about twice a week.

Construction of the Tung Chung east interchange will require about 0.5 M cu m of fill which will be generated from the local excavation and an estimated 7,500 cu m of concrete. Minor bridges to carry the distributary roads over the expressway including those at the Tung Chung west interchange are to be piled and casting of concrete structures could be in-situ.

Construction of the interchange will require the resumption of most private lots within the Tai Po area. The Tai Po Buddhist Youth Camp, however, will not be resumed but will remain sited immediately adjacent to the construction site and likely to suffer from dust, noise and visual impacts. The Youth Hostel may therefore require some long term environmental protection measures such as noise amelioration.

2.6 Paving

Paving of the expressway and service road is currently scheduled for early 1995 to the end of the contract, mid 1996. It may not be necessary to work outside the normal 12 hour working day.

The assumed pavement structure for the expressway and service road is:

(a)	Type I sub-base of crushed rock	150mm (1 layer)
(b)	Dense bituminous macadam	240mm (2 layers)
(c)	Asphaltic base course	60mm (1 layer)
(d)	Asphaltic wearing course	40mm (1 layer)
(e)	Friction course	30mm (1 layer)

The sub-base may be placed as a protective layer over the sections of subgrade as they are completed, rather than waiting until all areas are ready for pavement. If this is the case, much of the sub-base will be required before there is a haul road available and barge transportation would be used. If undertaken in one continuous operation the Type I sub-base would need about eight weeks to lay using one spreader served by three or four trucks an hour.

An asphalt mixing plant will probably be located within the site. The asphalt materials will not be needed until towards the end of the construction period when a route through the section will be available. The rate of placing will be dependent on the capacity of the central plant to produce the material, the competing demands on the supply for other sections of the work, and the number of teams employed. It has been assumed that about 1200 tonnes of material will be placed per day over a total of 15 weeks requiring supply at the rate of between seven and eight trucks per hour.

2.7 Finishes

The finishes will include traffic signs and their supports, street lighting, pavement markings, traffic barriers and fences. The equipment used for these items will consist of light to medium delivery trucks and small cranes, etc. It is unlikely that many of these vehicles will be active at any given time. Work will be undertaken during the latter part of construction.

2.8 Utility Installation

Utility services such as water, gas, electricity, telephone, and sewers, will be incorporated into the expressway and service road corridor.

This will involve careful coordination of WSD, CLP, HKTC and gas utility companies. Trucks, excavators and compactors will be involved in trench excavation, backfill and surfacing. Work will commence during 1994 and extend until the latter stages of the contract.

2.9 Railway Installation

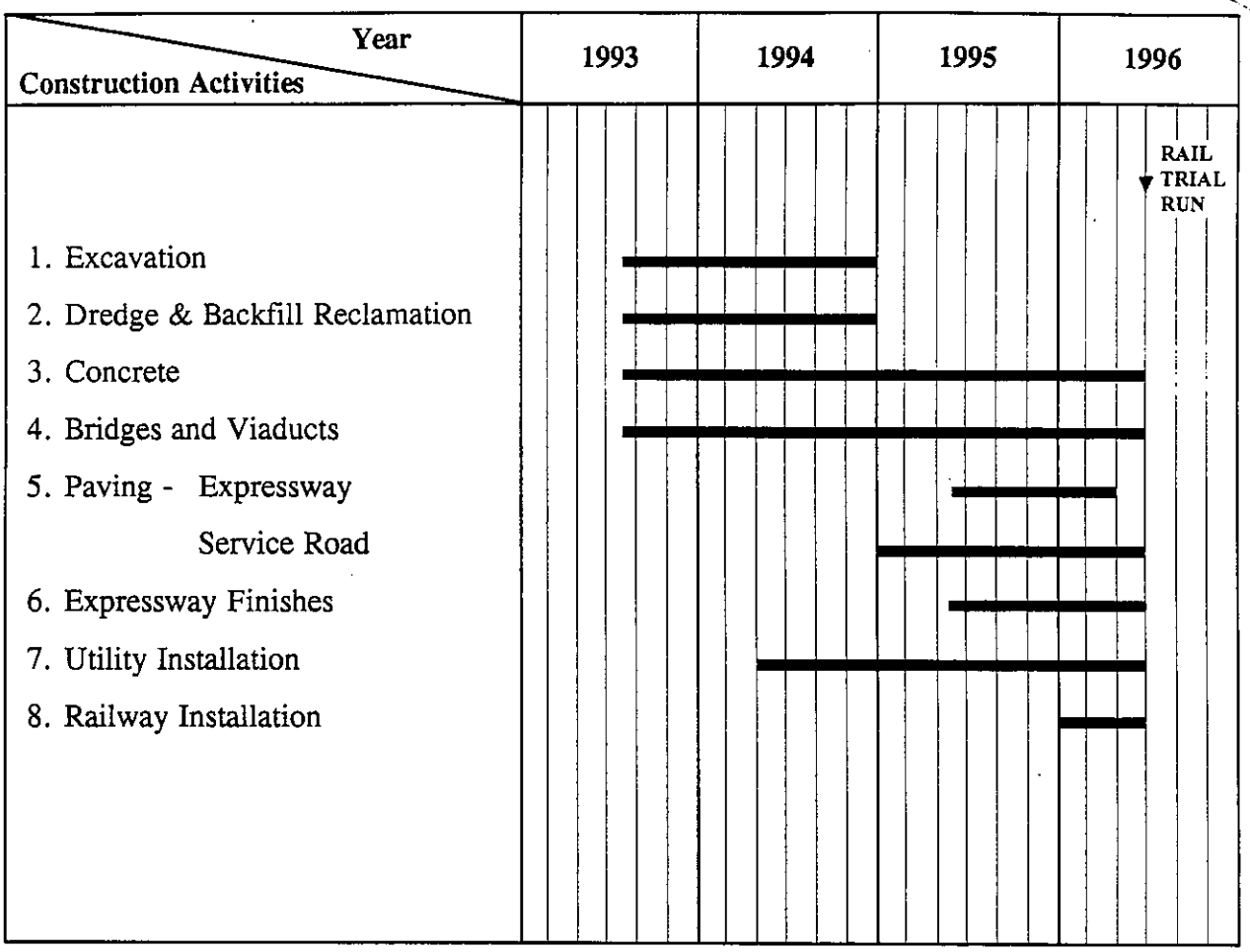
Ballasting and tracklaying is likely to be carried out by modern purpose built equipment. The overhead and trackside cabling and signal installations will then progress using the tracks for access. This will also be undertaken in the latter months of the contract.

Railway installation will not be included in the contracts for constructing the NLE but will be carried out under contracts organised by the railway operator.

The Lantau Line (LAL) of the airport railway will pass underneath the NLE in the centre of the Tung Chung reclamation. The NLD Consultants have assumed that the LAL will open at the same time as the new airport.

It has been assumed that the NLE contract will construct the diaphragm walls needed for the LAL station box beneath the NLE in Tung Chung and also the cutting in the approaches to the station.

FIGURE 2.1
OUTLINE CONSTRUCTION PROGRAMME



3. OPERATION

3. OPERATION

3.1 Expressway

Traffic volumes on the expressway will be high with a high proportion of heavy vehicles compared to many of the Hong Kong roads. Table 3.1 summarises the predicted peak traffic flows for the design year of 2011. Figure 3.1 illustrates the linkages used and the east and west bound flow rates. The Tung Chung section between the Tai Po interchange and the airport includes links 110-111 (eastbound) and 113-114 (westbound). Links 111-112 (eastbound) and 112-113 (westbound) are located between Tai Ho Wan and the Tai Po interchange. For the purpose of this assessment the worst case situation arising from the peak traffic flows has been assumed.

Table 3.1 Predicted Peak Traffic Flows For 2011

Direction of Flow	Link	Car	Taxi	LGV	MGV	HGV	Total Vehicles
AM Peak - One Hour							
East	110-111	560	761	110	576	47	2054
West	113-114	809	996	110	390	47	2352
East	111-112	1038	921	124	1014	65	3162
West	112-113	1053	1077	129	1059	65	3383
PM Peak - One Hour							
East	110-111	1002	1197	135	512	35	2881
West	113-114	793	1061	142	587	35	2618
East	111-112	1222	1296	143	938	51	3650
West	112-113	1332	1166	162	1065	51	3776
Midday Peak - One Hour							
East	110-111	707	970	149	466	27	2319
West	113-114	1002	1254	189	393	27	2865
East	111-112	845	1121	163	957	41	3127
West	112-113	1113	1405	201	947	41	3707
Daily Vehicle Flow - 24 Hours							
East	110-111	12684	16858	2433	8221	513	40709
West	113-114	16118	20352	2954	7260	513	47197
East	111-112	15786	19282	2653	6291	763	44774
West	112-113	19488	22676	3192	6626	763	52745

Source : North Lantau Development Consultants

The breakdown of traffic mix has been based upon the following categories in accordance with the Hong Kong licensing regulations:

	Tonnes
Cars	<1.65
Taxis	<1.65
Light Goods Vehicles (LGV)	<5.5
Medium Goods Vehicles (MGV)	5.5 - 24
Heavy Goods Vehicles (HGV)	>24

3.2 Railway

The Airport Railway will be accommodated on two tracks with a design speed of 135km/h. The Airport Railway Feasibility Study calculated probable train frequencies and these have been used for this Study. The airport service (ARL) is expected to run at four minute intervals between 0930 hours and 1730 hours between Central Hong Kong and the airport with a possible stop at Tsing Yi. Outside this period trains are likley to run at 8 minute intervals. Trains are likely to consist of ten cars.

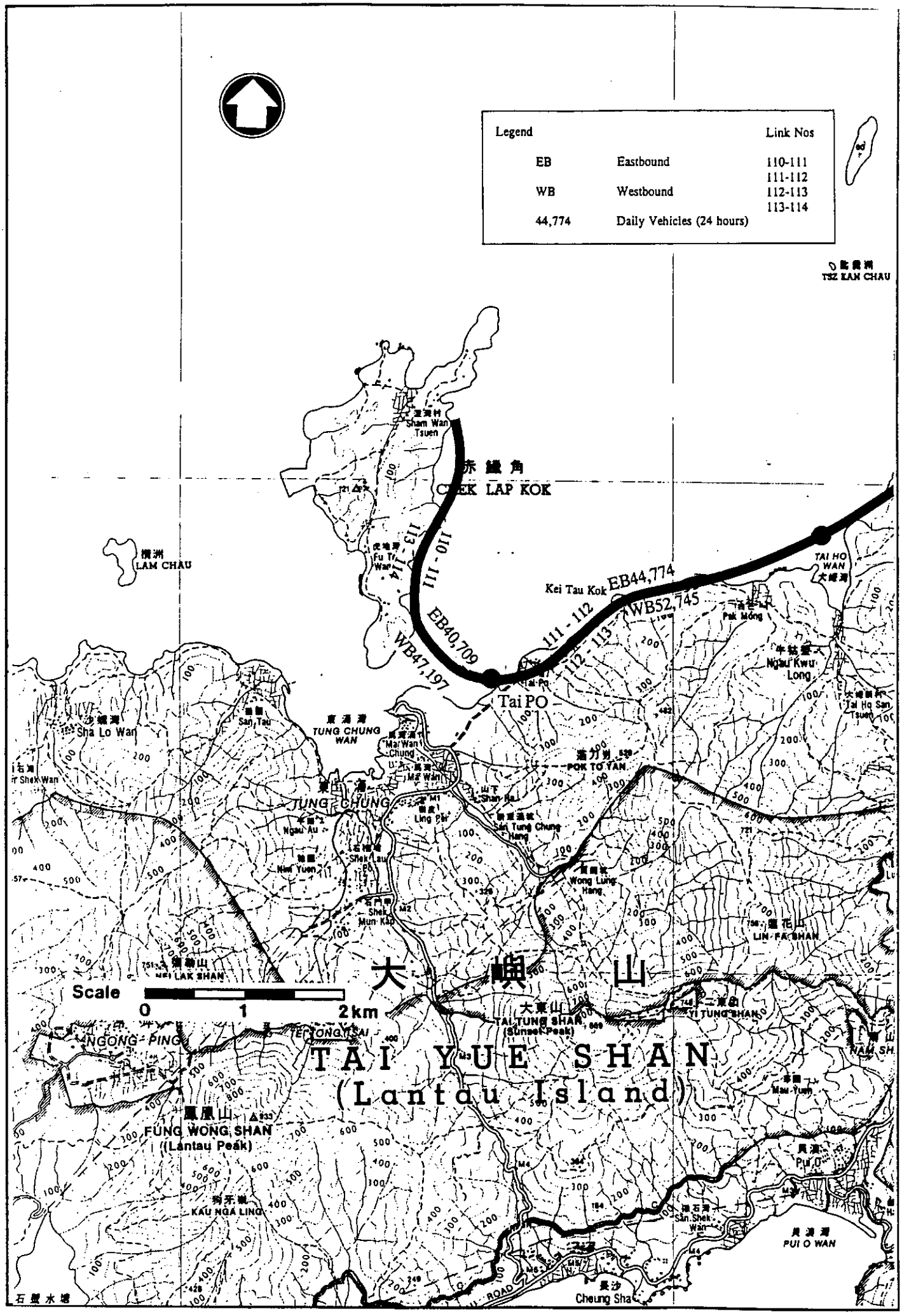
The local Lantau (LAL) service will probably operate every eight minutes between Tsing Yi and Tung Chung off peak and every four minutes during peak periods. During peak hours trains will probably comprise eight cars whilst off-peak they may be four cars.

3.3 Utilities Service Road

Government design standards prohibit utility services from being located within the main carriageways unless related to highway operation. Utilities will therefore be confined to the service road and will include the following which will run the whole length:

(a) fresh water trunk main, 1.4m diameter;
(b) sewerage main;
(c) high pressure gas main, 0.75m diameter, from the Hong Kong and China Gas Company;
(d) telephone cables from Hong Kong Telephone Company Limited; and
(e) electricity cables from China Light and Power Company.

Figure 3.1
Predicted 24 Hour Traffic Flows



4. NOISE

4. NOISE

4.1 Existing Environment And Baseline Surveys

The Tung Chung Section of the NLE runs through the main village settlement area of North Lantau, the most populous village being Ma Wan Chung. The existing noise environment consists of isolated villages scattered in and around the Tung Chung basin, a typically quiet and rural area, where the main noise source is local community background noise from televisions, radios, people, dogs barking, and school children at play, etc. Traffic noise is an important component in the day time near the Tung Chung Road and marine traffic noise is significant near the shoreline.

In early 1991 a baseline noise survey was carried out by the NLDS Consultants to characterize the existing noise environment. The results have been documented in the 'Background Noise Survey for the North Lantau Development Project' identifying the main noise sources and measuring the background noise levels and temporal variation in the noise within the NLD area. The background noise level was typically very low, in the range of L_{90}(1-hr) 30 dB(A) to 45 dB(A). Higher noise levels up to 50 dB(A) were measured at Ma Wan Chung in the daytime, and at night the background noise levels were generally under 30 dB(A).

4.2 Construction Phase Impact Assessment

4.2.1 Assessment Methodology And Criteria

Twelve major construction activities have been identified as potential sources of noise; these are listed in Appendix B1. Appendix B2 lists the type, number and sound power levels of power mechanical equipment (PME) likely to be used for each construction activity.

The impact of construction noise has been assessed by predicting the highest anticipated noise levels at the facade of noise sensitive receivers in the Tung Chung area from single activities. The assessment method was specified in the Technical Memorandum on Noise from Construction Work Other Than Percussive Piling (TM1) and the Technical Memorandum on Noise From Percussive Piling (TM2).

Sheet piling and diesel hammers are classed as percussive piling under the Noise Control Ordinance (NCO) and assessed according to TM2.

4.2.2 Sensitive Receivers

Nine noise sensitive neighbourhoods have been identified as being potentially sensitive to construction noise impacts. These are shown on Figure 4.1 and listed in Appendix B3. The village of Tai Po will be resumed prior to construction of the NLE but the Buddhist Youth Camp immediately to the west of Tai Po will remain along with all the other villages.

In accordance with TM1, the area sensitivity rating (ASR) of Tung Chung should be classified as 'A' as shown in Table 4.1. This ASR would be expected to change as the NLE is opened to traffic and when Tung Chung is under development. The ANLs shown in Table 4.1 have been calculated from the Basic Noise Levels (BNL) listed in TM1 on the basis that corrections for duration or multiple site situations would not apply. The ANLs are therefore the same as the BNLs.

Table 4.1 Specified (TM1) And Recommended Acceptable Noise Limits For Restricted Periods

Time Period	Area Sensitivity Rating (ASR)	Acceptable Noise Limits (ANL)
Period 1 Period 2	A	60 dB(A) 45 dB(A)

Period 1 - All days (1900 to 2300 hours) and general holidays (including Sundays) (0700 to 2300 hours).
Period 2 - All days (2300 to 0700 hours).

4.2.3 Impact Assessment And Evaluation

General

One of the objectives of this assessment has been to determine whether the noise criteria can be met following the construction method and programme described in Chapter 2. If the noise criteria cannot be met mitigation measures will be required for amelioration.

Construction activities have generally been planned for day time working, six days per week, and therefore noise permits may not be required. However, there may be times when prolonged working is necessary to make up for the loss of time due to bad weather, shortage of materials or labour, change of construction programme of other unforeseeable reasons. Any delay to the completion of these works would delay construction of other critical components of the Airport Core Projects and would be unacceptable.

To work within restricted periods a Construction Noise Permit would normally be required from the Control Authority and the relevant noise criteria must be strictly observed for the issuance of such permits.

Percussive piling in the restricted hours is prohibited and a permit will be required for day time piling according to TM2.

Under normal circumstances the only activity requiring 24 hour working will be earthworks dredging and reclamation, if permitted.

The scheduling of work over a 24 hour working period will be decided by the contractor and provision must be made for the issuance of Construction Noise Permits.

Predicted Noise Impacts

The highest noise levels likely to be generated at each of the noise neighbourhoods are listed in Appendix B4. The highest noise levels will be at the Buddhist Youth Camp where noise could reach 88 dB(A) during the cutting and excavation of earthworks at Tai Po and Kei Tau Kok.

Table 4.2 shows those activities which could not proceed in the restricted periods without exceeding the recommended ANLs at the Buddhist Youth Camp.

Table 4.2 Activities Unable To Work In The Restricted Periods

Activity ID	Activity Description	Period 1	Period 2
1.	Earthworks (reclamation/dredging)		
1.1	Dredging	*	*
1.2	Rock armouring	*	*
1.3	Sand placement	*	*
2	Earthworks (cutting/excavation)	*	*
3	Concrete		*
	Bridges and Viaducts		
4	Sea channel expressway		*
5	Sea channel railway		*
6	Tai Po elevated interchange	*	*
7	Paving	*	*
8	Finishes	*	*
9	Utility installation	*	*
10	Railway installation	*	*
11	NLE (LAL station diaphragm wall)		*
	LAL Cutting		
12.1	Excavation	*	*
12.2	Concreting	*	*

4.2.4 Mitigation Measures

The worst affected noise sensitive receivers will be the Buddhist Youth Camp and both the NLDS Consultants and the AMPS Consultants have recommended that this building should be insulated against noise to allow their projects to work 24 hours per day. Both of these projects will be constructed in advance of the NLE and it is therefore likely that the building will be insulated before the NLE works commence. The AMPS Consultants have recommended that air conditioners should be installed and the NLDS Consultants have recommended that this should be supplemented by window insulation. It is understood that the former recommendation has been accepted and the latter is presently under discussion within Government. Table 4.3 shows the maximum permitted noise levels that would be acceptable at the Buddhist Youth camp with noise insulation.

Table 4.3 Maximum Permitted Noise Levels With Sound Insulation

Method of Insulation	ANL (dB(A))	
	Period 1	Period 2
Airconditioners	65	60
Airconditioners and Window Insulation	75	70

The activity most likely to need 24 hour working is reclamation and dredging and this could cause noise levels of 76 dB(A) at the Youth Camp. This is close to the level that would be acceptable if the NLDS Consultants recommendations are accepted. The noisiest activity will be rock excavation but this is not likely to work 24 hours.

It is therefore considered that the contractors should be able to work within the provisions of the Noise Control Ordinance (NCO) and if they wish to apply for a Construction Noise Permit they may do so under the normal provisions of TM1. Contractors should be notified in the tender documents that ASR classification 'B' will be applied to this project except at the Buddhist Youth Camp where the noise levels stated in Table 4.3 (75 dB(A) in Period 1 and 70 dB(A) in Period 2) would apply assuming that the noise insulation proposed under the North Lantau Development contracts is installed.

Some mitigation at source may still be needed and this can be accomplished by the following:

(a) silencing of equipment,
(b) use of quieter equipment,
(c) use of baffles or acoustic enclosures,
(d) proper siting of equipment,
(e) proper maintenance of equipment.

For the above activities, use of quieter equipment, baffles or enclosures should be sufficient to bring the noise levels at the Buddhist Youth Camp and other sensitive receivers down to the recommended acceptable levels.

4.2.5 Monitoring and Audit

The purpose of the construction phase noise monitoring and auditing programme is mainly to establish compliance with the provisions of the NCO, with the terms and conditions set out in the Construction Noise Permits and to ensure that daytime noise is not excessive. Noise monitoring should be carried out at all noise sensitive receivers that are likely to be affected whenever noise generating operations are underway. The noise monitoring schedule should be measured in accordance with the Technical Memorandum on Noise from Construction Work other than than Precussive Piling. Measurement should initially be at least two per day, one in each of the restricted periods, unless complaints are received in which case more frequent measurements will be needed. Measurements will also be needed during the daytime, initially at up to 3 days per week or more frequently if noise levels become high. It may be possible to reduce the frequency of monitoring later in the contract if noise nuisance is not significant and in view of the fact that there is only one sensitive receiver.

It is recommended that the trigger, action and target levels for construction noise listed in Table 4.4 should be adopted. The only sensitive receiver likely to be affected by the construction noise is the Youth Camp. It is understood that noise insulation may be provided for this receiver under the Work Lantau Development project in which case higher noise levels could be adopted. However this would need a special application to be made to the Secretary for Planning Environment and Lands under Chatper 3 of TM1.

Table 4.4 Trigger, Action and Target Levels for Construction Noise (dB(A))

Time Period	Trigger	Action	Target
All days during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day-time and evening (0700 to 2300 hours)	50	55	60
All days during the night-time (2300 to 0700 hours)	35	40	45
Daytime (each day from 0700 to 1900 except general holidays)	65	70	75

The proposed action plan, should any of these be exceeded, is set out in Table 4.5.

Table 4.5 Construction Noise Action Plan

Event	Action	
	Engineer	Contractor
Exceedance of 50dB(A) and 35 dB(A) trigger levels Exceedance of daytime trigger or action level	Notify Contractor	-
Exceedance of 55dB(A) and 40dB(A) action levels Exceedance of daytime target level	Notify Contractor Require Contractor to propose measures to reduce noise Increase monitoring freqency to at least two measurements per time period	Submits noise mitigation proposals to the Engineer Implements noise mitigation proposals
Exceedance of 60dB(A) and 45dB(A) target level	Notify Contractor Notify EPD Require contractor to implement mitigation measures immediately Increase monitoring freqency to hourly	Implement mitigation measures Advise Engineer of measures applied

4.3 Operational Phase Impact Assessment

4.3.1 Assessment Methodology And Criteria

The predicted p.m. peak hour traffic figures for 2011 have been used for assessment of the traffic noise as shown in Figure 4.2. According to the traffic forecasts, volumes of eastward and westward bound traffic will reach 7500 veh/hr between the Tai Ho Wan and Tung Chung junctions and 5500 veh/hr between the Tung Chung junction and the Airport; the latter being less due to diversion of some traffic to the Tung Chung new town. Vehicle speeds will be 60 km/hr at these levels of congestion. The NLE will have a surface friction course which will reduce the generated noise by 3.5 dB(A).

The maximum operation hours and service frequencies assumed for train movements in 2011 are as shown in Table 4.6. Trains comprising 4 cars are assumed to generate a peak noise level of 83 dB(A) (free field) at 25m from the centreline of the track when travelling at 135 km/hr, the assumed operating speed of the railway. This noise level has been adjusted to allow for the 8 or 10 cars assumed for the LAL and ARL.

Table 4.6 Train Operation Hours And Service Frequencies In 2011

Train Service	Passby, Each Direction
ARL Service	
0500 - 0930	8 mins.
0930 - 1730	4 mins.
1730 - 0100	8 mins.
LAL Service (Tung Chung Section)	
0500 - 0700	8 mins.
0700 - 1000	4 mins.
1000 - 1600	8 mins.
1600 - 1900	4 mins.
1900 - 0100	8 mins.

4.3.2 Impact Assessment

Road Traffic

The potential noise impact on existing and future land uses in Tung Chung has been assessed by calculating the position of the 70 dB(A) contour line measured from the centreline of the NLE. This has given the setback distances needed to meet the Hong Kong Planning Standards And Guidelines (HKPSG) for road traffic noise at the facade of new dwellings, hotels, hostels, and offices in the Tung Chung new town. The setback distances without any mitigation are illustrated in Table 4.7. Smaller setback distances are predicted along the section between the Tung Chung roundabout and the Airport mainly because of a lower traffic volume and a smaller percentage of heavy vehicles. Because of the curvature of the NLE, the noise contours are slightly asymmetrical about the centreline, the contour lines being displaced further from the centreline on the north side than the southern side of the NLE.

Table 4.7 Setback Distances Required To Satisfy The HKPSG Criteria For Traffic Noise (No Mitigation)

Road Section	Setback Distance
Tai Ho Wan - Tung Chung Roundabout	300 - 340m
Tung Chung Roundabout - Airport	210 - 300m

Without mitigation, new educational institutions, places of public worship and courts of law would have to be sited beyond the 65 dB(A) contour line. Hospitals, clinics, and homes for the aged, etc, would have to be sited beyond the 55 dB(A) contour line. Figure 4.3 shows an overlay of the L10(1-hr.) contours at 30m PD on the dRODP for Tung Chung.

The shaded areas in the figure show where the HKPSG criteria would be exceeded for the particular land uses, without noise mitigation. These impacted areas include R1, R2, R3 and HOS developments beyond 70 dB(A) in Areas 4, 11, 15, 19, 58 and 59, and G/IC development beyond 65 dB(A) in Areas 2, 3, 8, 12, 17, 20, and 62.

It is understood that educational institutions such as secondary schools and kindergarten could be located on R sites. In this case, the noise criterion of 65 dB(A) should be applied. On the other hand, G/IC sites could be used for noise tolerant uses. Careful consideration should be given to the use of land in impacted areas.

Three typical cross sections for potential noise impact at heights other than 30m PD on the NLE are located on Figure 4.4 and the contour plots are shown on Figures 4.5 to 4.7. Sections A-A and B-B represent a section of the NLE with lower traffic figures, while section C-C a section with higher traffic figures. Both sections A-A and B-B are presented to show clearly the effect of road curvature on the noise levels. In general, noise levels decrease slowly with height. The closer the receivers are from the road, the greater will be the rate of decrease.

Trains

The likely noise impact from train operations has been assessed by measuring the setback distances from the centreline of the track required to satisfy the HKPSG criteria, without mitigation. Table 4.8 summarizes the setback distances required for the different train services. The following criterion is the maximum noise level of 85dB(A).

Table 4.8 **Setback Distances Required To Satisfy The HKPSG Criteria For Rail Noise (No Mitigation)**

Train Service	Setback Distance 85 dB(A) L_{Amax}
ARL + LAL	40m
ARL	40m
LAL	39m

The noise constraints on land use development in Tung Chung are illustrated in Figures 4.8 and 4.9. These noise contours have been obtained assuming that:

(a) the ARL is at grade along the whole length; and

(b) the LAL is at grade except for the section between P2 and D2 where it is in tunnel.

The shaded areas show where the HKPSG criteria are not met. Setback distances would have to be much greater in order to satisfy the NCO requirements. Assuming an acceptable noise level of 70 dB(A) between 0700 hours and 2300 hours and 60 dB(A) between 2300 hours and 0700 hours as before, setback distances would be as given in Table 4.9. The controlling criterion is the night-time noise.

Table 4.9 **Setback Distances Required To Satisfy NCO Criteria For Rail Noise (No Mitigation)**

Train Service	Setback Distance 2300 to 0700 hours
ARL + LAL	>1000m
ARL	880m
LAL	710m

Note : Data obtained from North Lantau Development Consultants

It would appear that the NCO requirements are the overriding criteria for night time train operations.

4.3.3 Mitigation Measures

Road Traffic

Road traffic noise may be mitigated at source, along its path or at the receiver. The most effective mitigation will be to control at source, using quieter road surfaces, quieter vehicles, or through traffic management. For developing areas, such as Tung Chung, proper noise planning will allow for noise constraints to be incorporated in developing the outline development plans which will serve to reduce noise exposure of future receivers.

As noted, quieter road surfacing has been assumed for the NLE and noise zoning has been incorporated in the NLD dRODP. The remaining option for mitigation is to consider purpose-built barriers to intercept the noise along its path.

The effectiveness of noise barriers has been evaluated by comparing noise contours for a typical straight road section of the NLE with and without mitigation. The reduction in setback distances needed to meet the HKPSG for high-rise residential development gives a good indication of the effectiveness of mitigation measures.

The underlying assumption is that future noise sensitive receivers will have 180 degrees angle of view of the road. Noise levels will be lowered by 1.7 dB(A) or more if the angle of view can be restricted to 120 degrees or less.

In light of the results obtained from the previous study, four optional treatments of the NLE have been evaluated and are described below:

Option One - Roadside Barrier

This option explores the effect of a five metre high panel-type noise barrier on the nearside edge of the carriageway as shown in Figure 4.10. Lower barriers will not be effective for high-rise receivers on the roadside and barriers higher than five metres are not recommended for aesthetic and other non-acoustical reasons.

The noise contours with five metre high barriers on a typical straight road section of the NLE are shown in Figure 4.11 and are compared with a similar set of noise contours without mitigation in Figure 4.12. For high-rise residential development adjacent to the NLE, setback distances can be reduced by 150m. A further reduction in setback distance to about 110m can be achieved by restricting the angle of view to 120 degrees or less.

Option Two - Inward Curved Barriers

This option explores the effect with an inward curved barrier at a total height of seven metres above the road surface in order to provide headroom for heavy vehicles on the road as shown in Figure 4.13.

Noise contours with this treatment are shown in Figure 4.14. By comparing the impact without noise mitigation, it can be seen that the setback distance can be reduced by 180m.

Option Three - Double Barriers

This option explores the effect with double barriers as shown in Figure 4.15. The noise benefit with a three metre high barrier at the medium strip plus a four metre high barrier at the nearside edge has been assessed and the results are shown in Figure 4.16. By comparing the contours with and without the double barriers, it can be seen that the setback distance can be reduced by 130m.

Option Four - Earth Mounds Plus Noise Barriers

This option explores the effect of a six metre high earth mound with a three metre high noise barrier on top as shown in Figure 4.17. The noise contours with this treatment are shown in Figure 4.18. By comparing these contours with the set without mitigation, it can be seen that the setback distance can be reduced by 130m.

Trains

Noise mitigation of trains could use 1.5m high trackside barriers for the ARL and LAL as shown in Figure 4.19. A typical noise reduction with these barriers is 8 dB(A) at 1.5m above the level of track.

Table 4.10 gives the setback distances required to satisfy the HKPSG criteria with these barriers and it can be seen that rail noise would not constrain sensitive land use development beyond 10 metres from the tracks depending on the train service. The controlling criterion is again the maximum noise level.

Table 4.10 Setback Distances Required To Satisfy The HKPSG Criteria For Rail Noise (With Mitigation)

Train Service	Setback Distance 85 dB(A) L_{Amax}
ARL + LAL	<10m
ARL	<10m
LAL	<10m

On the other hand, larger setback distances would still be needed to satisfy the NCO requirements even with the above barriers. Table 4.11 gives the setback distances required. Again the controlling criterion is the night-time noise.

Table 4.11 Setback Distances Required To Satisfy NCO Criteria For Rail Noise (With Mitigation)

Train Service	Setback Distances 2300 to 0700 hours
ARL + LAL	85m
ARL	70m
LAL	65m

Note : Data obtained from the NLDS Consultants

4.3.4 Monitoring and Audit

It is not considered necessary to carry out monitoring and audit for the NLE alone as it forms only one component of the new development in Tung Chung. A coordinated approach is needed and it is understood that this is being dealt with by the NLDS Consultants.

Monitoring and audit for the expressway and railway should be on the basis of a combination of measurements and predictions. Measurements should include rail and road traffic volumes and percentages of heavy vehicles on the road. These be used to calculate noise from the road and railway and the calculations may then be calibrated by measurements of the actual noise.

A monitoring programme should be undertaken annually so that trend analysis can be carried out. Noise mitigation measures for existing and future phases of development may then be reviewed and proposals for modifications made as appropriate.

It is suggested that monitoring of the expressway and ARL though Tung Chung should be along three cross sections of the road. The locations of these cannot be determined at the present time as they will need to to take account of the detailed layout of the new town in Tung chung and this is not yet available. The first monitoring should be one year after opening of the NLE and monitoring locations can be determined at that time. It will be important to use locations where monitoring can be repeated in future years.

4.4 Conclusions

4.4.1 Construction Phase

Construction of the Tung Chung section of the NLE is not expected to produce a significant noise impact in the village settlements in the Tung Chung basin. The Buddhist Youth Camp at Tai Po will receive the greatest noise impact and it has been recommended that noise insulation should be provided for this receiver. The adjacent village of Tai Po will be relocated before construction of the NLE starts.

4.4.2 Operation Phase

Operational noise from the NLE will impose constraints on noise sensitive development on either side of the NLE in Tung Chung if unmitigated. The results of the assessment have been passed on to the NLDS Consultants for consideration in their dRODP for North Lantau. They have recommended that the most practical and economical form

of mitigation would be earth banks six metres high with three metre high noise barriers on top. The noise barriers and mounds would be landscaped to reduce their visual impact. Also, noise sensitive development should be placed beyond 200m from the centreline of the road. These recommendations are supported. The noise barriers could be built under the NLE construction contract or could be built later under a NLD construction contract. The timing of building the barriers is not critical so long as they are in place before the residential blocks which would be affected by noise from the NLE are occupied.

It is understood that although some noise conflicts may still exist with the above treatment and zoning this could be resolved by further mitigation such as restricting the angle of view of the road for buildings on the roadside. Other techniques that could be used include the use of noise tolerant buildings, building orientation, self protecting buildings and internal building layout.

Train noise can be effectively mitigated using 1.5m high trackside barriers. It has been shown with these barriers that the HKPSG criteria for train noise can be met with noise sensitive development beyond about 20m from the centreline of the track.

Figure 4.1
Locations of Noise Sensitive Receivers

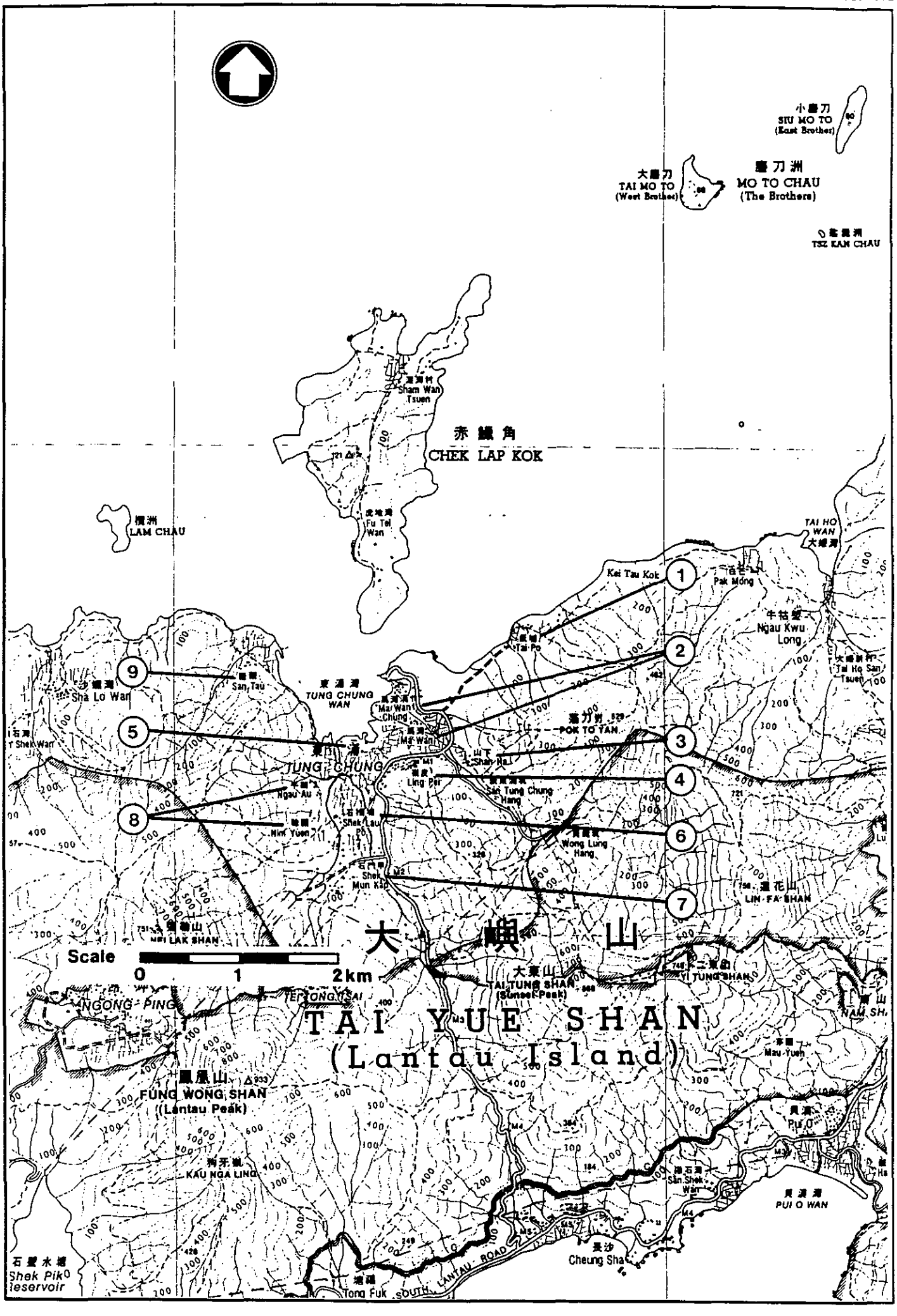


Figure 4.2
Predicted PM Peak Hour Traffic Figures for 2011

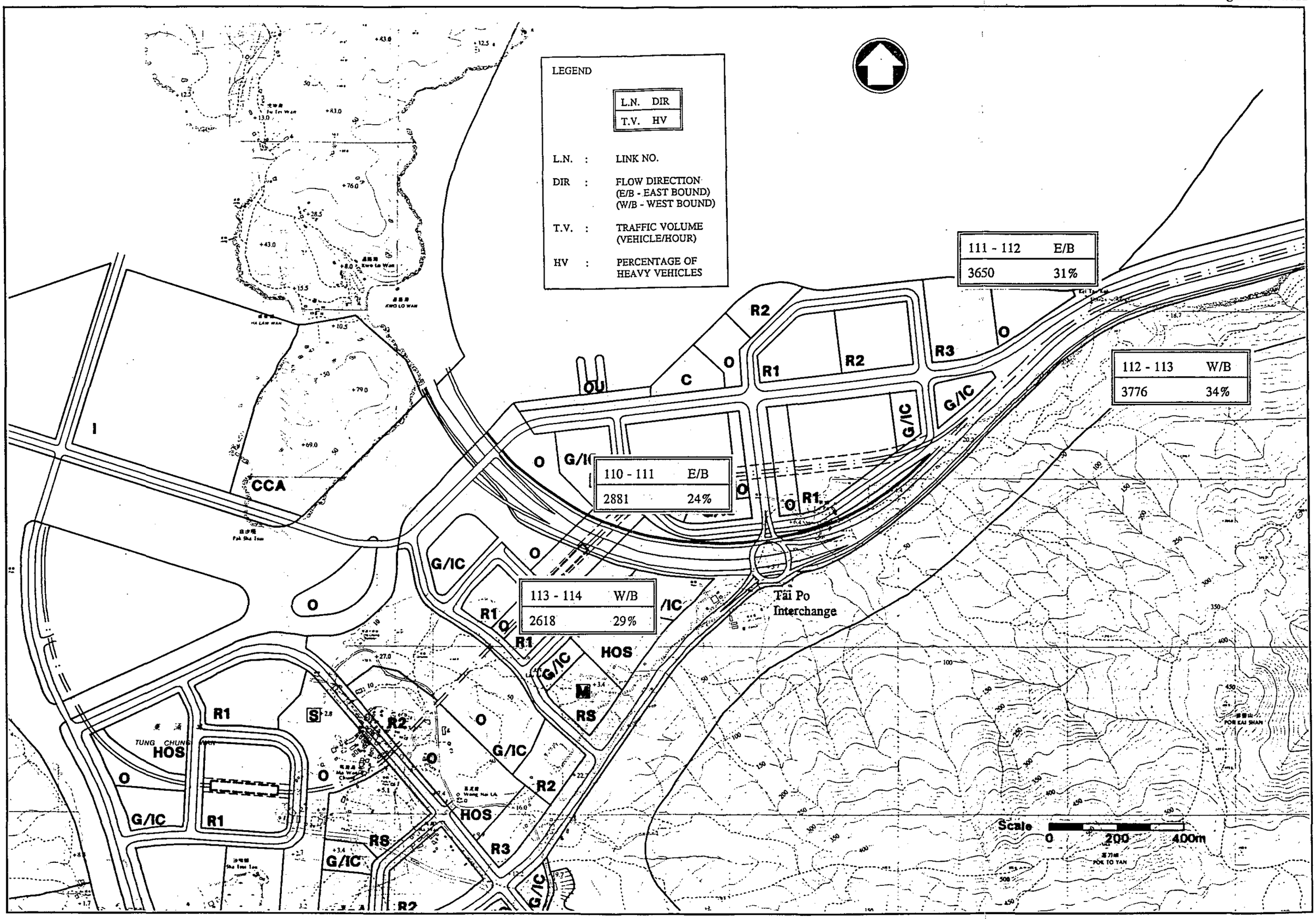


Figure 4.3
Road Noise Contours for $L_{10(1\text{-}hr)}$ at 30 Metres PD without Mitigation

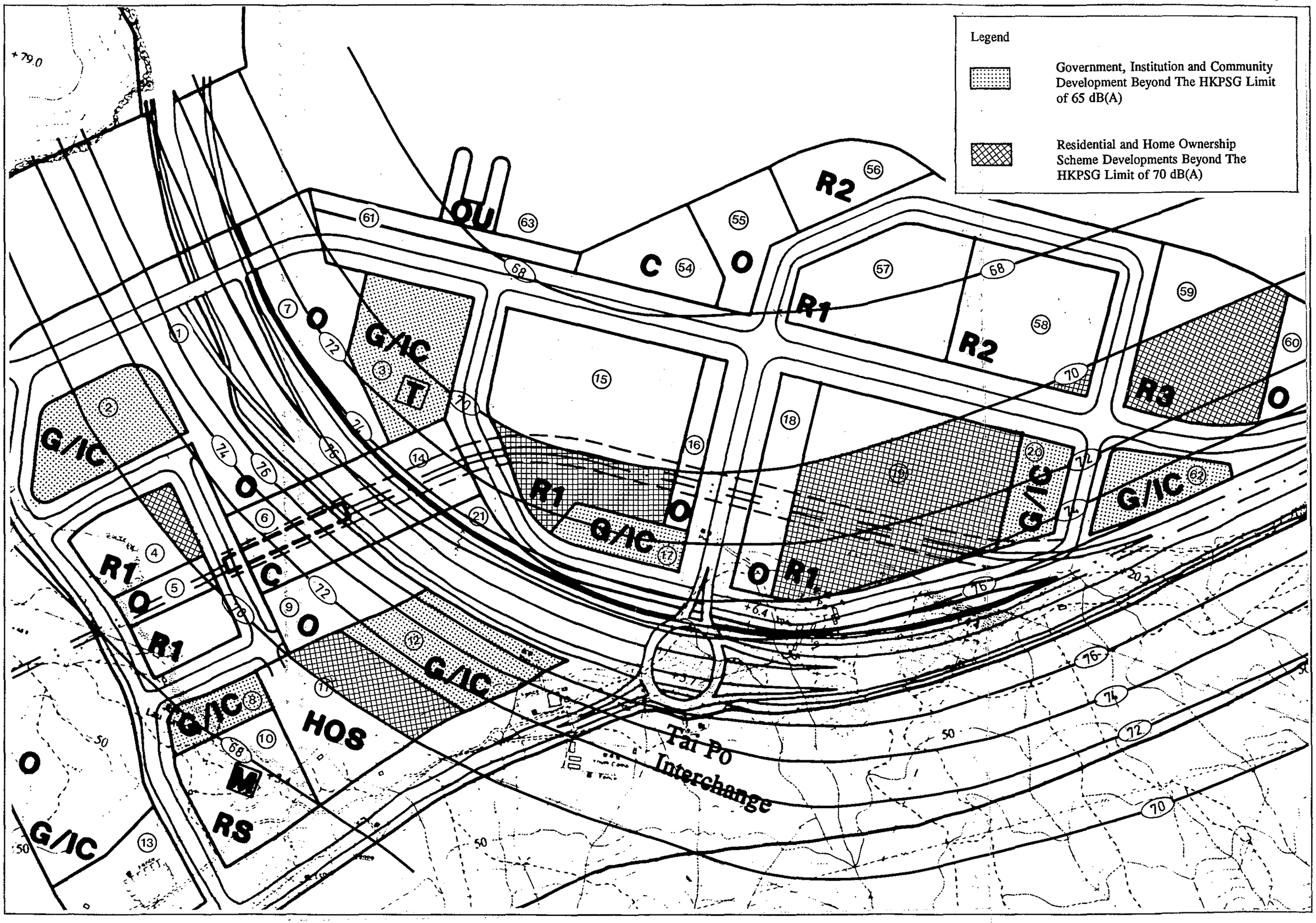


Figure 4.4
Selected Sections for Noise Contour Plots

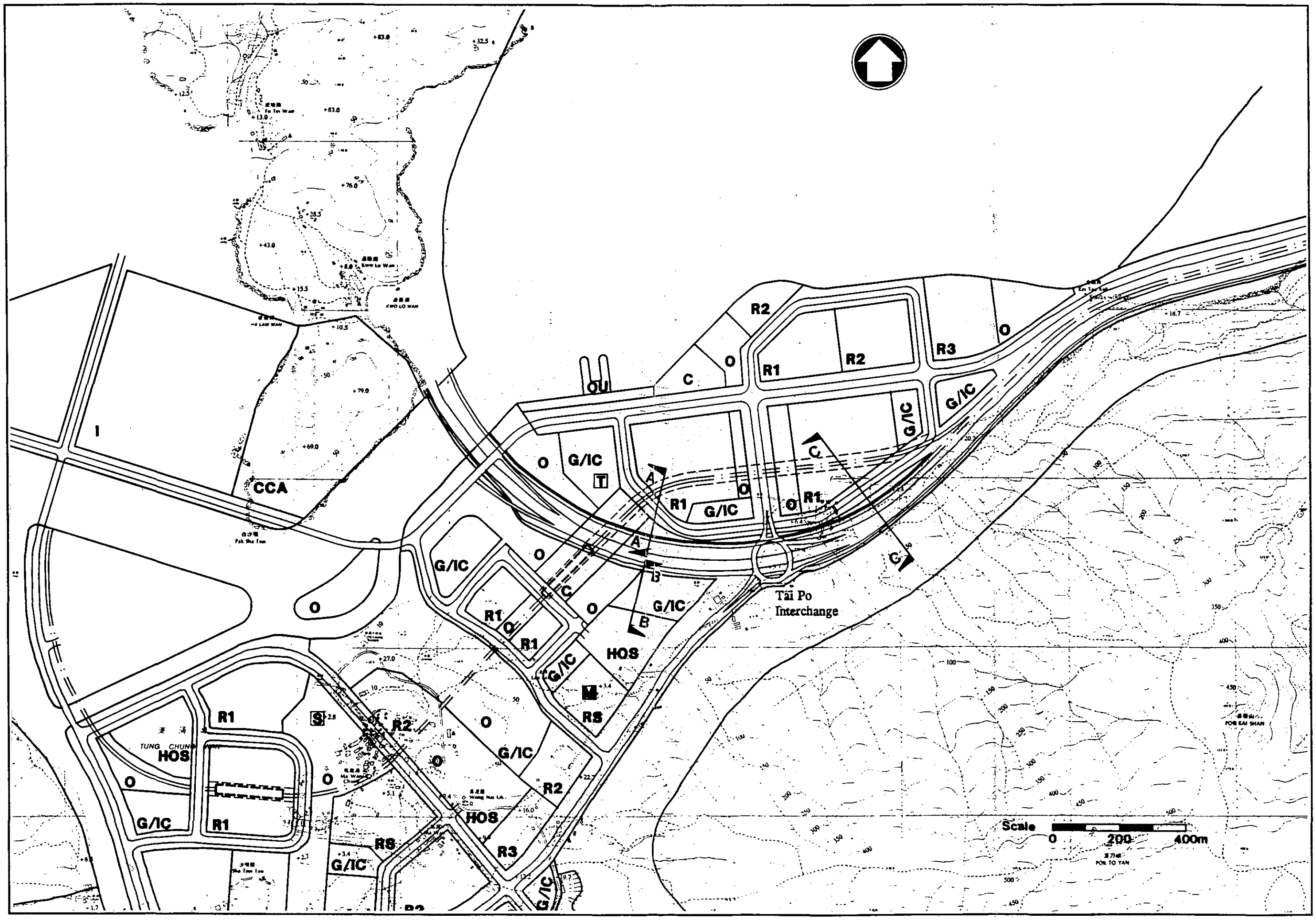


Figure 4.5
Noise Contour Plot on Section A-A

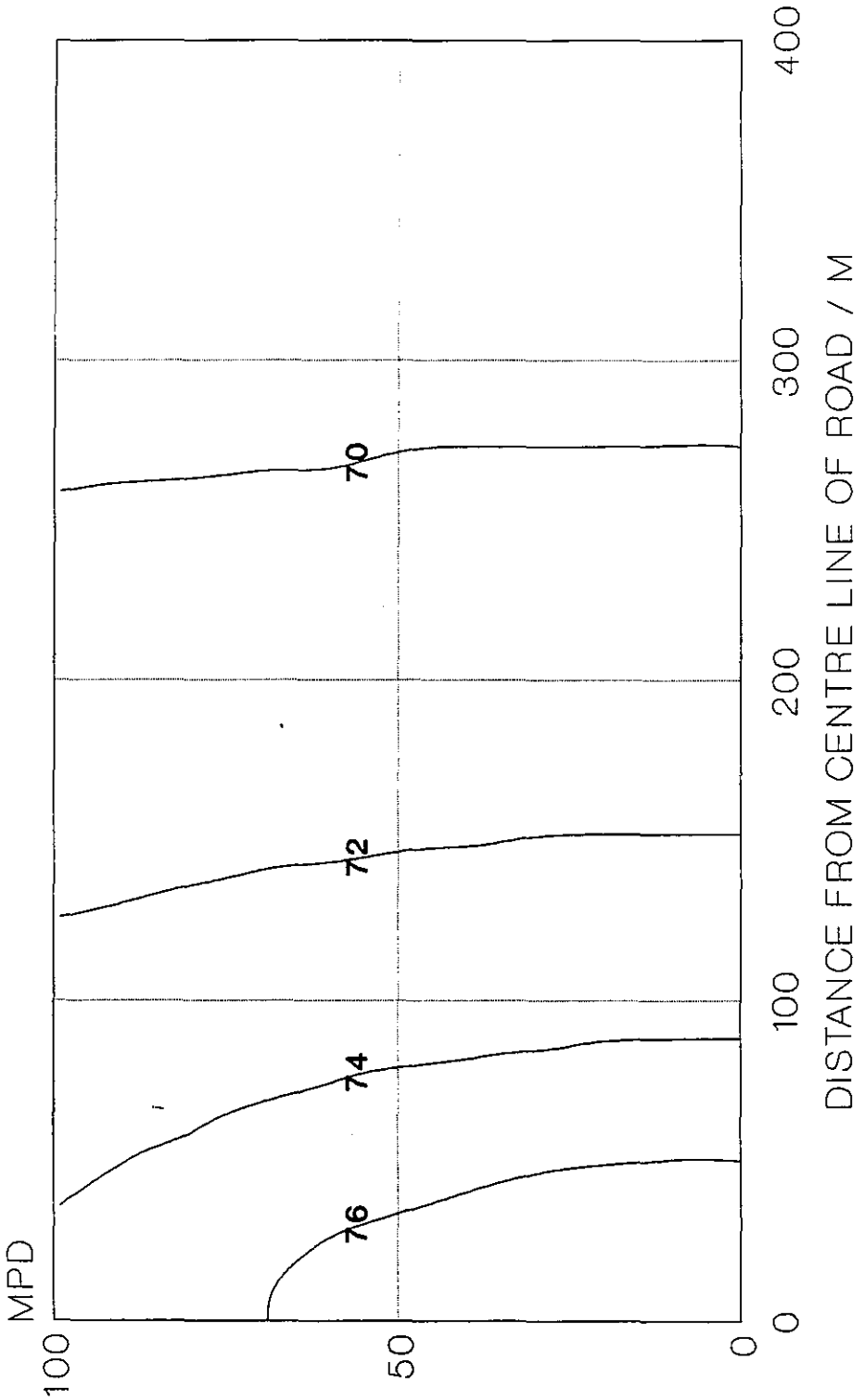


Figure 4.6
Noise Contour Plot on Section B-B

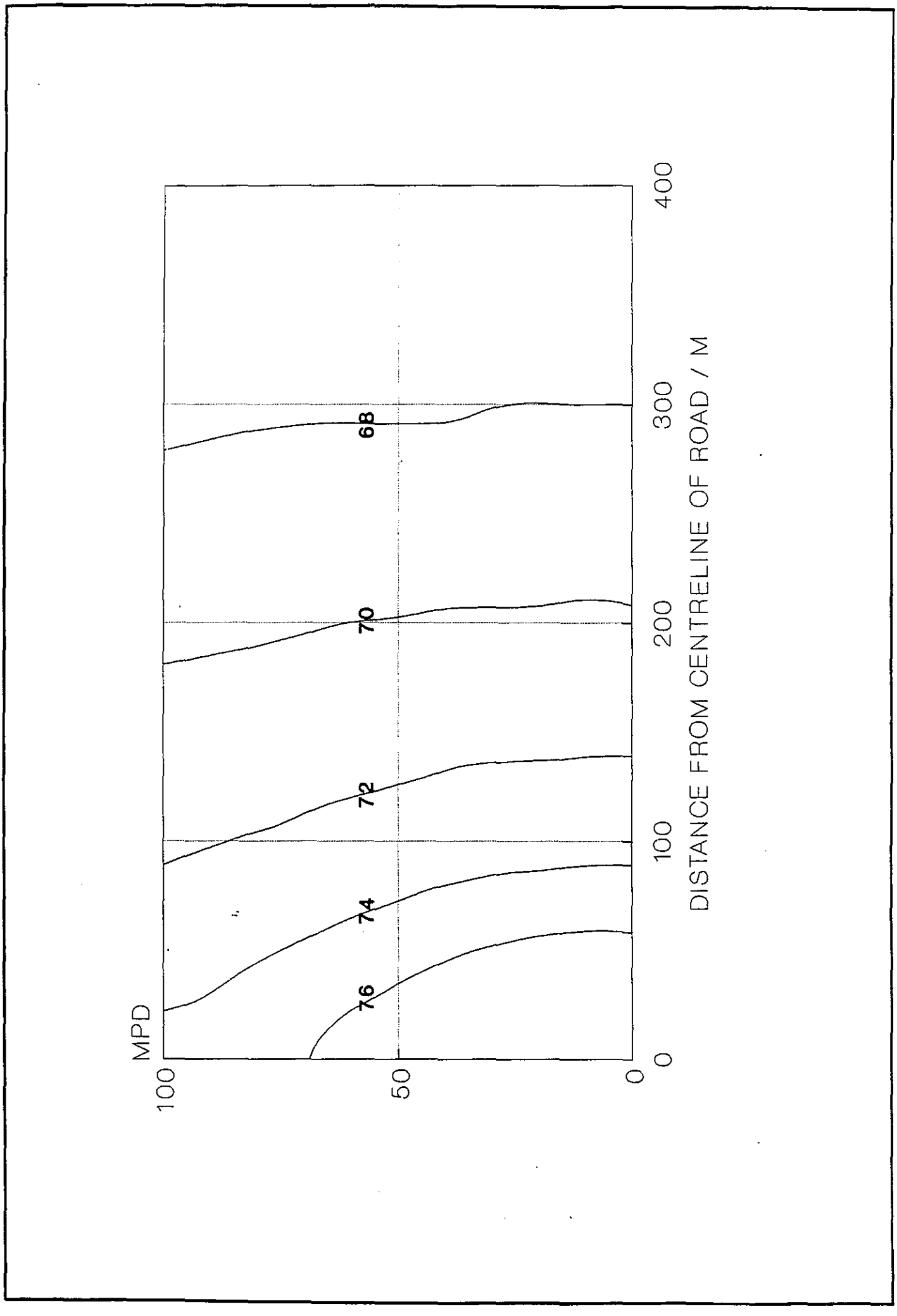


Figure 4.7
Noise Contour Plot on Section C-C

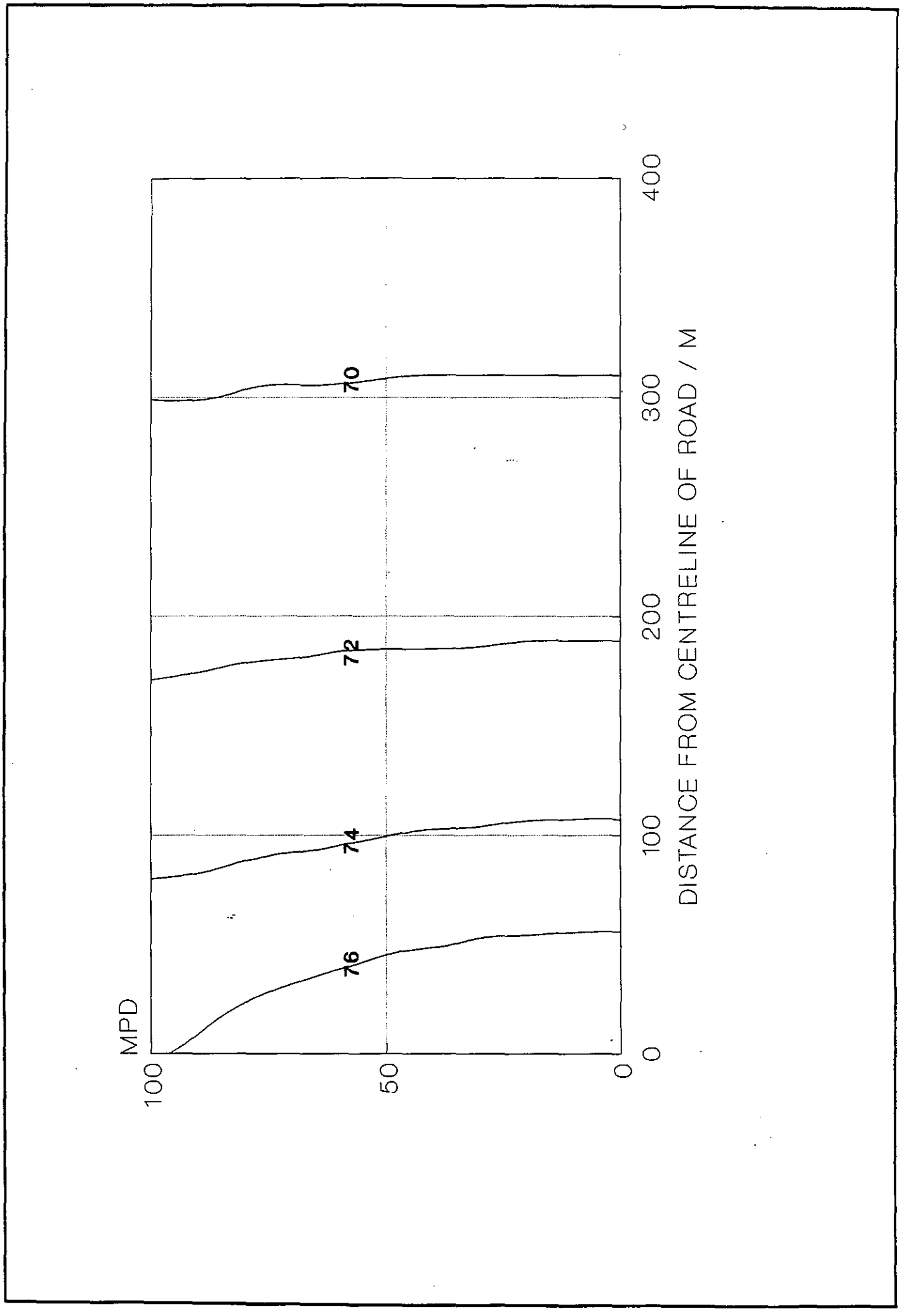


Figure 4.8
Rail Noise Contours for L_{Amax} without Mitigation

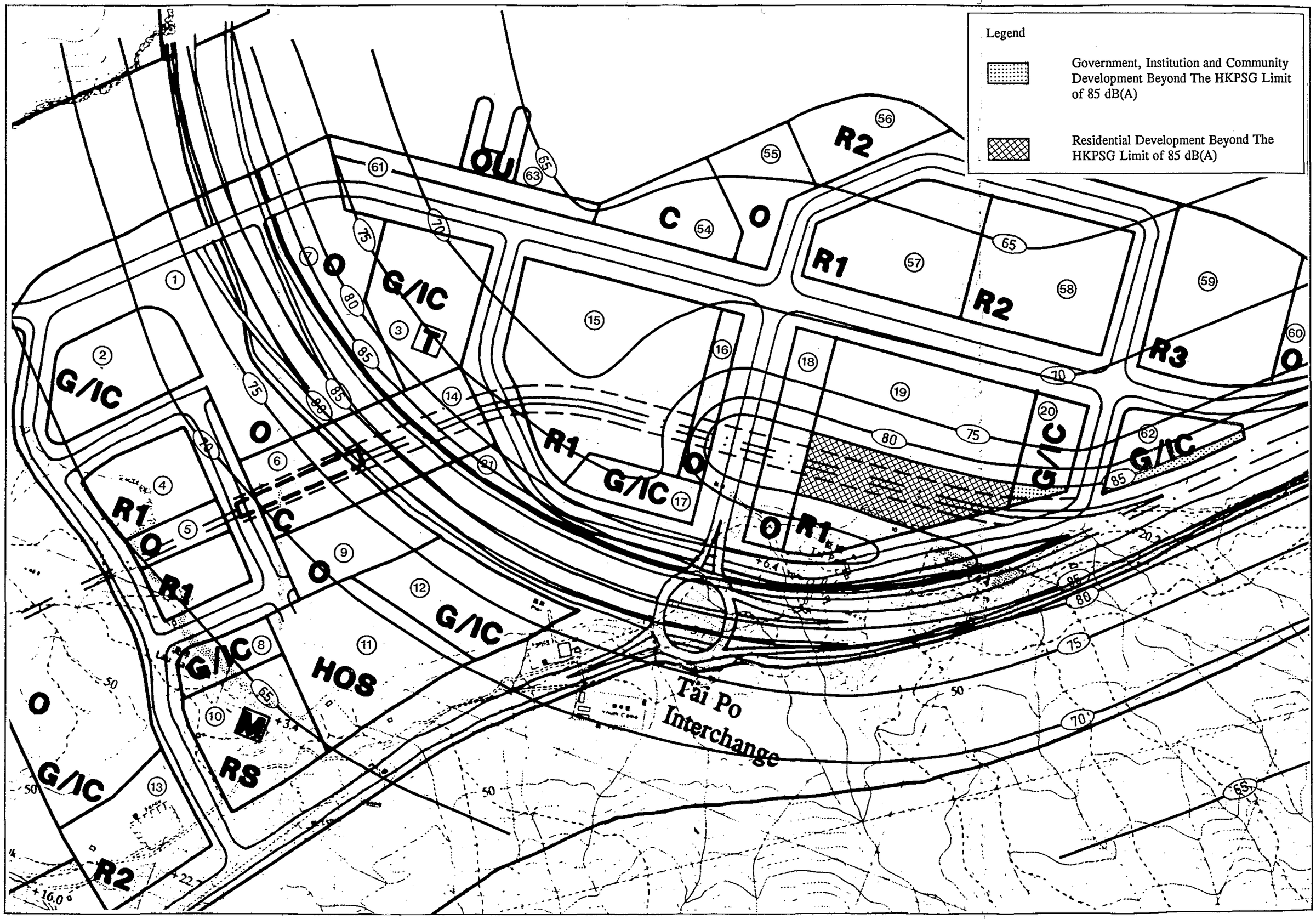


Figure 4.9
Rail Noise Contours for $L_{eq,24hr}$ without Mitigation

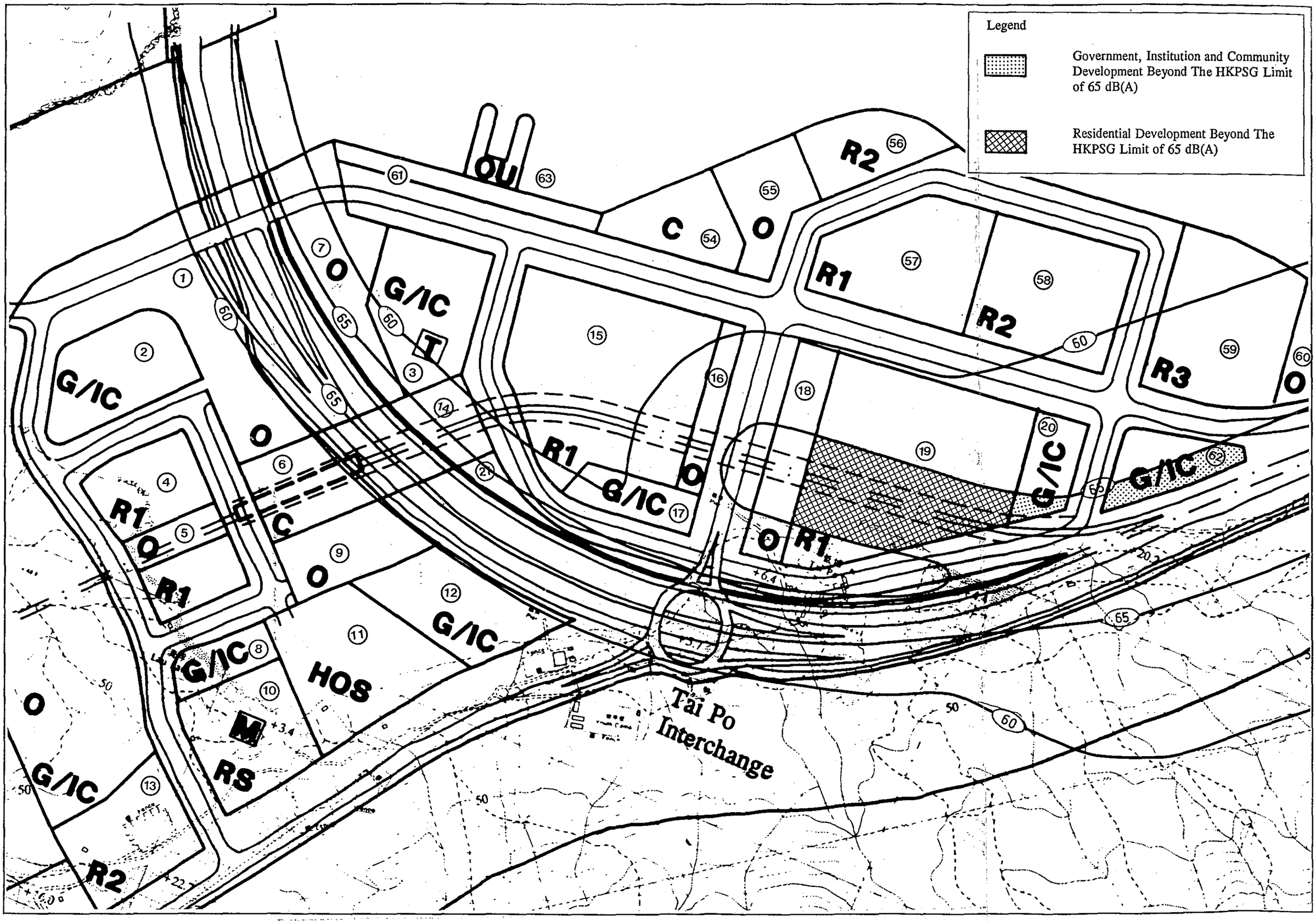


Figure 4.10
Option One - 5 Metre Roadside Barrier

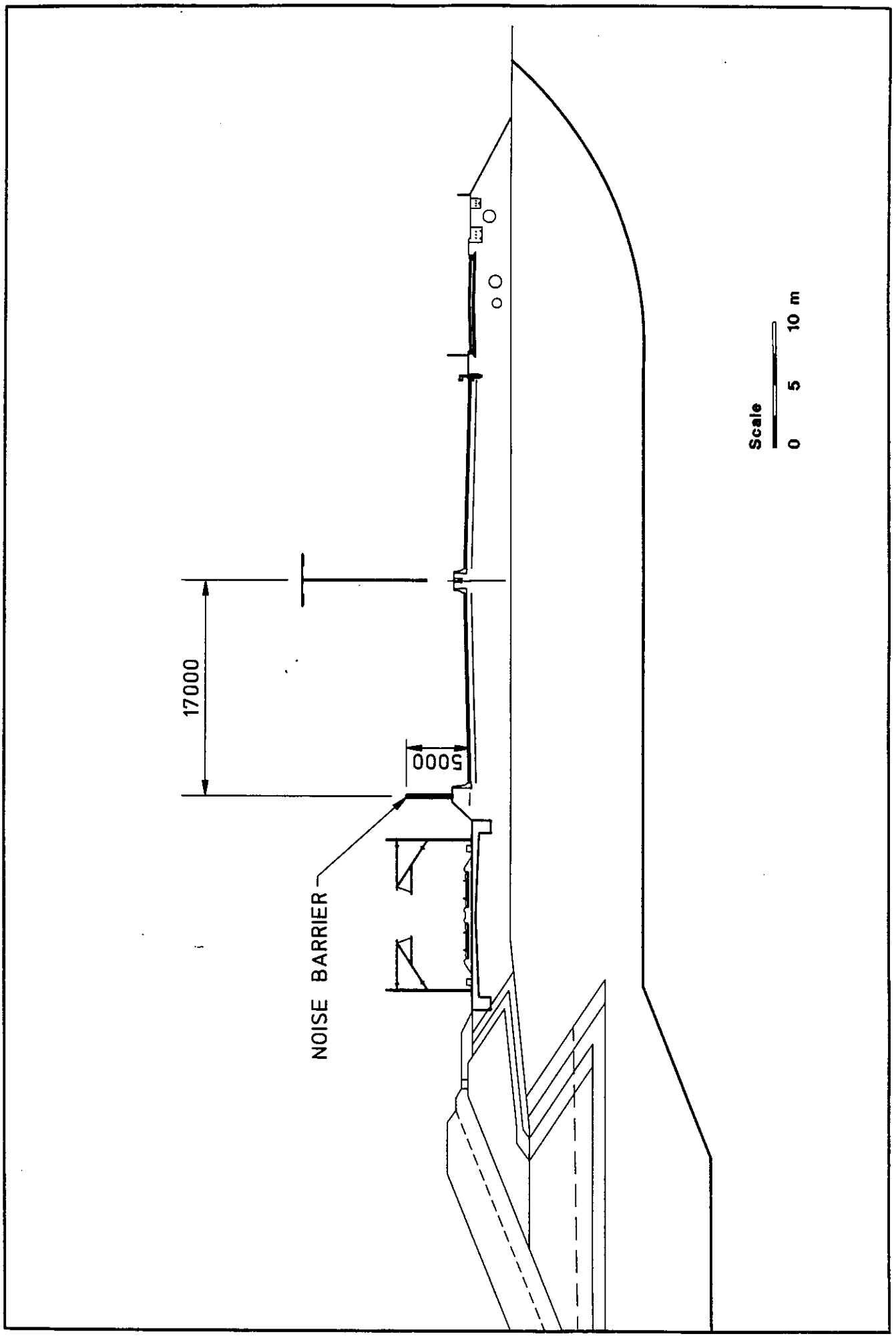


Figure 4.11
Noise Contour Plot - Option One - Roadside Barrier

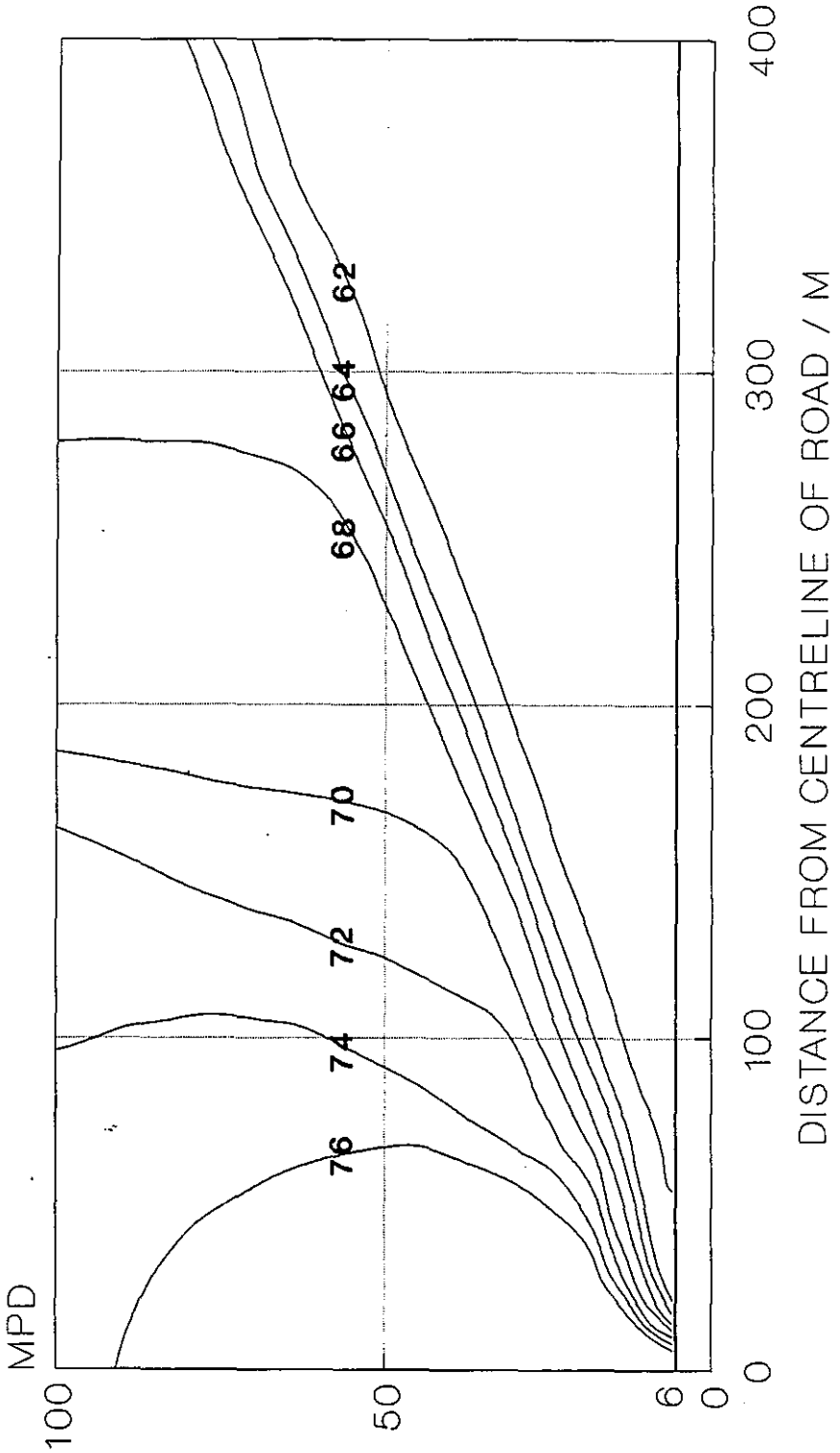


Figure 4.12
Noise Contour Plot without Noise Mitigation

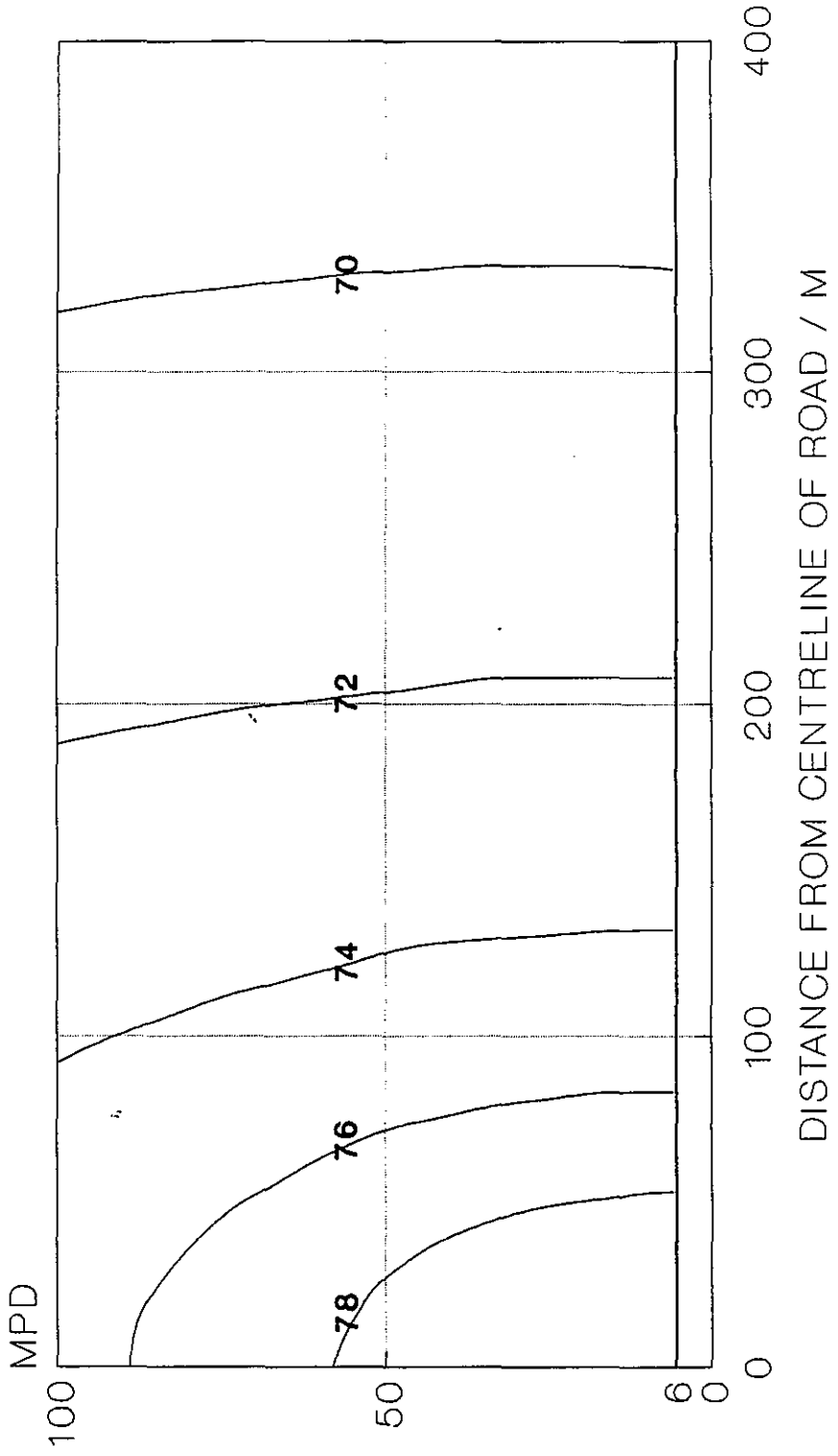


Figure 4.13
Option Two - 7 Metre Inward Curved Barrier

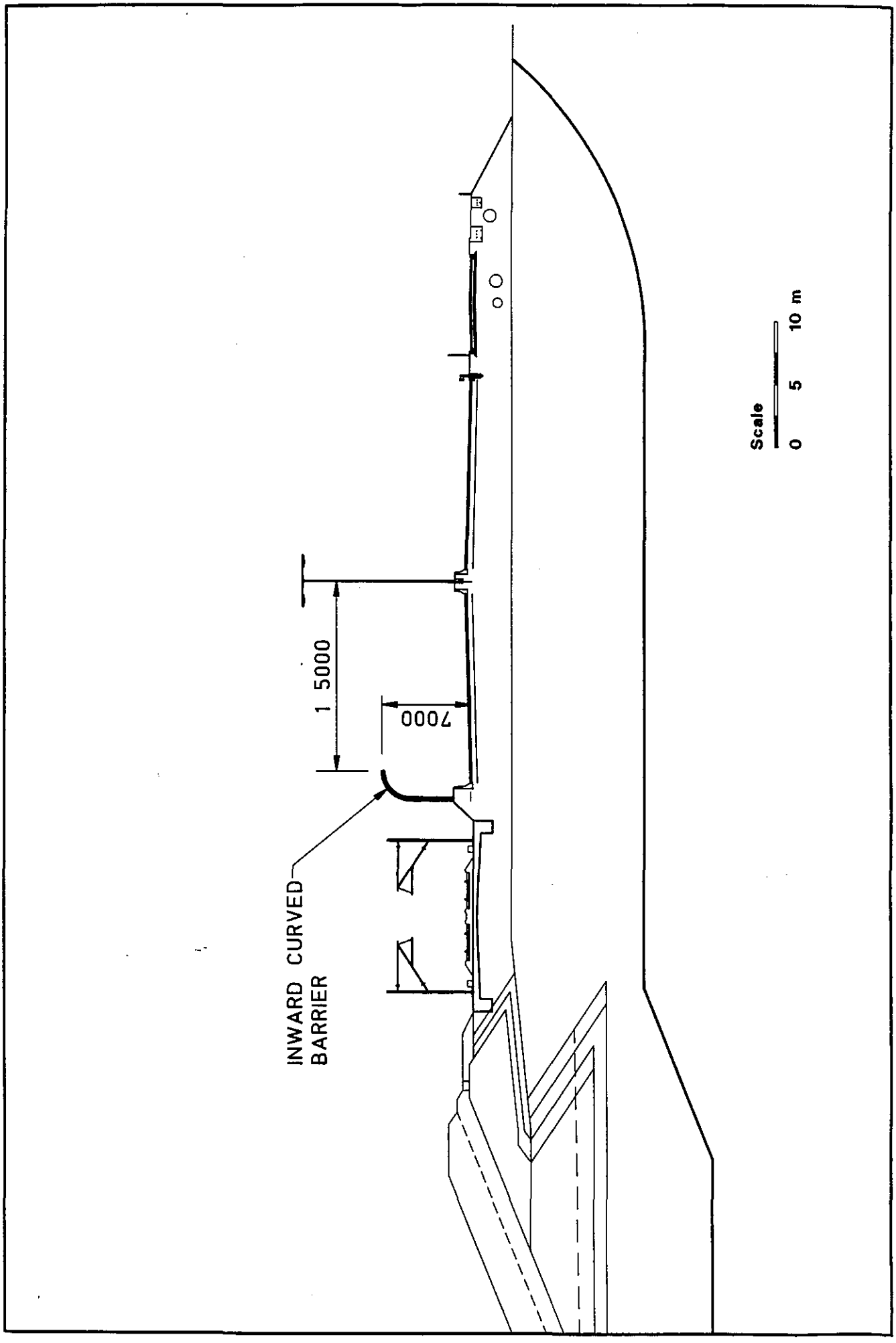


Figure 4.14
Noise Contour Plot - Option Two - Inward Curved Barrier

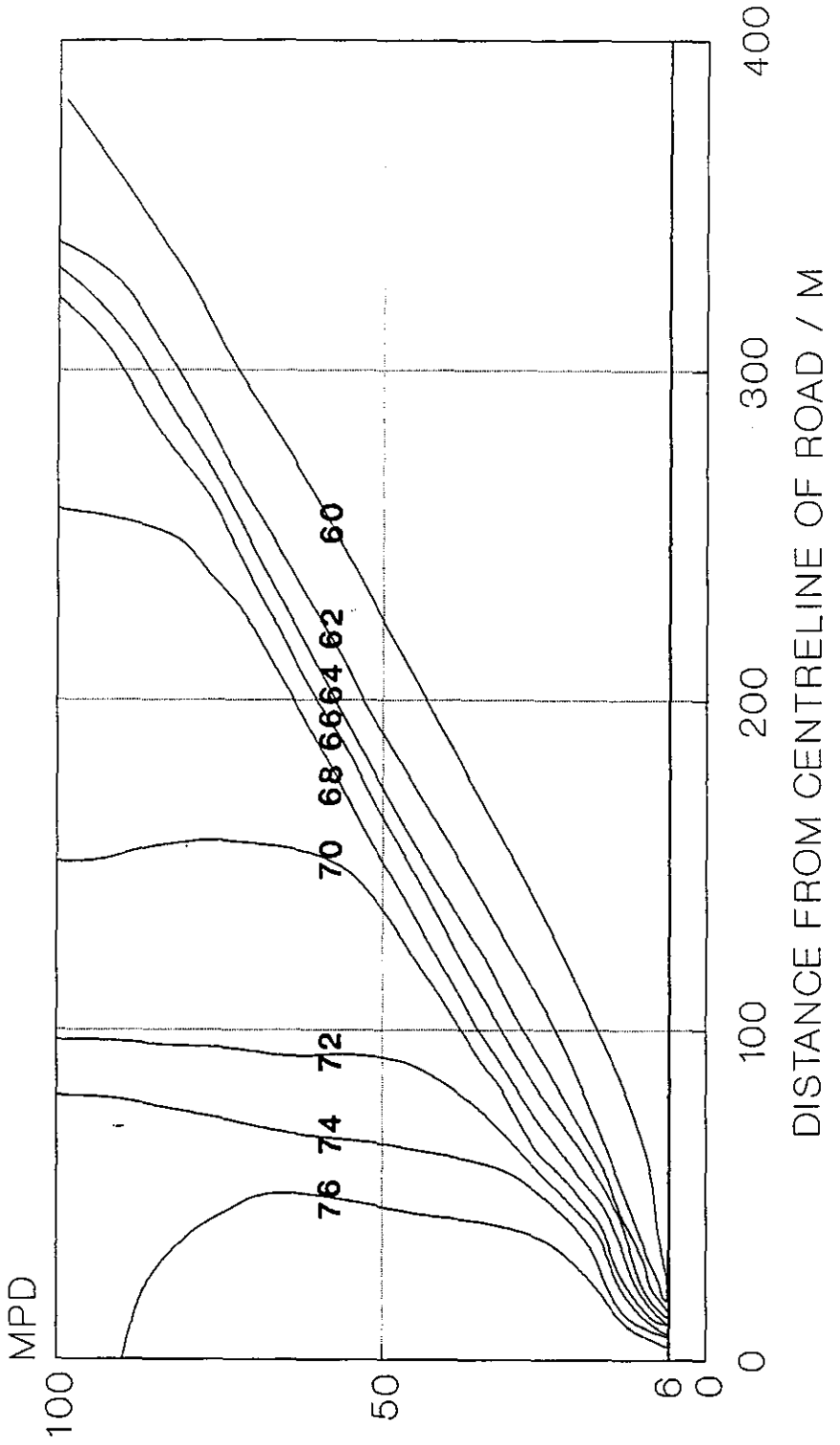


Figure 4.15
Option Three - 3 Metre and 4 Metre Double Barriers

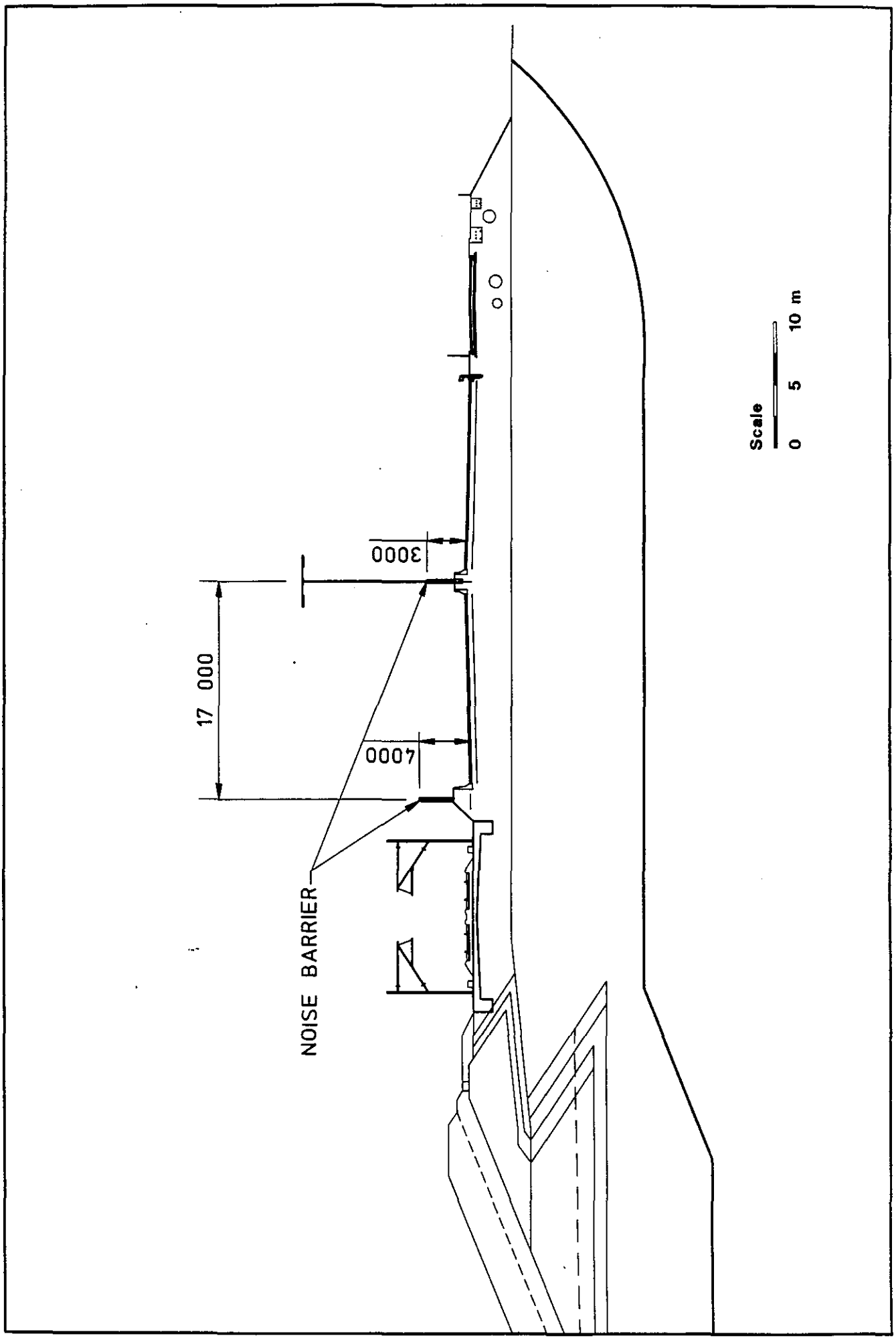


Figure 4.16
Noise Contour Plot - Option Three Double Barriers

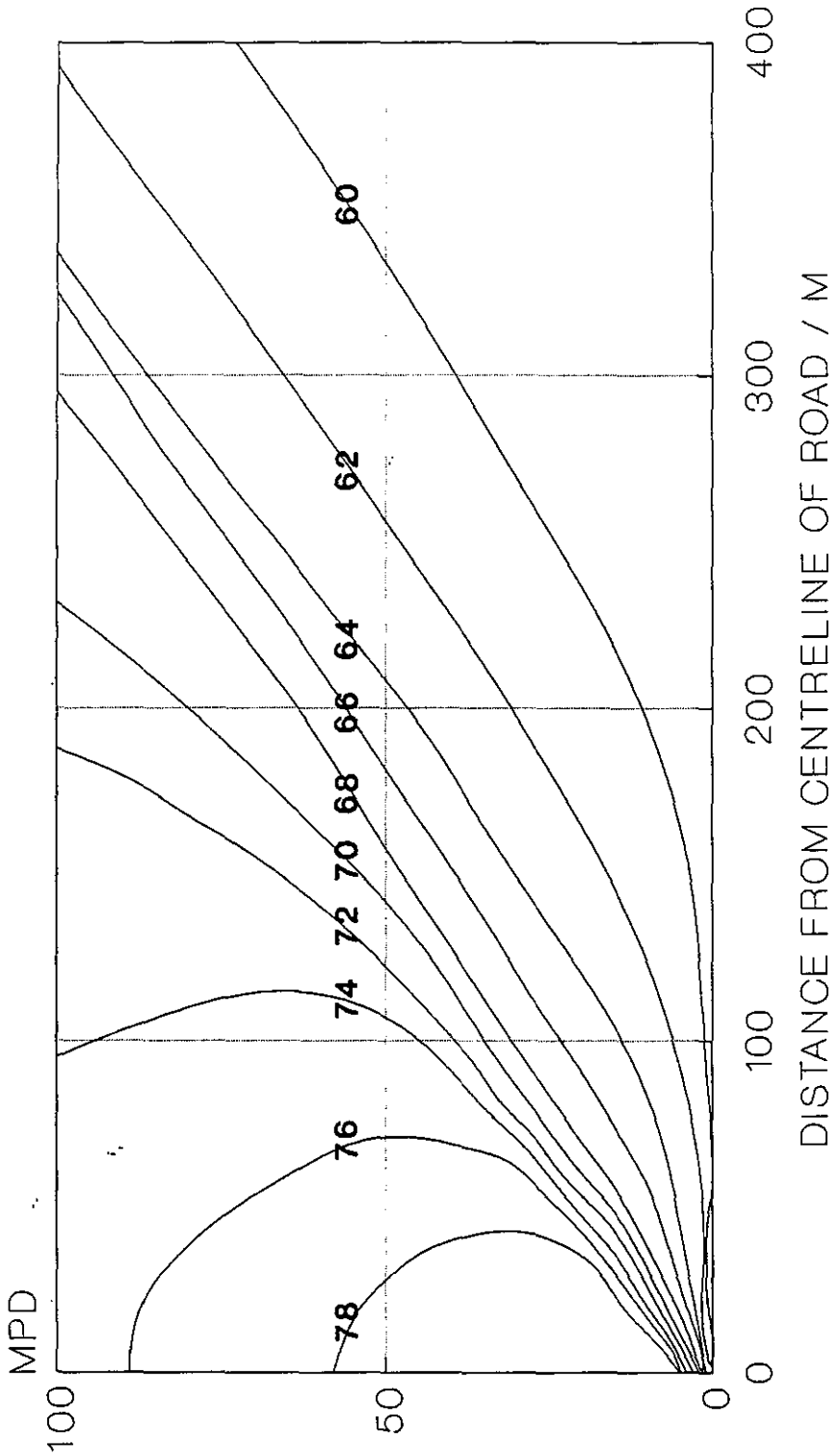


Figure 4.17
Option Four - 6 Metre Earth Mound and 3 Metre Noise Barrier

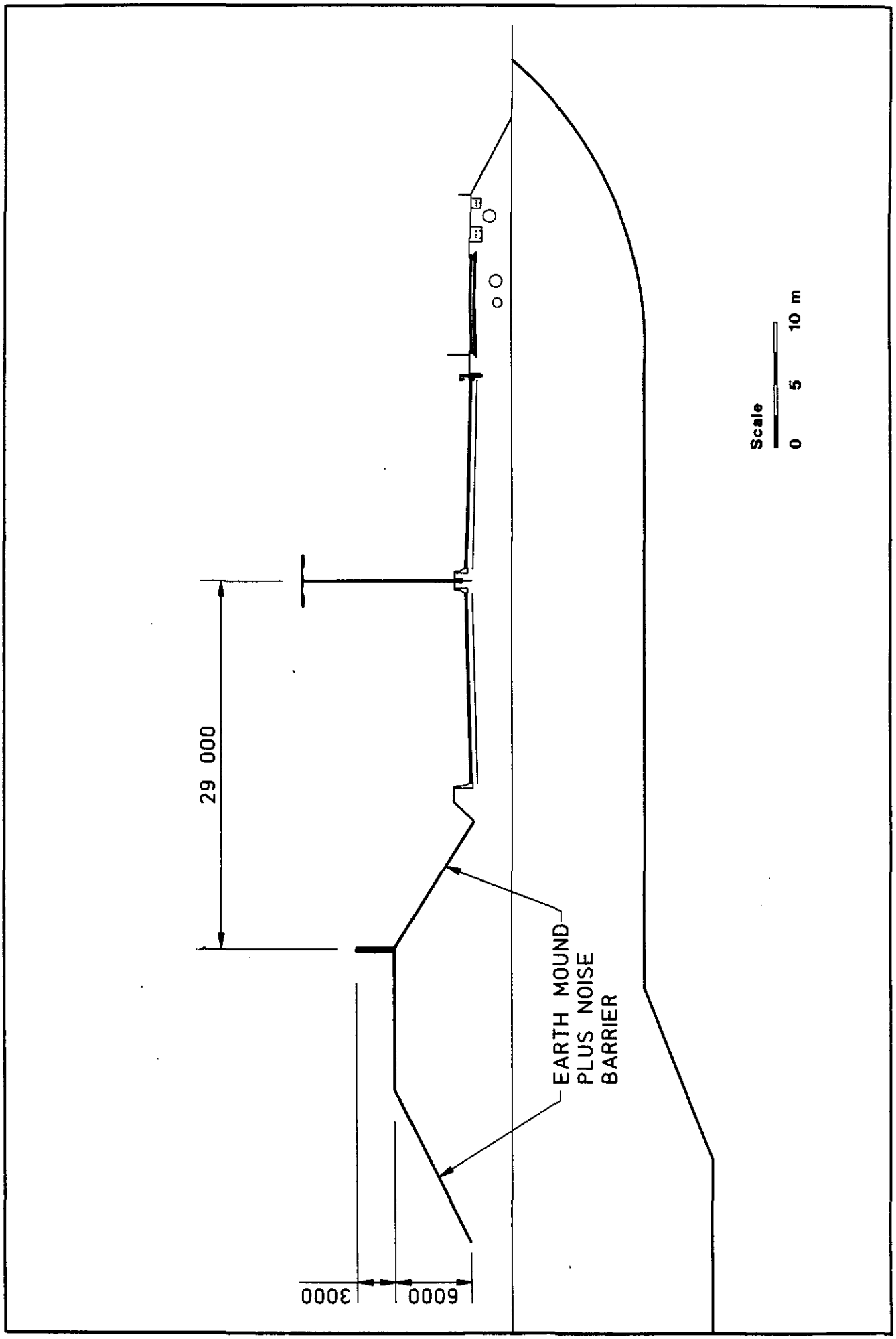


Figure 4.18
Noise Contour Plot - Earth Mound and Barrier

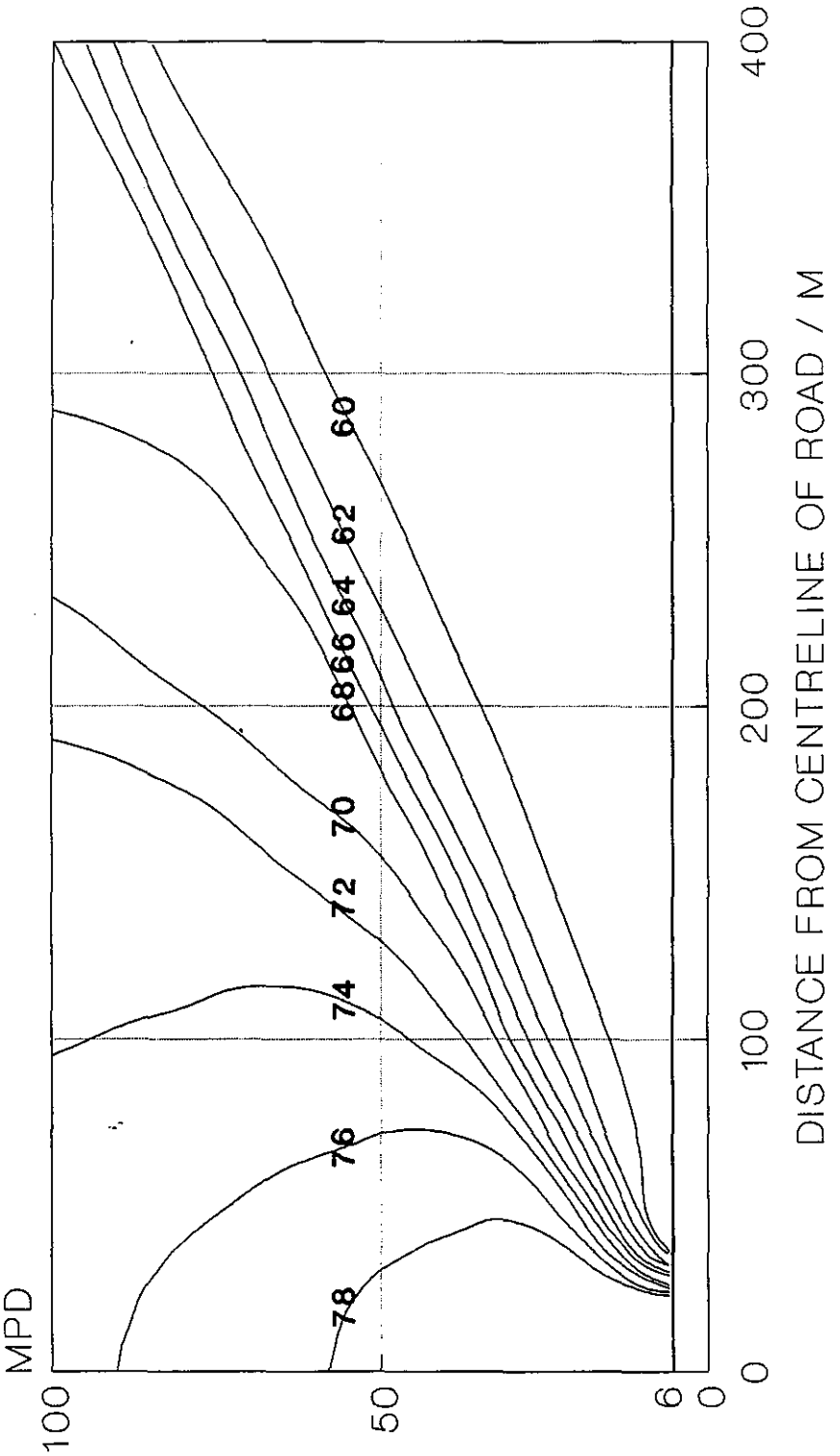
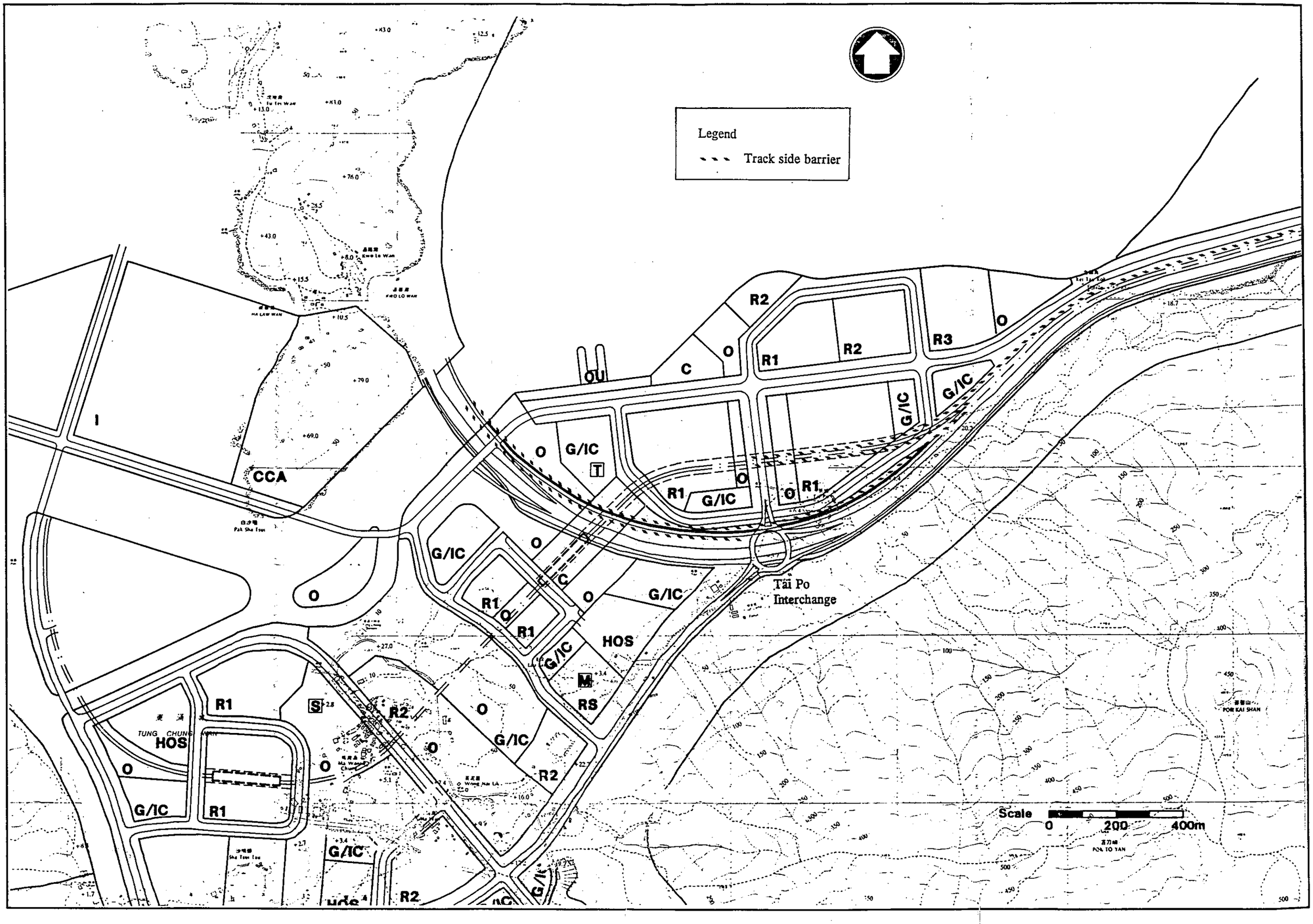


Figure 4.19
1.5 Metre Trackside Barriers alongside the ARL and LAL



5. AIR QUALITY

5. AIR QUALITY

5.1 Introduction

This section of the report assesses the impacts of construction and operation of the Tung Chung section of the NLE on air quality.

Dust will be the primary pollutant generated by construction activities. In addition an asphalt mixing plant may be built for road paving causing an impact on air quality from Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Dioxide (CO_2), and dust. During operation of the NLE, dust and gaseous emissions (NO_2, CO and RSP) from vehicles will be the major pollutants.

5.2 Construction Phase Impact Assessment

5.2.1 Sensitive Receivers

A total of 21 air sensitive receivers (ASRs) in the Tung Chung and Tai Ho valleys have been identified, according to the definition of air sensitive uses in the Hong Kong Planning Standards and Guidelines (HKPSG), which could be affected by the construction activities.

The sensitive receivers are listed in Appendix C1 and illustrated in Figure 5.1. The existing sensitive receiver at location one, Tai Po village, will be relocated prior to the start of construction.

5.2.2 Methodology And Assessment Criteria

Methodology

The Industrial Source Short-Term (ISCST) model has been used for predicting air quality changes. The model allows stack, area and volume source types which are suitable for the modelling of air quality impacts arising from construction activities.

Construction Programme

This assessment has been based on the latest construction programme and for the purposes of modelling has been divided into two following periods:

(a) Period 1 - mid 1993 to end of 1994; and
(b) Period 2 - early 1995 to mid 1996.

Emission Factors

Dust is measured as total suspended particulates (TSP) and respirable suspended particulates (RSP). TSP includes all particle sizes, although dust particles with diameters larger than 30 μm tend to settle out close to the source. RSP includes only those particles with diameters 0-10μm. For modelling purposes dust is sub-divided into two categories possessing nominal aerodynamic diameters of 0-10μm and 10-30μm.

The construction activities that are predicted to cause dust are:-

(a) vehicles on haul roads;
(b) drilling;

(c) blasting;
(d) loading and unloading;
(e) rock crushing;
(f) concrete batching; and
(g) asphalt mixing.

Asphalt mixing will also generate SO_2, NO_2 and CO_2 gases.

The emission factors used in the modelling for the above stationary construction activities have been based on USEPA-AP42 4th Ed., 1985; and are detailed in Appendix C2.

The Hong Kong Air Quality Objectives (AQOs) for the TSP and RSP levels are based on 24 hour or longer averaging times. In addition the EPD recommends that the TSP level for construction is based on a 1 hour average. Pollution levels for this assessment have therefore been calculated over 1 hour and 24 hour for TSP and 24 hour for RSP. Blasting has been assumed to be one blast per day and twelve hour working has been used as the basis for calculating 1 hour averaged dust levels.

Source Location

In determining the source of air quality impacts the approximate locations of construction activities have been used since the exact sites are not currently known. The locations of each activity are shown on Figure 5.2 and listed in Appendix C3.

The coordinates of each construction activity are denoted by using the south west corner of the grid square in which the activity is located. Where the site is an irregular shape, several squares of different size have been used to represent the site.

Meteorological Conditions

The dispersion of air and particulates is governed by the following meteorological parameters:

(a) wind speed;
(b) wind direction;
(c) stability class; and
(d) mixing height

Wind speed of $2ms^{-1}$ and stability class 'D' have been chosen. At lower wind speeds dispersion will be limited and the pollutants will concentrate relatively near the source. At higher wind speeds dispersion of air will be higher and the pollution at ASRs will be lower. Stability class 'D' represents the most stable day time conditions. These parameters are considered to represent the worst case meteorological criteria for air quality assessment.

Background Levels

The background levels of air pollution in the Study Area were estimated by the NLDS Consultants based on mathematical modelling and site measurements. Their assessment was reported in NLDS Topic Report TR10, "Environmental Assessment". The maximum background concentrations are summarised in Table 5.1.

Table 5.1 Maximum Yearly Background Air Pollution Concentrations In The Tung Chung Area (Averaging Time 1 Hour)

Pollutants	Tung Chung ($\mu g/m^3$)	Tai Ho Wan ($\mu g/m^3$)
Sulphur dioxide	50	60
Nitrogen dioxide	80	80
Carbon monoxide	25-135	30-150
Non-RSP particular > 10 μm	< 1	< 1
Respirable suspended particulates < 10μm	15	20
Total suspended particulates	15	20

Evaluation Techniques

In order to evaluate the impact of construction activities on air quality thirty-six wind angles were tested. The highest value at each receptor was taken to estimate the worst 1 hour averaging time concentration.

The 24 hour dust levels were then calculated by totalling the dust levels from the 36 wind directions multiplied by the percentage frequency of that wind direction based on the annual wind data provided by the Royal Observatory measured at Chek Lap Kok in 1981. Although the use of annual statistics may slightly underestimate the extreme worst case 24 hour concentrations it is considered that this method gives fully representative 24 hour values. The annual figures employed took account of the prevailing winds and these were given a relatively high weighting in the multiplication. As the project will last for many years the use of annual figures is the best practicable method available for the construction assessment.

This method of assessment allows for the variability of local winds since it is unlikely that wind will blow from a constant direction over short distances in an area of complex topography such as North Lantau, particularly at the low wind speeds used for the assessment.

Since modelling of air quality did not initially take into account the background levels, they were added on before comparison with the appropriate AQOs and the EPD recommended 1 hour TSP level, shown in Table 5.2.

Table 5.2 Air Quality Objectives

Pollutant	Concentration in micrograms per cubic metre (i) (Parts per million (ppm) in brackets)				
	1 Hour (ii)	8 Hour (iii)	24 hours (iii)	3 Months (iv)	1 Year (iv)
Sulphur Dioxide	800 (0.30)		350 (0.13)		80 (0.03)
Total Suspended Particulates	(vii)		260		80
Respirable Suspended Particulates (v)			180		55
Carbon Monoxide	30,000 (26.20)	10,000 (8.73)			
Nitrogen Dioxide	300 (0.16)		150 (0.08)		80 (0.04)
Photochemical Oxidants (as ozone) (vi)	240				
Lead				1.5	

Notes:
(i) Measured at 298K (25°C) and 101.325 kPa (one atmosphere).
(ii) Not to be exceeded more than three times per year.
(iii) Not to be exceeded more than once per year.
(iv) Yearly and three monthly figures calculated as arithmetic means.
(v) Suspended particles with nominal aerodynamic diameter of <10 micrometres.
(vi) Photochemical oxidants are determined by measurement of ozone only.
(vii) Suggested short term averaging level for 1 hour is 500 $\mu g/m^3$.

5.2.3 Construction Impacts And Mitigation Measures

Figures 5.3 to 5.5 show the predicted dust concentrations at the sensitive receivers during construction without any mitigation applied at source. Tai Po (ASR 1) is not shown as this receiver will be relocated before construction starts.

Figures 5.6 to 5.8 show the maximum contributions during construction period one without mitigation at each ASR, from the three key dust emission activities, namely blasting, hauling and rock crushing.

Figures 5.9 to 5.14 show a comparison of the predictions with and without mitigation at source.

The mitigation measures modelled are as follows:-

(a)	concrete batching	-	enclosures and filters (90% reduction in dust emissions);
(b)	rock crushing	-	filters and wet spray systems (94% reduction in dust emissions);
(c)	haul road	-	vehicle speed reduction to 8 km hr^{-1} and the alternative of:
			(i) watering (mitigation method A - 70% reduction in dust emissions), and
			(ii) surface chemical treatment (mitigation method B - 96% reduction in dust emissions); and
(d)	loading and unloading	-	watering and chemical wetting agents (90% reduction in dust emissions)

24 Hour TSP

The AQO for 24 hour TSP levels is 260 μgm^{-3}. The Buddhist Youth Camp at Tai Po, Sha Ha, San Tung Chung Hang, and Wong Lung Hang, will receive TSP levels exceeding the AQOs during construction periods one and two unless mitigation is applied. The main contributor will be dust caused by vehicles on the haul roads. Additionally the Buddhist Youth Camp will also receive dust from rock crushing activities at the rock crushing plant if located nearby.

Mitigation methods A (watering) and B (surface chemical treatment) would significantly reduce the dust levels. Mitigation B and siting of the rock crushing plant away from the Youth Camp would reduce the dust levels at the Buddhist Youth Camp to within the limits of the AQOs.

1 Hour TSP

The EPD recommended TSP level of 500 μgm^{-3} from construction activities is not statutory and has not been included in other Airport Core Projects but it has been used in this assessment to give an indication of the short term impacts. During construction period one, the level of 500μgm^{-3} will be exceeded at all ASRs. The activity which will contribute most to the dust level will be blasting although the impact will be short lived and localised. There is little that can be done to limit the dust from blasting except to use the minimum practical charge.

During construction period two, nine of the 21 ASRs could be unaffected by the impact from dust. Over 90% of the dust will be from hauling, but mitigation measure B could reduce the TSP levels at all ASRs down to the recommended level.

24 Hour RSP

The 24 hour AQO for RSP is 180μgm^{-3}. Without mitigation there will be exceedance at the Buddhist Youth Camp, Sha Ha, San Tung Chung Hang and Wong Lung Hang during period one unless mitigation measure B is applied. During period two, the Buddhist Youth Camp will receive excessive RSP levels, but with mitigation measures either A or B the RSP levels at all the receivers will be within the AQOs.

Other Pollutants

The impact on air quality from the asphalt mixing plant will not be significant and are shown in Table 5.3.

Table 5.3 Maximum Pollutants Levels From Asphalt Mixing Plant (Excluding Background Levels)

Pollutant			Level (μgm^{-3})	Worst Affected ASR
TSP	-	24 hour	5	
	-	1 hour	10	
RSP	-	24 hour	4	
CO	-	8 hour	1.2	
	-	1 hour	1.2	Shek Pik Au
NO_2	-	24 hour	1.6	
	-	1 hour	1.1	
SO_2	-	24 hour	2.3	
	-	1 hour	4.6	

Mitigation

Mitigation of dust, particularly from vehicles on haul roads, will be needed to reduce the impact on the ASRs. The Engineer should be empowered to direct the contractor to take appropriate measures if dust levels become excessive. It is not considered appropriate to specify maximum levels in the contract but as a guide the Engineer should take action if the dust levels at any sensitive receiver exceed the 24 hour AQO for TSP. The option of mitigating the dust by increasing the contract period is not practical as this contract is a critical component leading to the opening of the new airport.

5.2.4 Monitoring and Audit

Impact monitoring of 1 hour and 24 hour TSP levels should be carried out at all sensitive receivers and at the site boundary whenever construction activities are generating dust. The monitoring schedule should be determined by the Engineer depending on the contractor's method of working but as a guide should be about three days per week. More frequent impact monitoring will be necessary if dust levels increase. Baseline monitoring should be carried out prior to the start of the construction works with measurements being taken at each monitoring station daily for two weeks.

All monitoring should be report on daily record sheets which will record the sampling point, the sampling time, the monitored level, the equipment used, the weather conditions and the activities being carried out on site. Monthly reports of all monitoring data should be prepared and copied to the Contractor and EPD.

Where the impact monitoring shows that the recorded dust (TSP) level is significantly greater than the levels established in the baseline survey or that TSP levels are increasing as a result of the contractor's activities, the Contractor should be directed to take effective remedial measures including, but not limited to, reviewing dust sources and modifying working procedures. The contract documents should include methods of dust suppression to be adopted by the contractor.

The Contractor should be instructed to inform the Engineer of all steps taken. Written reports and proposals for action should be passed to the Engineer by the Contractor whenever air quality monitoring shows that the recorded dust level is significantly greater than the levels established in the baseline survey or that dust levels are increasing.

Table 5.4 shows trigger, action and target levels proposed for construction dust which would be reasonable based on the assessment carried out for this report. Table 5.5 presents an action plan should any of these levels be exceeded.

Table 5.4 Trigger, Action and Target Levels for Dust

	Trigger	Action	Target
24hr TSP level in $\mu g/m^3$	180	220	260

Table 5.5 Construction Dust Action Plan

Event	Action	
	Engineer	**Contractor**
Exceedance of trigger level for one sample	Repeat measurement as soon as possible	-
Exceedance of trigger level for more than one consecutive sample	Repeat measurements Notify contractor	-
Exceedance of action level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of action level for more than one consective sample	Increase freqency of monitoring to daily Notify contractor Require contractor to make proposals to reduce dust	Review plant and methods Submit proposals for reducing dust to Engineeer Implement remedial actions
Exceedance of target level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of target level for more than one sample	Increase frequency of monitoring to at least daily Notify contractor Notify EPD Require contractor to implement immediate steps to reduce dust	Review plant and methods Implement measures to reduce dust immediately Notify Engineer of action taken

5.3 Operation Phase Impact Assessment

5.3.1 Sensitive Receivers

Eighteen existing sensitive receivers for air quality impacts from operation of the NLE have been identified in the Tung Chung area using the defintion in the HKPSG. These are listed in Appendix C4 and shown on Figure 5.1 from locations 2-19 since ASR 1 will be relocated prior to construction. There will also be sensitive receivers in the Tung Chung new town but these have not been identified as individual receivers. The impact on the newly developed area in Tung Chung has been measured by drawing contours of air quality. These have been passed to the NLD Consultants as an input to the development of the RODP for Tung Chung.

5.3.2 Methodology And Assessment Criteria

The air dispersion model CALINE4 has been used to quantify the operational air quality impacts from the NLE in the Study Area. The assessment has considered only road traffic as the railway is not expected to cause any significant air pollution.

Traffic Data

The latest traffic volume predictions for 2011 have been obtained from the NLD Consultants. The one hour, eight hour and 24 hour traffic volumes for air modelling are shown in Table 5.6 and the traffic mix is shown on Table 5.7.

The traffic speed has been estimated to be 60 km/hour as the road will be operating at high volume/capacity ratio.

Table 5.6 Traffic Flow During Operation Phase

Time	Vehicles/hour	
	Tung Chung Interchange to Airport	Kei Tau Kok to Tung Chung Interchange
1-hr Average	5499	7426
8-hr Average	5015	5504
24-hr Average	3663	4063

Table 5.7 Average Traffic Mix

Vehicle Type	Percentage			
	Tung Chung Interchange to Airport		Kei Tau Kok to Tung Chung Interchange	
	1 hr	24 hr	1 hr	24 hr
Car	33	33	34	36
LGV + Taxis	59	59	55	57
MGV	5	5	6	4
HGV	4	4	5	3

NLE Alignment

For the operational modelling of vehicle emissions and traffic flow, the Tung Chung section of the NLE was divided into sixteen links as shown in Appendix C5.

Emission Factor

Vehicle speeds and emission rates were derived from the EEC Environment and Quality of Life "Corinair Working Group on Emissions Factors for Calculating 1985 Emissions from Road Traffic", 1989. Details are shown in Appendix C6. It has been assumed that all petrol driven cars will be equipped with a catalytic converter and the average vehicle will meet the emission standards to be enforced in 1992.

Meteorological Conditions

The following meteorological conditions have been chosen as a worst case condition for the modelling of air dispersion :

Wind speed	:	2 ms^{-1}
Stability class	:	D
Mixing Height	:	1000 m
Temperature	:	25°C
Aerodynamic roughness coefficient	:	100 cm

Background Pollution

The background air pollution levels for the Tung Chung area have been taken from NLDS TR10 as discussed above.

5.3.3 Operational Impacts

The predicted levels of pollutants for the operational phase of the NLE are presented in Appendix C7. The pollution levels at existing ASRs are all well below the AQOs.

The distribution of CO, NO_2 and RSP pollutants are illustrated on Figure 5.15 to Figure 5.19. These figures have been passed to the NLD Consultants. It is understood that the air pollution from the NLE has not proved critical in developing the RODP as the sensitive uses in the new town have been set back from the NLE by some 200m to meet noise standards.

5.3.4 Monitoring and Audit

Monitoring of air quality for the NLE alone should not be necessary. However monitoring of air quality on North Lantau is recommended so that impacts of all projects on this area can be checked. It is recommended that a permanent air quality monitoring station be installed and that this should be operational one year before the new airport opens.

5.4 Conclusions

5.4.1 Construction Phase

The Buddhist Youth Camp at Tai Po will be worst affected ASR from dust from construction activities. The dust level at the Youth Camp could be reduced to meet the AQOs by strict dust control on site. Suitable clauses should be included in the construction contracts allowing the Engineer power to ensure that dust control is applied. Impact monitoring will be necessary whenever activities likely to cause dust are in progress.

5.4.2 Operation Phase

The pollution levels predicted are relatively low and suggest that the set back distances due to the vehicle emissions from the NLE will be very small. Any constraints on future development will be governed by the noise from vehicles rather than air pollution from the NLE.

Figure 5.1
Locations of Air Sensitive Receivers

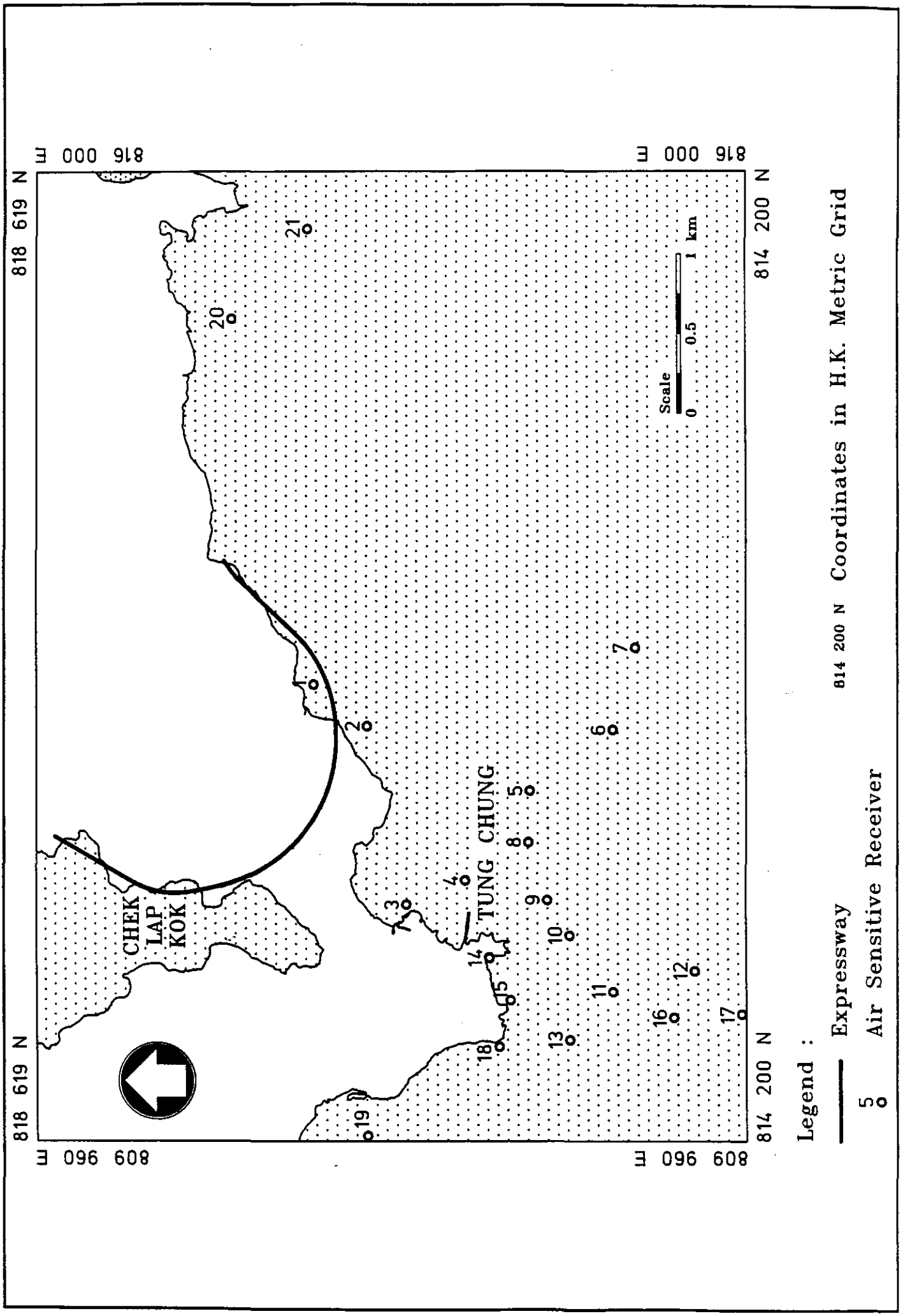


Figure 5.2
Locations of Key Construction Activities

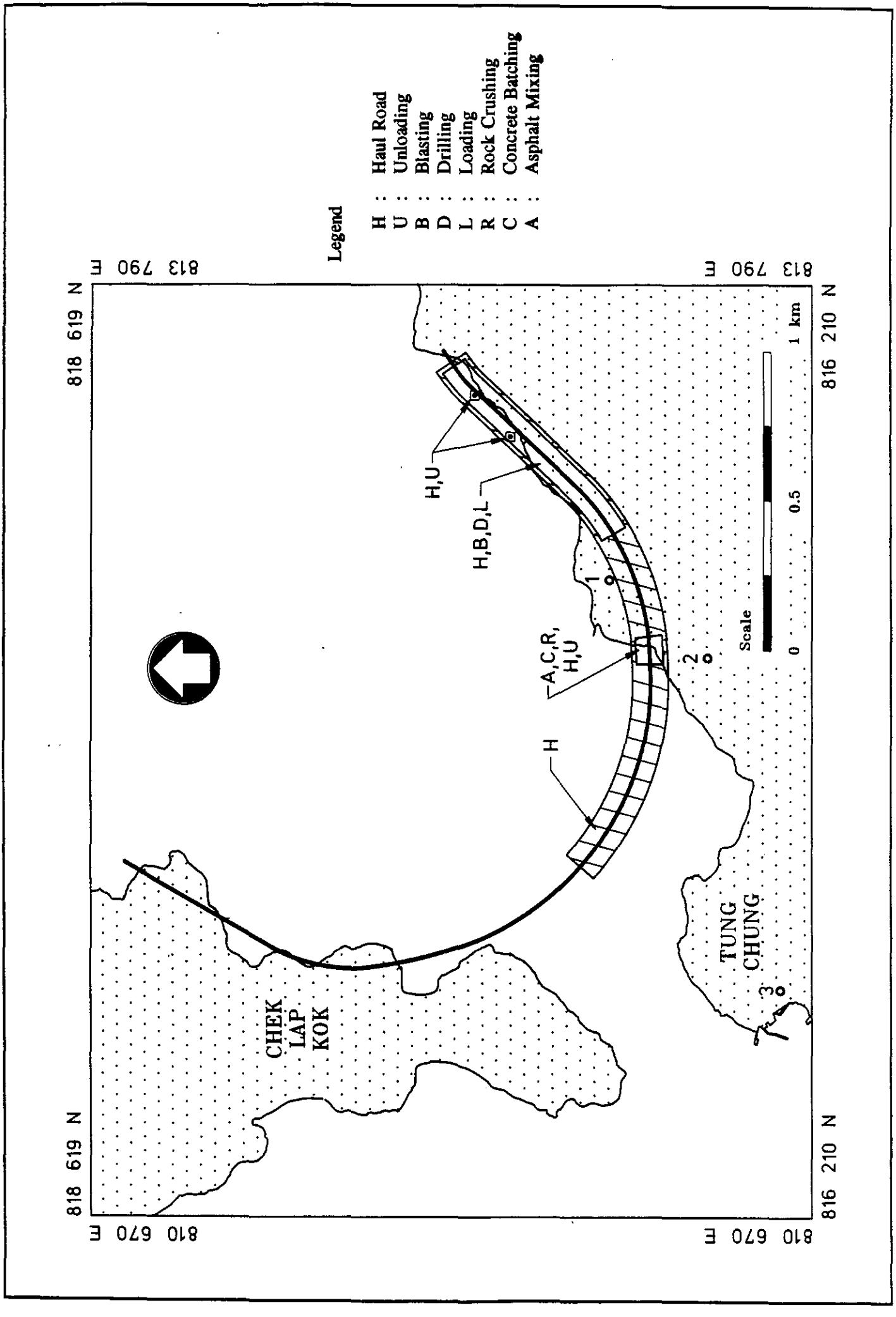


Figure 5.3
Predicted 24 Hour TSP Concentrations
during Construction without Mitigation

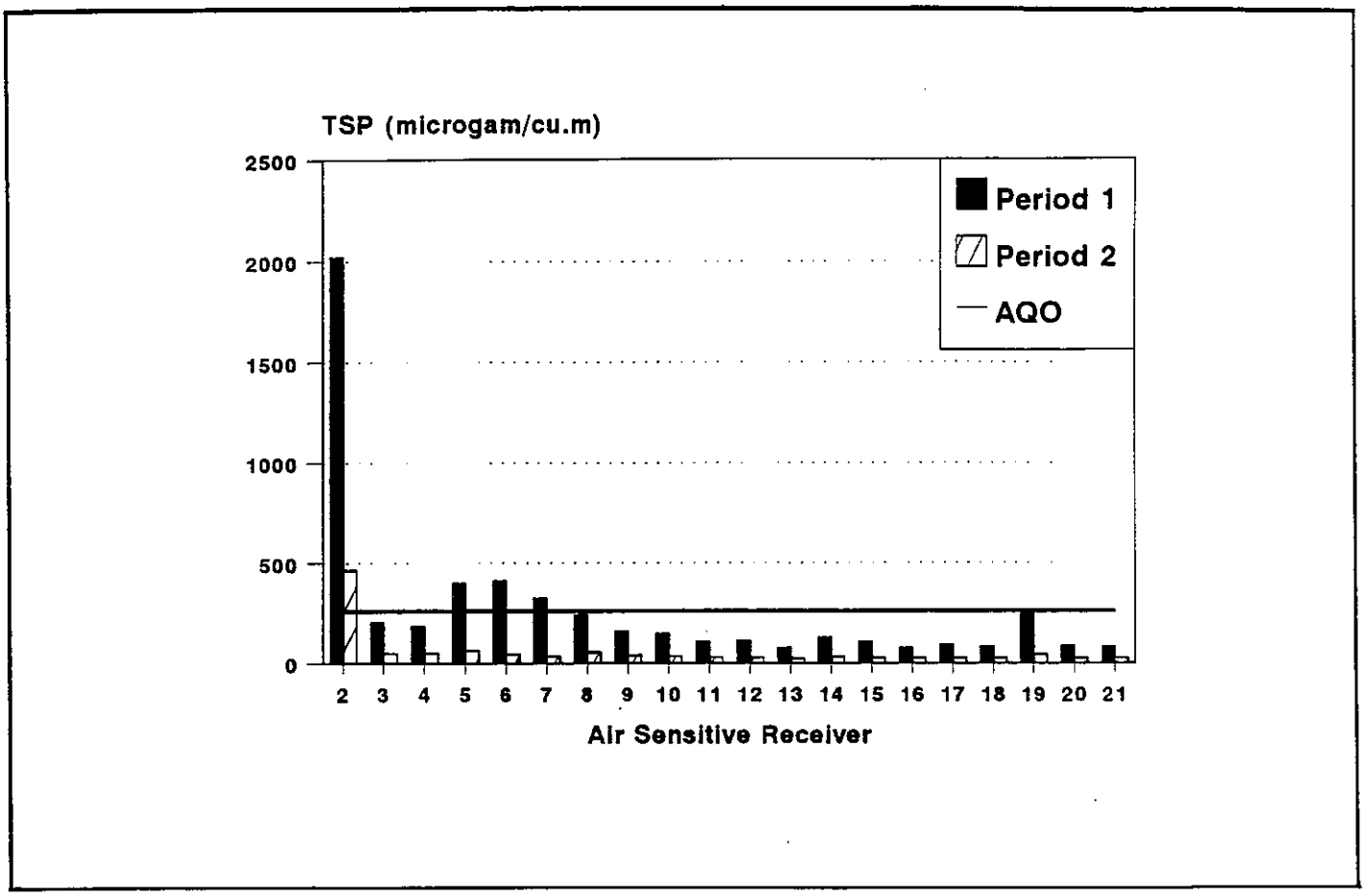
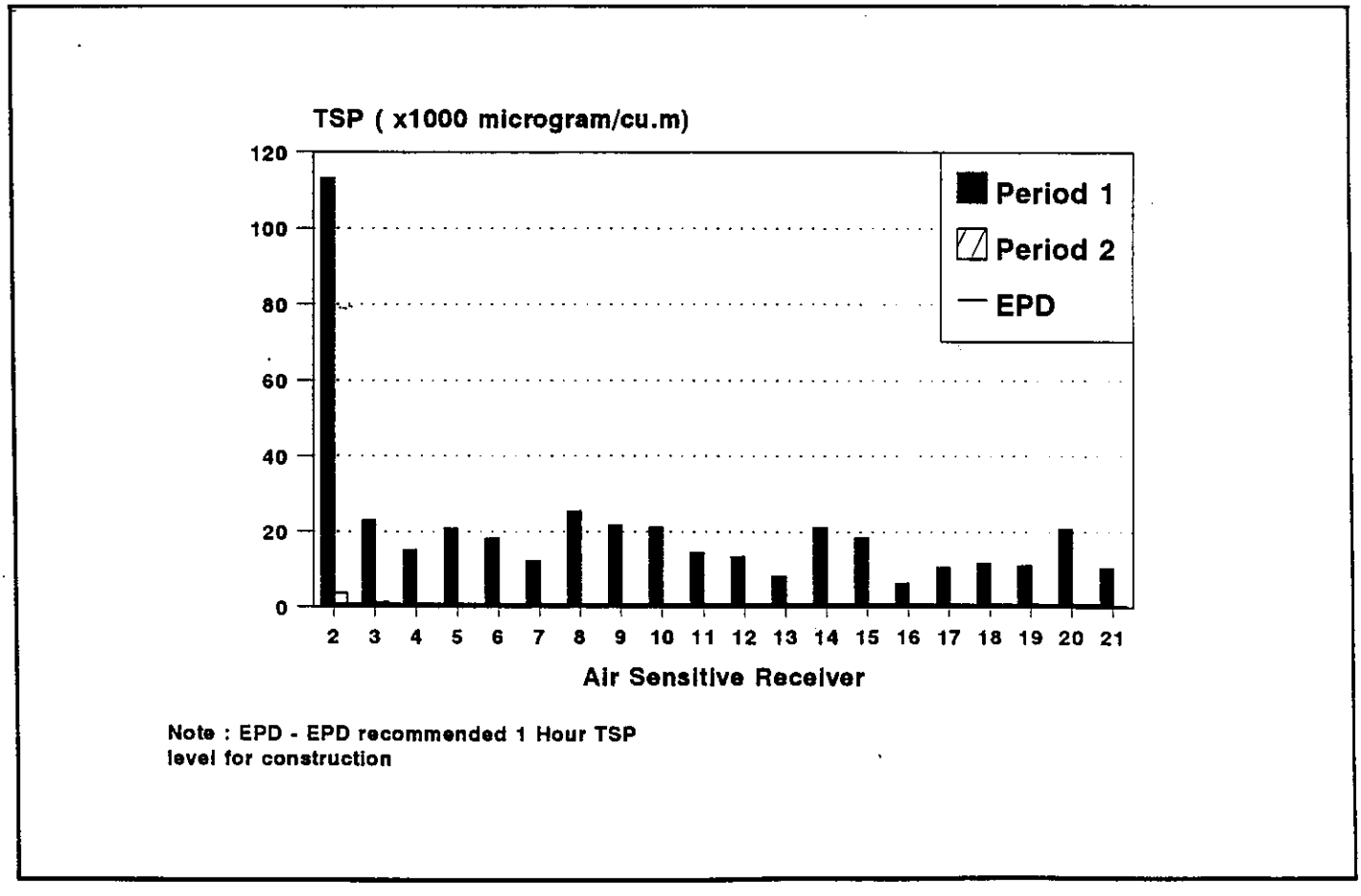


Figure 5.4
Predicted 1 Hour TSP Concentrations
during Construction without Mitigation



Note : EPD - EPD recommended 1 Hour TSP
level for construction

Figure 5.5
Predicted 24 Hour RSP Concentrations during Construction without Mitigation

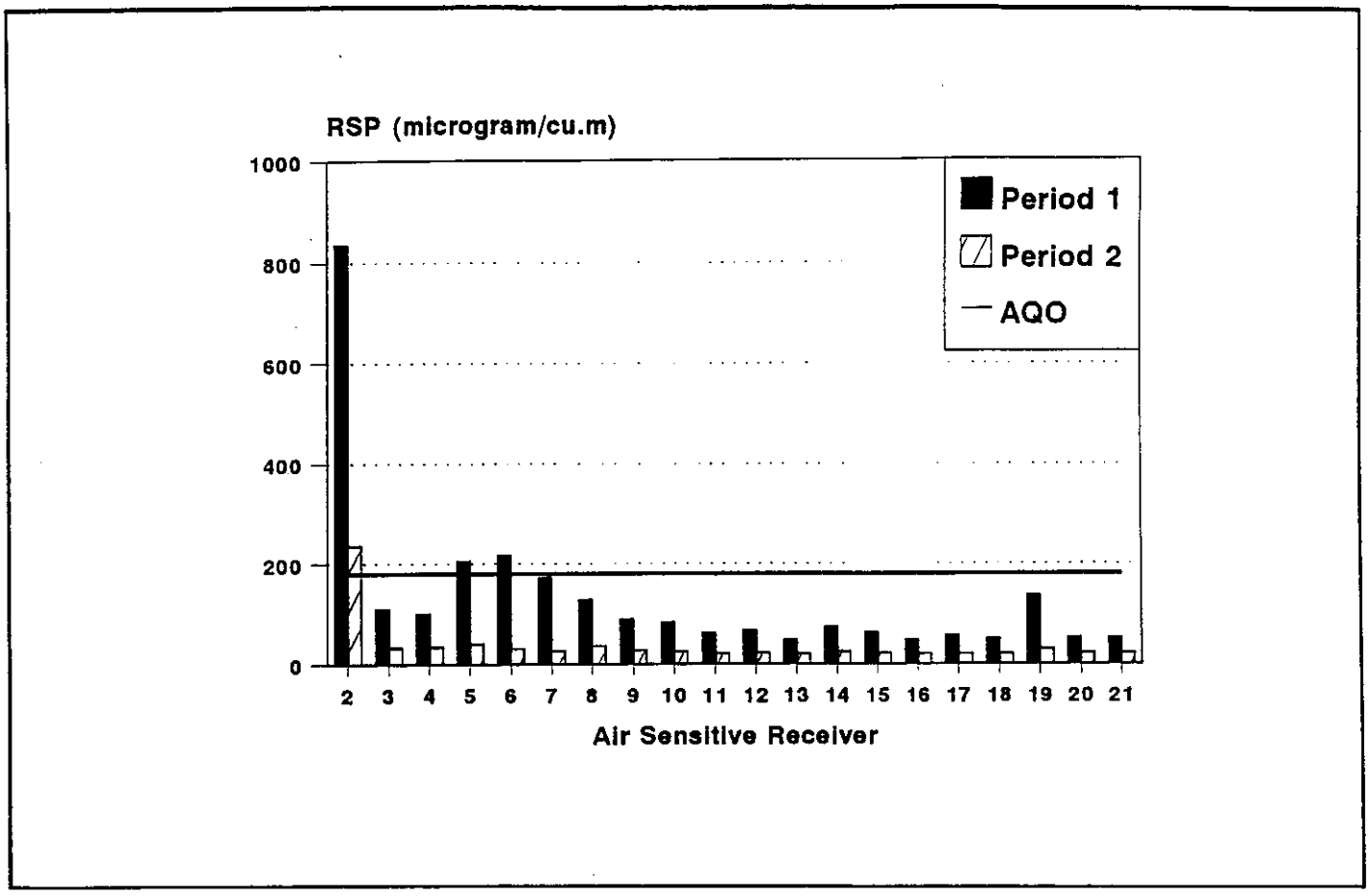


Figure 5.6
Maximum 24 Hour TSP Concentrations from Selective Sources during Construction Period 1 without Mitigation

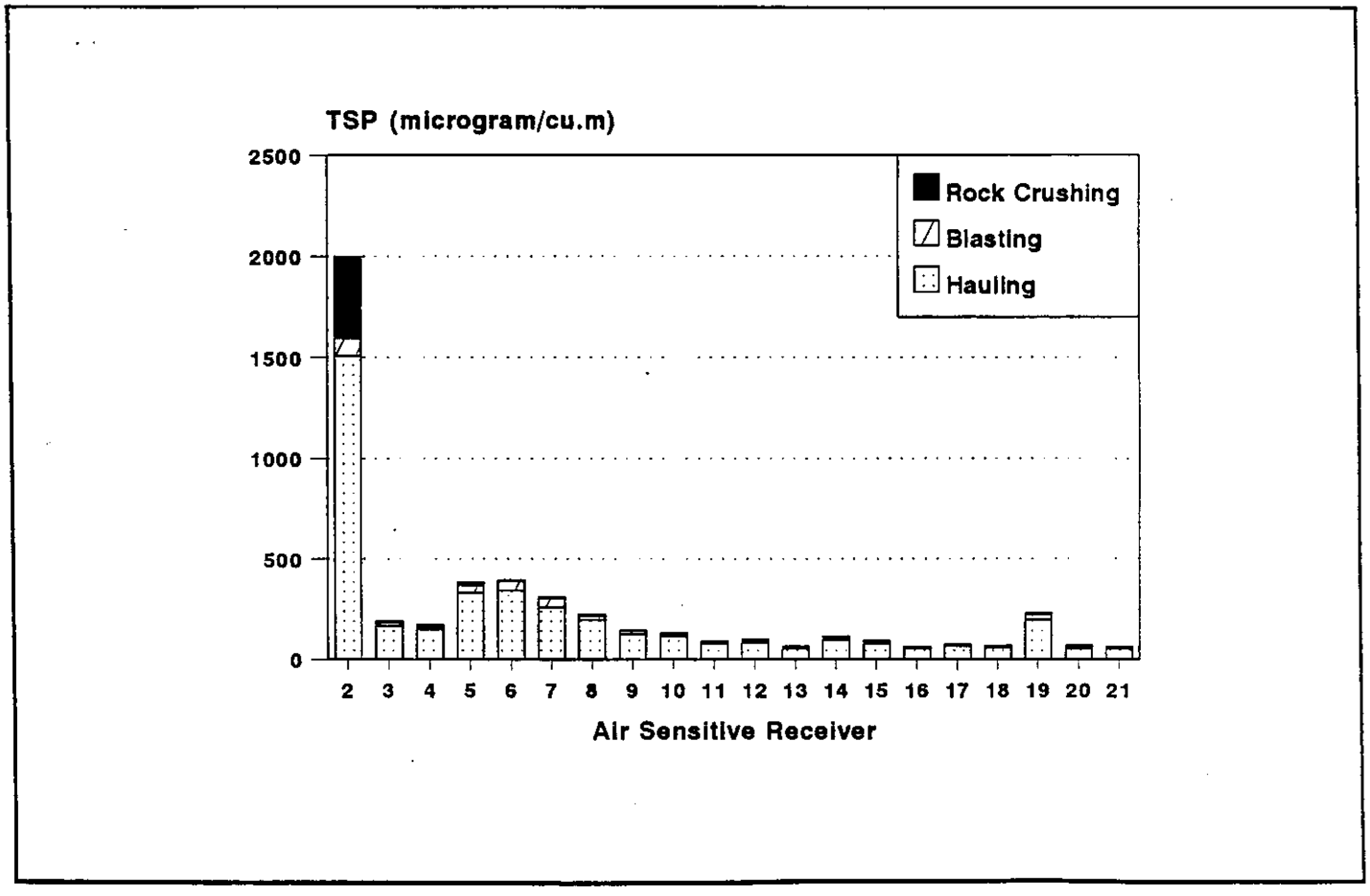
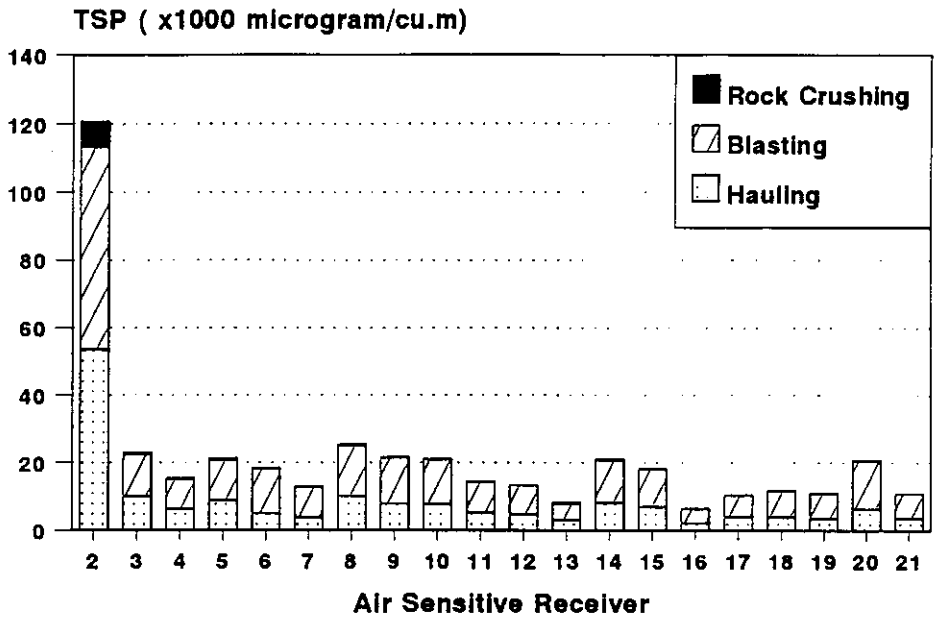


Figure 5.7
Maximum 1 Hour TSP Concentratations from Selective Sources during Construction Period 1 without Mitigation



Note: EPD - EPD recommended 1 Hour TSP level for construction

Figure 5.8
Maximum 24 Hour RSP Concentratations from Selective Sources during Construction Period 1 without Mitigation

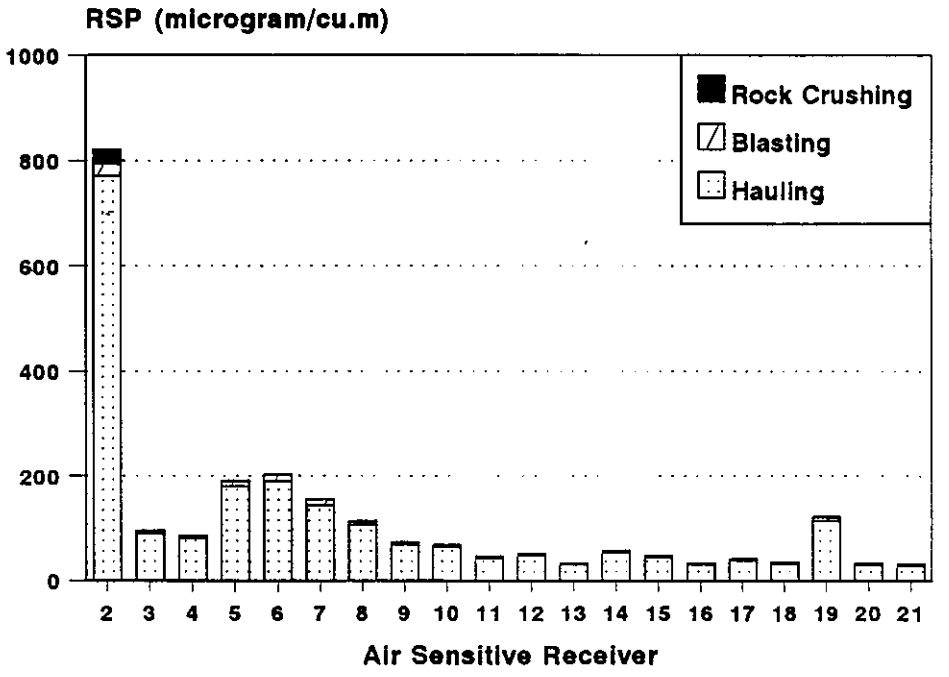


Figure 5.9
Predicted 24 Hour TSP Concentrations with and without Mitigation during Construction Period 1

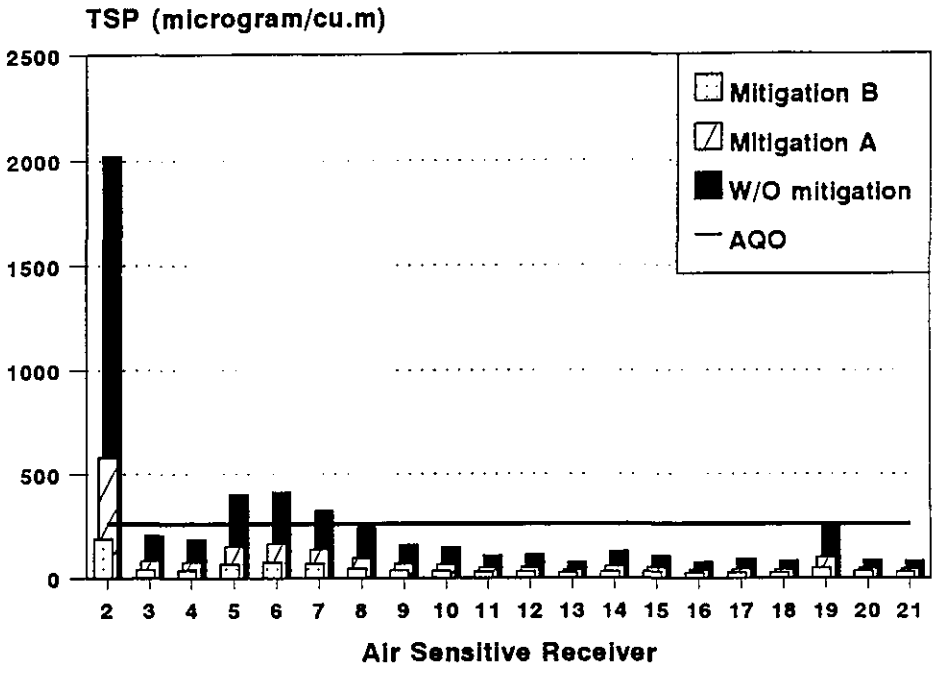


Figure 5.10
Predicted 24 Hour RSP Concentrations with and without Mitigation during Construction Period 1

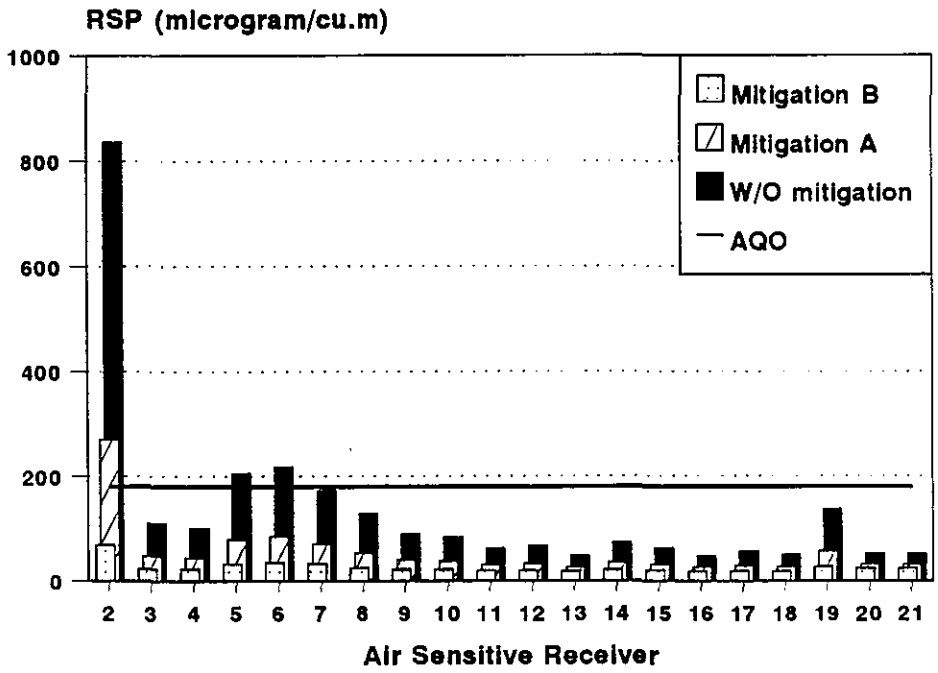


Figure 5.11
Predicted 24 Hour TSP Concentrations with and without Mitigation during Construction Period 2

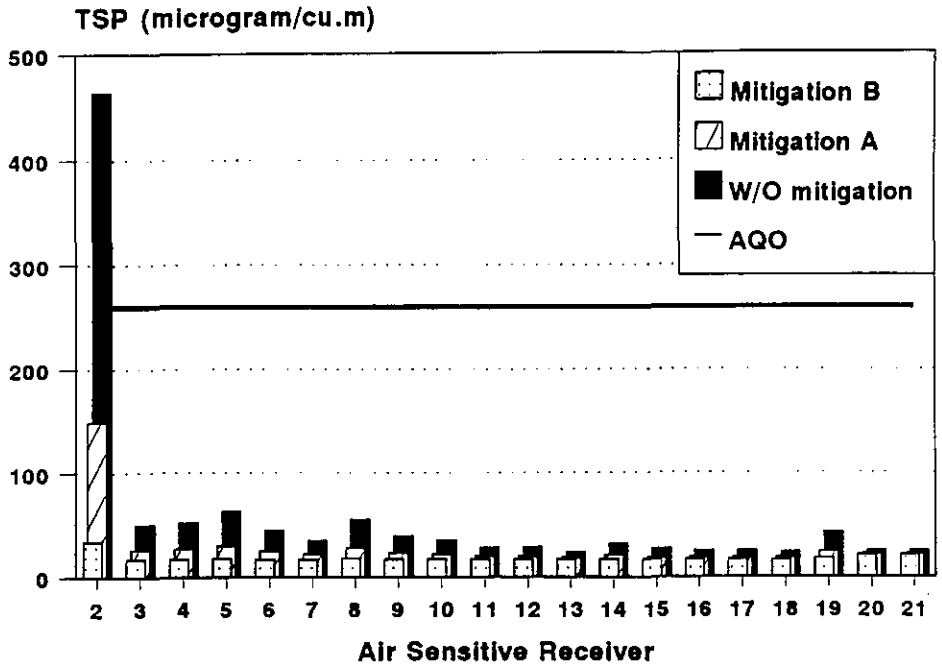


Figure 5.12
Predicted 24 Hour RSP Concentrations with and without Mitigation during Construction Period 2

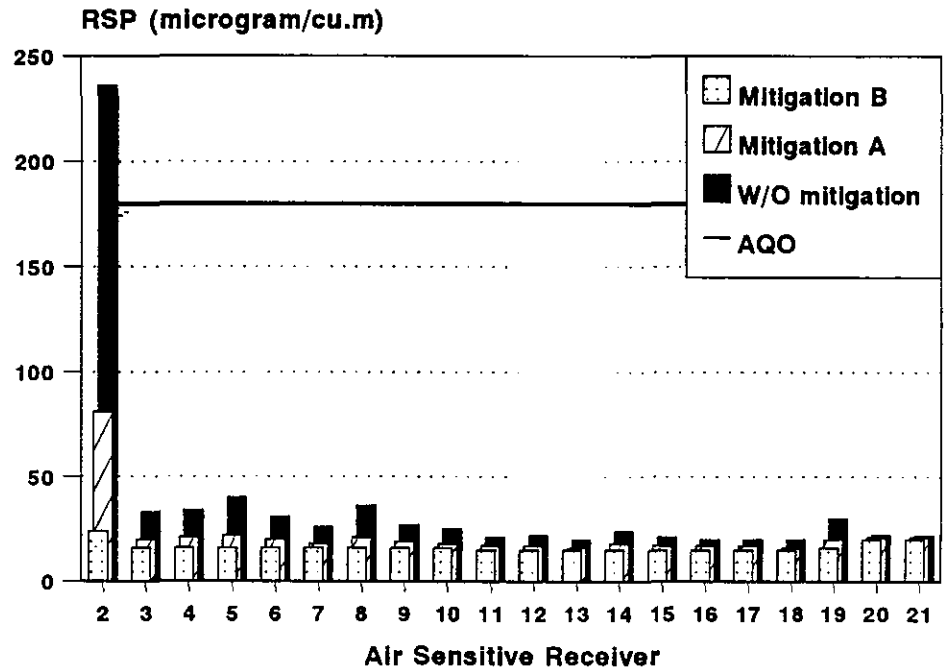
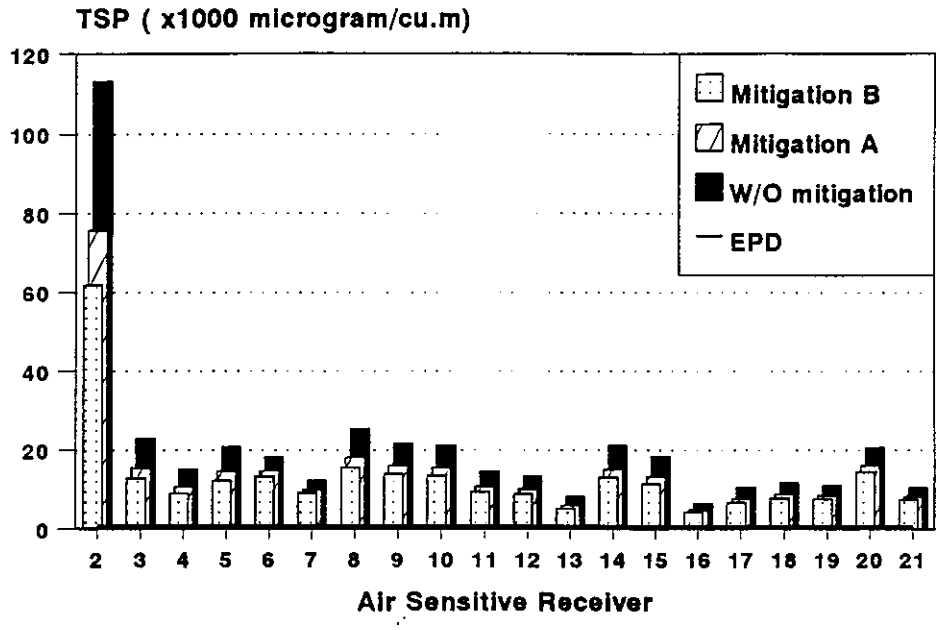
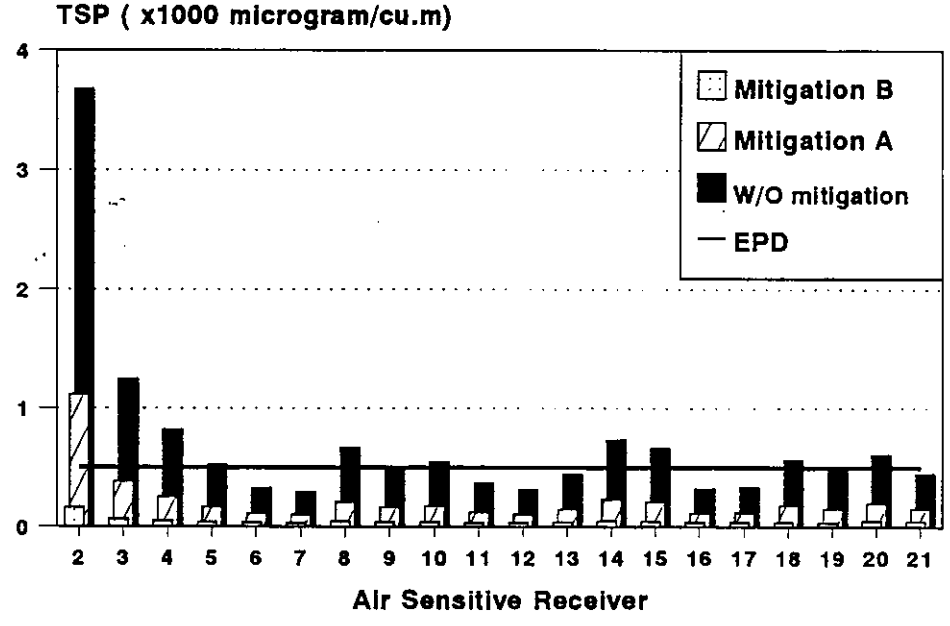


Figure 5.13
Predicted 1 Hour TSP Concentrations with and without Mitigation during Construction Period 1



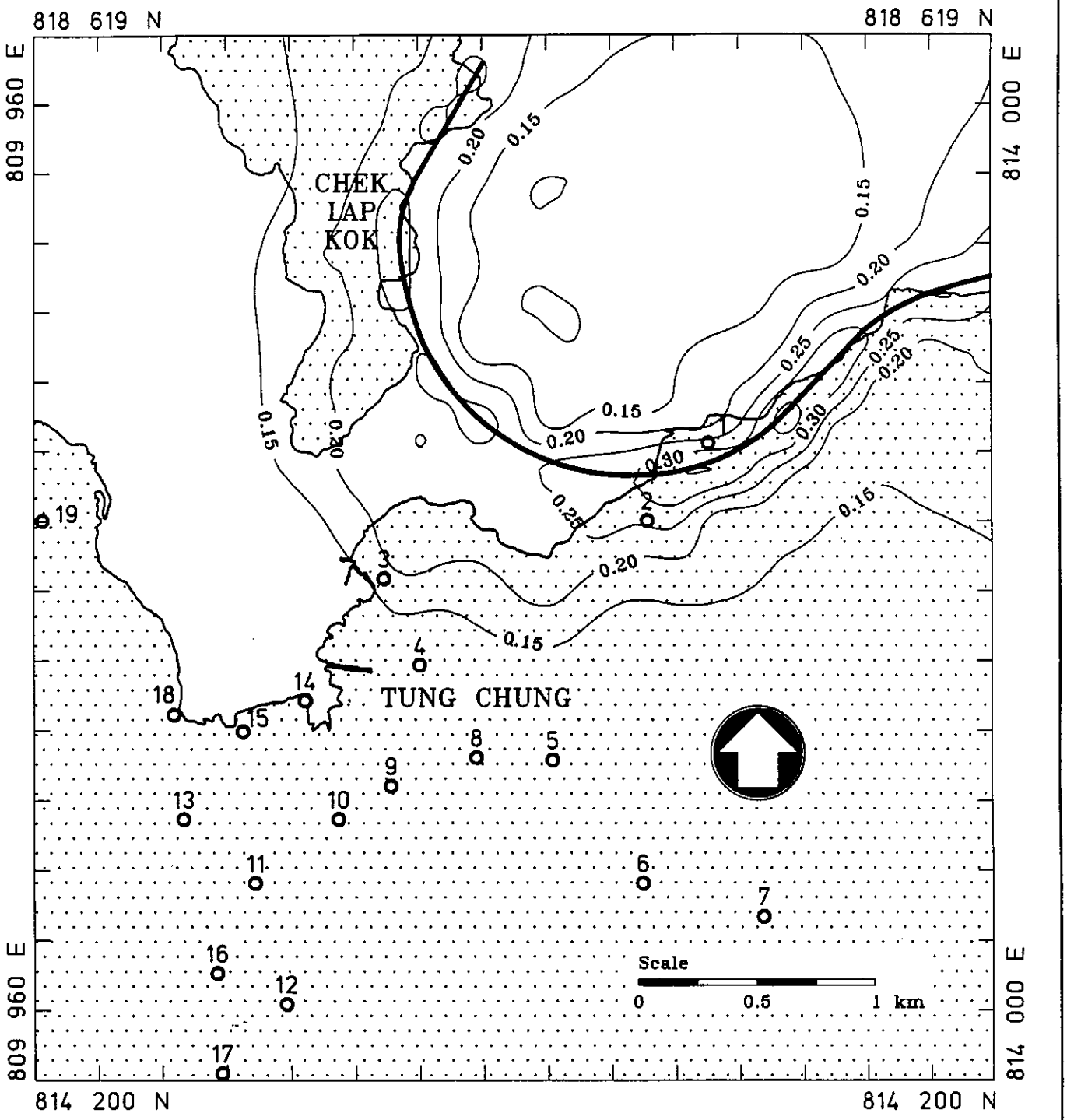
Note : EPD - EPD recommended 1 Hour TSP level for construction

Figure 5.14
Predicted 1 Hour TSP Concentrations with and without Mitigation during Construction Period 2



Note : EPD - EPD recommended 1 Hour TSP level for construction

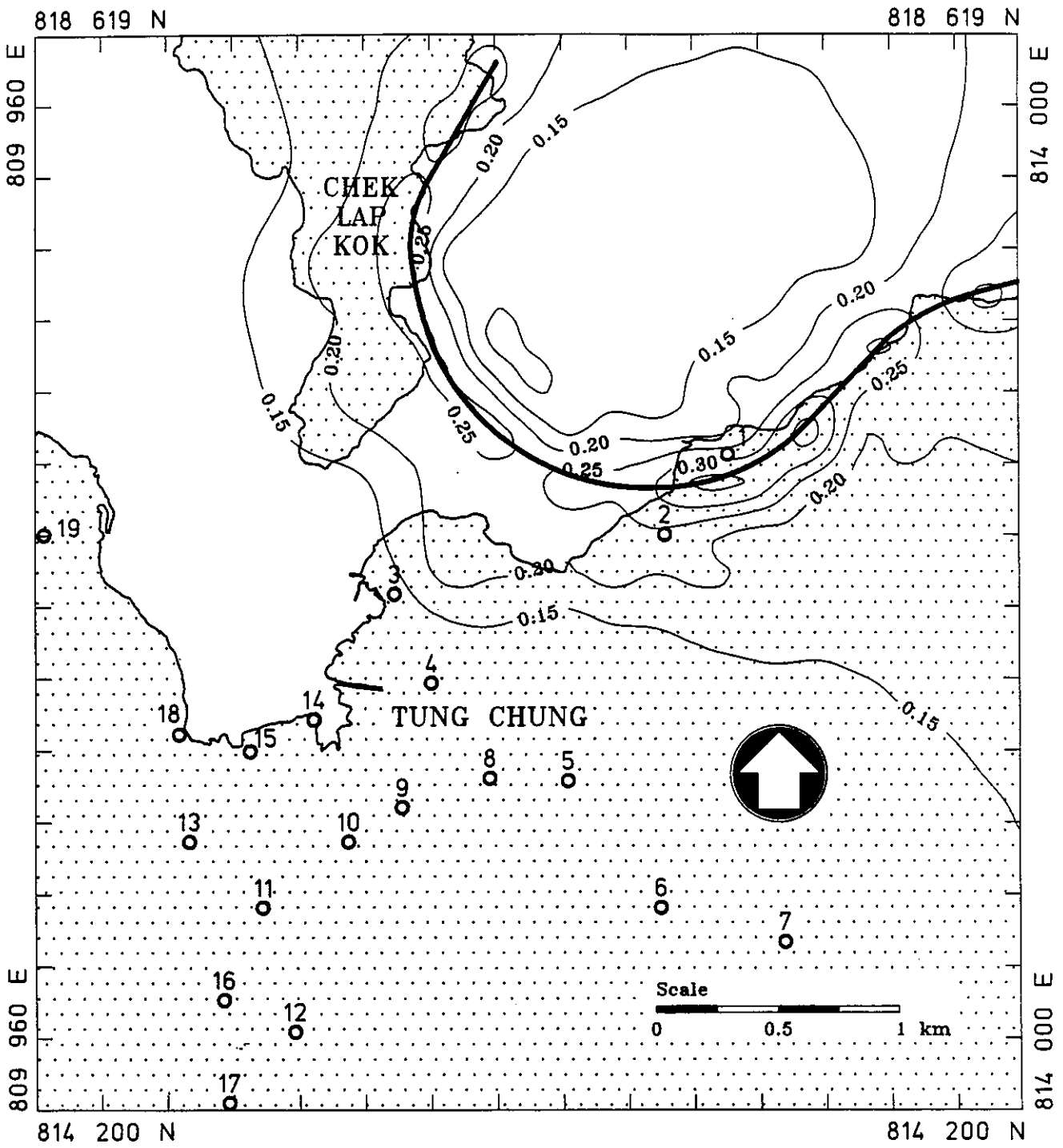
Figure 5.15
1 Hour Average CO Concentrations during Operation



Legend :

———	Expressway
5 o	Air Sensitive Receiver
—0.20—	Contour Level in ppm
814 200 N	Coordinates in H.K. Metric Grid

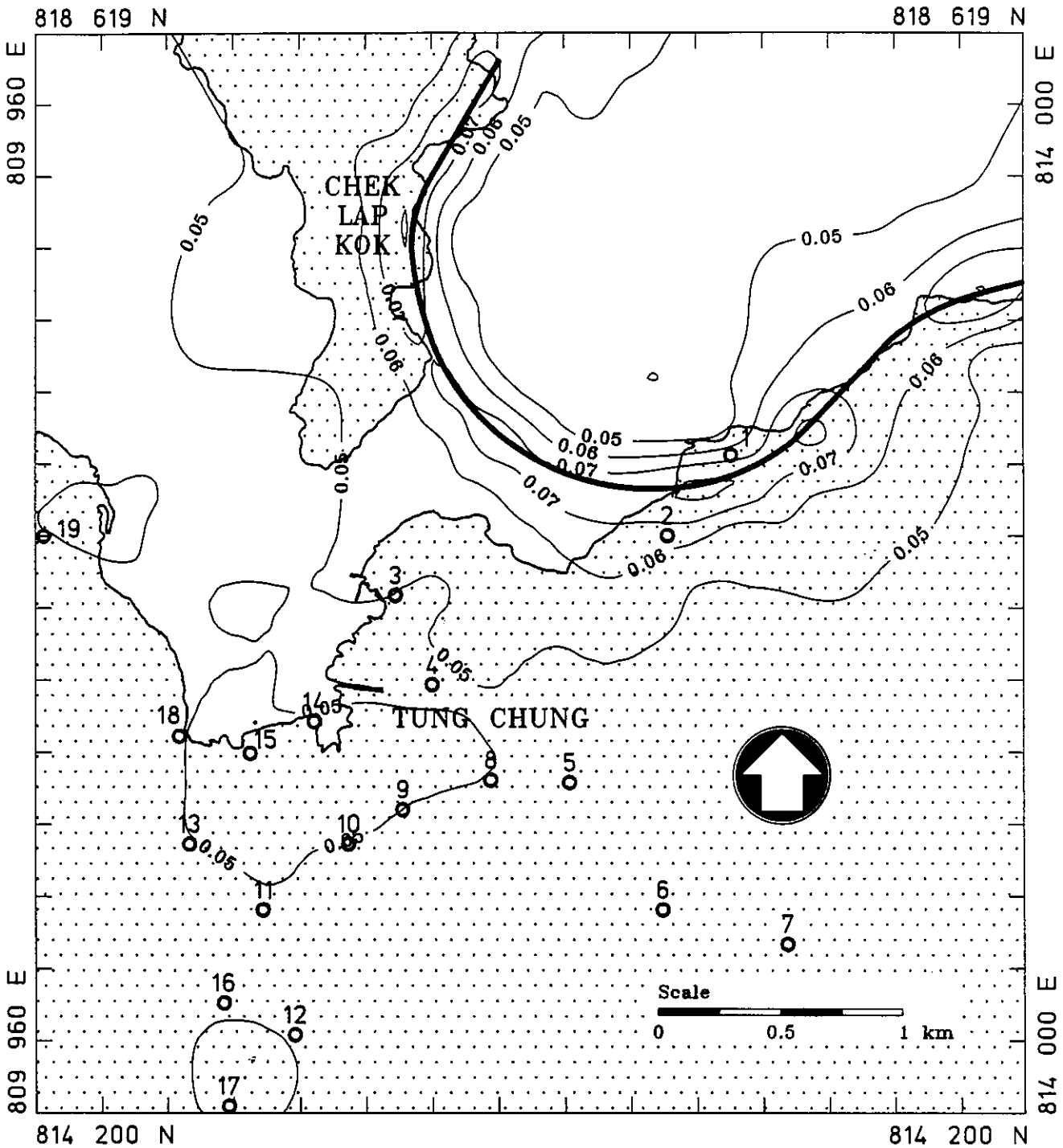
Figure 5.16
8 Hour Average CO Concentrations during Operation



Legend :

———	Expressway
5 o	Air Sensitive Receiver
—0.20—	Contour Level in ppm
814 200 N	Coordinates in H.K. Metric Grid

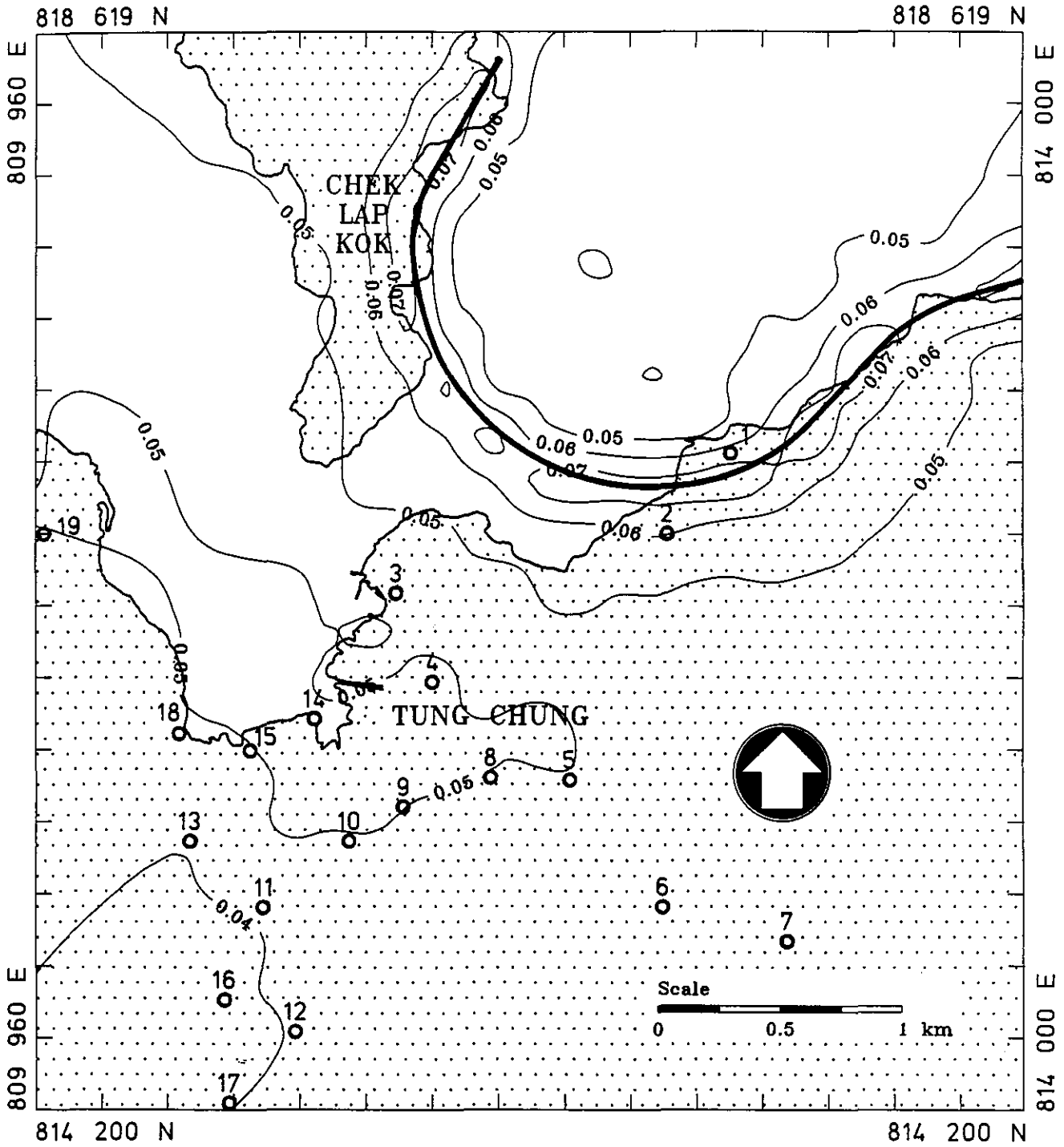
Figure 5.17
1 Hour Average NO_2 Concentratons during Operation



Legend :

———	Expressway
5	Air Sensitive Receiver
—0.05—	Contour Level in ppm
814 200 N	Coordinates in H.K. Metric Grid

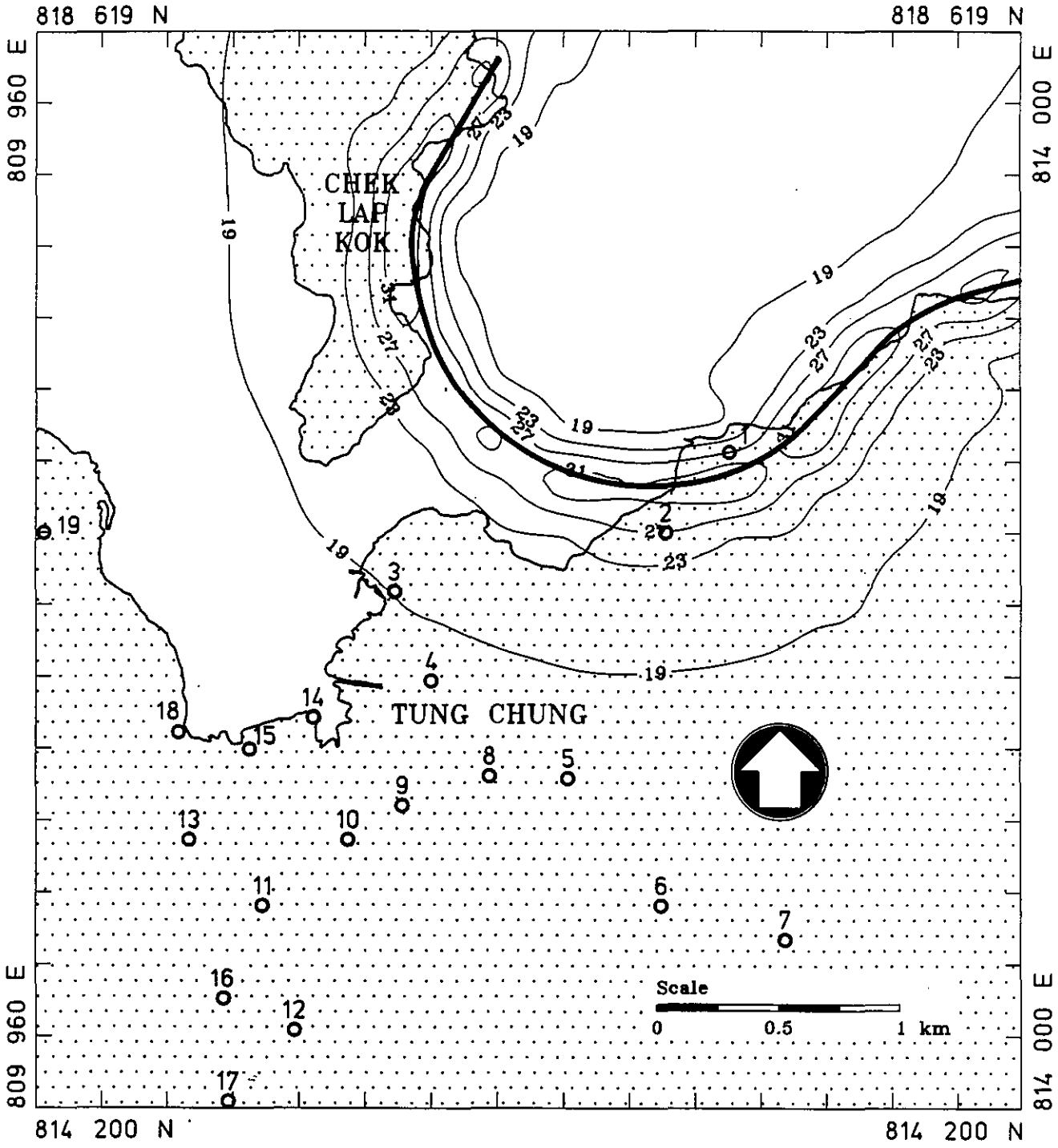
Figure 5.18
24 Hour Average NO_2 Concentrations during Operation



Legend :

———	Expressway
5	Air Sensitive Receiver
—0.05—	Contour Level in ppm
814 200 N	Coordinates in H.K. Metric Grid

Figure 5.19
24 Hour Average RSP Concentrations during Operation



Legend :

- Expressway
- 5 — Air Sensitive Receiver
- — 27 — Contour Level in ug/m^3
- 814 200 N — Coordinates in H.K. Metric Grid

6. WATER QUALITY

6. WATER QUALITY

6.1 Existing Environment And Baseline Surveys

Water Movements

The Tung Chung section of the NLE will be constructed on reclaimed land whose adjacent waters form part of the proposed North Western Water Control Zone (NWWCZ). The waters of the Tung Chung section include Tung Chung Bay itself to East Tung Chung Bay which lies west of an imaginary line between Pak Mong and the north east tip of Chek Lap Kok.

Field surveys and mathematical modelling, using WAHMO, have been carried out for the North Lantau Development Study (NLDS) and the Replacement Airport at Chek Lap Kok. No additional field studies or modelling have been carried out for the present study as the previous work is considered sufficient to assess water movements.

The movements and exchanges of water in Tung Chung Bay are dependent on waters running through the channel between north Lantau Island and Chek Lap Kok. Although some run-off from the Tung Chung catchment discharges into the bay it is primarily flushed by a fast flowing ebb tide conveyed through the sea channel as shown in Figure 6.1. The channel is up to nine metres deep in places with peak current velocities about 0.7 m/s. These flows decrease closer to the north Lantau shore and peak current velocities elsewhere in the bay decrease to about 0.1 - 0.2 m/s. This indicates local strengthening of currents as a result of passing through the channel.

On the slower flood tide the main sources of tidal exchange are waters from the Victoria and Western harbours. Figure 6.2 is taken from a photograph of the flood tide to illustrate the complexity of local water movements.

Water Quality

The North Western Waters, which includes the Tung Chung area, are a complex water body with water quality varying seasonally as determined by estuarine and oceanic influences. During the wet summer months a massive influx of fresh brackish water from the Pearl River produces strong salinity gradients while during the dry winter months, the water column is well mixed as oceanic waters move northwards into the Pearl River.

Water quality in the NWWCZ is generally characterised by the silt and pollutant loads transported into Hong Kong coastal waters from the Pearl River. Other sources of pollution include loads arising in the urban areas, run-off from local catchments mainly via nullahs and streams, and industrial and domestic effluent from existing sewage outfalls.

Monitoring of water quality undertaken, in the past, by the Pollution Control Division (PCD) of the Civil Engineering Services Department is shown on Figure 6.3 with monitoring stations located at Tai Po in East Tung Chung Bay (NM53), and within Tung Chung Bay (NM54). The results are presented in Appendices D1 and D2.

Although none of the Environmental Protection Department's routine marine water quality monitoring stations are within the Tung Chung area, they have been included on Figure 6.3. The summary data from their 30 month water quality monitoring at stations NM1 to NM5, in the NWWCZ has been included as a reference point in Appendices D3 to D5.

Mean values for nitrogen from the North Western Waters (EPD) and the Tung Chung area (PCD) were relatively high, with wet season oxidised nitrogen values two or three times the levels recorded in the dry season. This reflects the seasonal variations of water quality in this area resulting from the estuarine influx of the Pearl River carrying its silt and pollutant load, the flushing of stream beds and nullahs during the wet season, and the northward movement of oceanic waters in winter.

Relatively low BOD values were recorded with EPD data peaking in the wet season and PCD data peaking in the dry season. High dissolved oxygen levels were recorded by all stations throughout both seasons, peaking during the wet seasons. Turbidity was generally higher during the wet season while the suspended solids fluctuated during both seasons. PCD data recorded increased chlorophyll-a concentrations during the wet season.

Additional water quality monitoring is being carried out by the NLDS Consultants with a view to establishing baseline conditions with more accurancy prior to the start of construction works for the NLD. The results of the monitoring will be available in September 1992 and should also be used to provide baseline condition for the NLE construction.

Sediment Quality

As part of the North Lantau Development Study (NLDS) eight sediment samples from locations shown on Figure 6.4 were collected along the Tung Chung section of the NLE and analysed for metal concentrations and organic matter. The results are presented in Table 6.1. The concentrations within the sea bed deposits represent the potential for release of contaminants into the water during dredging and disposal.

Table 6.1 NLDS Sediment Sample Results

Sample Number	Concentration Mg/Kg										
	Zn	Cu	Ni	Pb	Cd	Cr	Hg	TKN	TP	COD	OM %
1	25	4	4	11	0.2	5	0.01	160	2	3300	1.3
2	22	4	3	10	0.2	3	0.01	110	4	1700	1.1
3	24	3	3	10	0.3	2	0.05	130	5	2400	1.5
4	42	8	15	35	2.2	6	0.17	280	9	5300	2.5
5	89	15	16	34	0.8	10	0.16	670	18	19000	3.8
6	120	29	21	49	0.6	18	0.32	890	29	20000	4.2
7	120	29	22	44	0.8	18	0.27	920	28	17000	4.1
8	130	31	21	48	0.6	18	0.27	860	41	17000	4.2
Study Area Mean Value	72	15	13	30	0.7	10	0.15	500	17	10700	2.8

Source : NLDS

These results were compared those in Table 6.2 which are the trigger and action levels for Hong Kong sediments proposed in the Contaminated Spoil Management Study (CSMS) and likely to become the accepted standard.

Table 6.2 Contaminated Spoil Management Study (CSMS)

Levels	Metal Concentration Mg/Kg						
	Zn	Cu	Ni	Pb	Cd	Cr	Hg
Trigger	150	55	35	65	4.3	50	0.8
Action	200	65	40	75	5.2	80	1.0

Source : Proposed Trigger and Action levels for Hong Kong Sediments, CSMS, Technical Note 1, 1991.

Comparison of the results show that none of the marine deposits in the area are likely to be considered as contaminated.

Water Courses

The existing drainage regime of the Tung Chung section will require diversion and culverting when Phase One of the NLE reclamation commences. The water courses behind the NLE and Tung Chung are steep in the upland section ending in small alluvial fans in the lower reaches. Water quality, particularly in the upland sections, is good as there are few sources of pollution and waters discharged into the streams are only grey water as most of the dwellings have septic tanks.

The drainage development scheme proposed for Tung Chung, the main catchment, is illustrated in Figure 6.5. Following Phase One (1997) the scheme will require the construction of two culverts to drain the streams and valleys of east and west Tung Chung into a larger culvert. This larger culvert will drain westwards along the edge of the reclamation and north into the sea channel. The result will be to clear the core of Tung Chung and the airport access corridor from any drainage reserve, and provide flood protection to both the new development and existing villages. The scheme also permits partial retention of existing streams which will maintain their original catchment function for the area, and landscape which can be integrated in the Recreation Priority Area (RPA). Until construction progress permits, the flows from eastern Tung Chung will continue to pass through the existing flood protection scheme.

Additionally the drainage scheme will incorporate a water feature and a relief channel. The water feature will be located in an open space and may feature a central island which may accommodate the Ha Wang temple which requires relocation. A control structure, located at the downstream end will control water levels and prevent ingress of sea water, easing water quality management and flood control measures.

The relief channel will separate the 'post-2011 island' (Phase Five), near the sea channel and improve tidal flushing of the outfall channels. A portion of the tidal flows will be diverted into the lower segment of the larger Tung Chung drainage culvert which would otherwise suffer low re-circulation during the dry periods.

East of Tung Chung the Phase One (1997) drainage development scheme will cover Tai Po to Kei Tau Kok only, as shown in Figure 6.6. As the NLE approaches and crosses the sea channel, water courses will need to be diverted and should be protected as far as practicable. Drainage should be conveyed east away from the sea channel, across the reclamation, and directly into the sea to allow efficient dispersal.

The drainage system in Tai Po will be split into two sections, one draining the upland basins east of the Tai Po interchange, and the second intercepting inland flows west of the interchange through Tai Po west. The inland streams will be linked by a system of interceptors, running parallel to the NLE, east of the interchange. The interceptors will be open channels connected to the main culverts. Links to existing streams will include silt and boulder traps. The interceptors will function as a buffer for sediment trapping between the natural streams and culverts in the reclaimed land. This will assist in reducing maintenance costs and facilitate desilting operations.

This scheme will reduce the number of drainage crossings of the NLE/ARL and LAL corridors, reduce interference with the LAL line, and reduce land loss in drainage reserves by following route alignments and open spaces.

Potable Water

The potable water supply for Tung Chung is presently provided by a series of small reservoirs and there are plans to also supply the villages with potable water. A new water treatment works is scheduled to be commissioned to provide supplies to the new developments on North Lantau precluding the need to drill for groundwater in this area.

6.2 Construction Phase Impact Assessment

6.2.1 Assessment Methodology And Criteria

In 1993 the Government will gazette the North Western Water Control Zone (NWWCZ) and other remaining Water Control Zones (WCZs) under the Water Pollution Control Ordinance as recommended by the Sewage Strategy Study (SSS).

The criteria used for assessment of impacts are the Water Quality Objectives as proposed by the SSS and shown in Appendix D6. Water quality will be required to comply with the objectives and any discharges, including those from construction sites, will have to comply with the Technical Memorandum : Standards For Effluents Discharged Into Drainage And Sewerage Systems, Inland And Coastal Waters (Water Pollution Control Ordinance, Cap. 358, S.21).

However since construction work will commence prior to the gazettal of the NWWCZ, the Technical Memorandum will not have legal status unless incorporated into the construction contract.

6.2.2 Sensitive Receivers

In Figure 6.7, sensitive receivers which could be affected by construction of the NLE have been identified according to the Hong Kong Planning Standards and Guidelines (HKPSG) and are as follows:

(a) fishing grounds currently existing between North Lantau and Castle Peak. Often used to restock the fish cages in the fish culture zones;

(b) shell fisheries located at Tung Chung and Tai Ho Wan. To be relocated prior to construction of the NLE;

(c) fish culture zones at Tung Chung. To be removed to allow construction for the New Airport to commence;

(d) bathing beaches along North Lantau. The majority of these are small, ungazetted and will be lost;

(e) existing and proposed drainage channels and stream courses. Potentially sensitive receivers of polluted water; and

(f) all receiving water bodies particularly the sea channel, Tung Chung Bay and East Tung Chung Bay. Potentially very sensitive to water quality impacts.

The main impacts of construction of the Tung Chung section of the NLE will mainly be limited to the Sea Channel, Tung Chung Bay and East Tung Chung Bay.

6.2.3 Construction Components

It is anticipated that construction impacts on the water quality of sensitive receivers such as the sea channel, Tung Chung Bay and East Tung Chung Bay will be minimal as most of the Tung Chung section of the NLE will be constructed on existing or already reclaimed land. Limited reclamation and dredging will still be required but the main potential impacts on these receivers will be from:

(a) construction of the bridge and its piers across the sea channel; and

(b) contamination of water courses and water bodies by spillages, discharges and run-off from construction sites.

6.2.4 Bridge Construction

The NLE bridges across the sea channel may be constructed partly from precast units and partly in-situ. A casting basin for precast units could be built close by on the shore of the sea channel. Construction of the piers and abutments for the bridges will be in the channel or on its banks.

During construction of the NLE and reclamation of the airport, Tung Chung Bay will become increasingly sensitive to water pollution as the bay will become virtually enclosed with the only outlets being via the sea channel. Water from the Tung Chung catchment will continue to drain into the bay and pollution loads from Ma Wan Chung will remain, except for those from the fish culture zone which will have been relocated. This situation may lead to a build up of pollution in the bay since flushing of the bay will be very limited as flows through the sea channel will tend to take the most direct route along the southern edge of the airport reclamation.

Sensitivity will decrease as subsequent phases of the NLD proceed, sections of the bay are reclaimed and pollution loads from Ma Wan Chung are removed. However, it is important to minimise the amount of pollution entering Tung Chung Bay during construction of the bridges. Pollution may include:

(a) debris accidentally or otherwise dropped into the water;
(b) washings from cleaning of the bridge works, for example, prior to concrete pours;
(c) grout leakage from concrete pours; and
(d) spills of oils, grease and other chemicals;

The construction period of the bridges will be relatively short and there will not be a long term impact on water quality. Nevertheless pollution should be strictly controlled.

6.2.5 Work Sites

It is proposed that a central construction facility to be located at Tung Chung will provide construction support to smaller sites along the NLE.

None of the NLE work sites will provide residential facilities as it is anticipated that construction workers will either travel daily to the site or be imported labour living in the Work Camp. However, there will be the usual site offices, work shops, maintenance and repair facilities.

Potential sources of water pollution from the work sites will be spillages, discharges and run-off. These should be treated if necessary to comply with the pollution control limits of the Technical Memorandum.

Spillages

Spillages are accidental by nature and may occur during construction contaminating the surface water on site with some or all of the following:

(a) washout from concrete batching plants;
(b) oils, grease or chemicals;
(c) bentonite slurries; and
(d) silts from dust suppression.

Unplanned spillages may occur from concrete batching plants and it may not be possible to mitigate for them.

Oils and grease from the maintenance and use of vehicles for example, chemicals, and bentonite slurries must not be allowed to enter water courses or the sea and will have to be alternatively disposed of in accordance with the Technical Memorandum.

Dust suppression of stockpiled materials and haul roads should be limited to the minimum volume able to achieve the purpose. Good site management should minimise this potential impact.

It is not possible to mitigate for accidents causing spillages but the contractor can ensure that the correct equipment and procedures are at hand to contain or clean up the spill immediately and efficiently.

Discharges And Run-Off Waters

Water movements in the adjacent coastal waters are weak and if run-off and drainage of pollutants has to be to the sea then the point of discharge should be away from the sea channel and into the main water body of East Tung Chung Bay.

Washout from concrete batching plants is likely to occur on a regular basis; discharge waters should not be drained into water courses.

Blocking of on-site drainage systems may cause a build up of a pollution load.

6.2.6 Mitigation Measures

Mitigation measures may be required to minimise the impact of construction activities on water quality. Since the Water Pollution Control Technical Memorandum on Effluent Standards will only legally apply following gazettal of the WCZs it is recommended that the Standards are included in the construction contract. Any discharges of significant volumes found to be in excess of the Effluent Standards may then require pollution control measures to bring them back within the water pollution control limits.

Special Contract Clauses should be drawn up to include, but not be limited to, the following:

(a) sites should be provided with adequate drainage channels and settlement lagoons to limit the levels of silt in discharge waters. These must then be maintained, especially those close to the sea channel;

(b) oil interceptors may be required in areas of vehicle maintenance. Oil should be separated from the aqueous phase and re-used wherever possible. Spent oil should be contained in barrels and disposed of at the appropriate sites, which include landfill sites, recycling plants, or when opened the Chemical Waste Treatment Facility on Tsing Yi Island;

(c) stockpiles of aggregates or other construction material should be treated to minimise erosion;

(d) dust suppression techniques should use a minimum volume of liquid;

(e) bentonite should be cleaned and re-used wherever possible;

(f) refuse booms should be installed across the full width of the sea channel on either side of the construction works; and

(g) the site should be kept clean and tidy, and construction materials and waste should be stored on site in such a way that they will not be washed into the sea during storms.

However much care is taken on site it is inevitable that some debris will be dropped or washed into the sea from this and other construction works. This must be regularly cleaned up although it will be difficult to apportion 'blame' for the debris to any one contractor. A clause stating that the contractor should keep clean the waters in Tung Chung Bay (for example) could be included in this and other contracts but would be difficult to enforce and would not be equitable. It is therefore recommended that a

cleaning team be included in the contract comprising a sampan and operators to be mobilised on the Engineer's instruction and paid for on a day works basis. This team would be mobilised whenever flotsam builds up, anywhere in the North Lantau area.

6.2.7 Monitoring and Audit

To ensure that the Effluent Standards are met and to determine the impact of construction activities on water quality a minimum of the following should be undertaken:-

(a) drainage channels and settlement tanks or lagoons should be regularly inspected to ensure they are functioning properly;

(b) the pH of all significantly sized discharges, run-off and waters, in all drainage channels, man-made or otherwise, should be monitored and measured to ensure the pH of receiving water complies with the Water Quality Objectives;

(c) oil interceptors should be regularly inspected to ensure and maintain efficient operation; and

(d) post spillage monitoring should be provided for.

To ensure compliance, monitoring clauses could also be included in the construction contract.

Monitoring and audit of water quality will be necessary throughout the construction of the NLE to ensure the water quality, particularly on the vicinity of the sea channel does not deteriorate. It will also be important to coordinate the audit of monitoring data between the various contracts in this area (the New Airport, Tung Chung Phase 1 and the NLE); this should be by liaison between the respective Engineers for the contracts once details of construction method and programmes are known.

Monitoring stations should be determined by the Engineer according to the contractor's proposed method of working. As a guide these are likely to be:-

(a) 100m either site of the works in or alongside the sea channel for the bridge; and

(b) 4 locations equally spaced at 500m spacing and 500m from the dredging and reclamation works near Kei Tau Kok.

Baseline conditions should first be established at these stations by taking measurements on 4 sampling days per week, at mid-flood and mid-ebb, for 4 consecutive weeks within six weeks of the start of the marine works. Measurements should be at two depths, 1m below the water surface and 1m above the sea bed unless the water is less than 3m deep in which case the measurement should be at mid-depth only. In-situ measurements of turbidity, temperature, salinity and dissolved oxygen should be taken and samples recovered for laboratory determination of suspended solids.

Impact monitoring should be carried out throughout the contract whenever marine works are in progress and should continue until the adjacent water body has returned to normal conditions. The monitoring programme will depend on the contractor's activities but as a guide a data set (comprising all the parameters collected for baseline monitoring) should normally be collected up to three days per week. It may be possible to delete the suspended sediment test if an adequate calibration between turbidity and

suspended sediments can be determined. Monitoring should be more frequent if there are indications that water quality is deteriroating.

Should the impact monitoring record levels of turbidity, suspended solids, or dissolved oxygen which are indicative of a deteriorating situation such that closer monitoring is reasonably indicated, then the Engineer should undertake daily impact monitoring until the recorded depth averaged values of these parameters indicate an improving and acceptable level of water quality.

Where impact monitoring shows a deteriorating water quality, the Contractor should be directed to take all necessary steps to ensure the works being carried out by the Contractor are not contributing to the deteioration. These steps should include, the checking of all marine plant and equipment, the maintenance or replacement of any marine plant or equipment contributing to the deterioration and the review of all working methods. The Contractor should inform the Engineer of all steps taken. Written reports and proposals for action should be passed to the Engineer by the Contractor whenever water quality monitoring shows deteriorating water quality.

Table 6.3 shows trigger, action and target levels of water quality which would be reasonable based on the assessment carried out for this report.

Table 6.3 Trigger, Action and Target Levels for Water Quality

	Trigger	Action	Target
Suspended Solids	30% increase above baseline level	30% increase above the running mean of sampling data for the previous month	30% increase above the maximum level recorded upstream of the works on that sampling day
Dissolved Oxygen	As for suspended solids by 30% decrease	As for suspended solids by 30% decrease	As for suspended solid by 30% decrease

The location of impact monitoring should be 500m downstream for work at Kei Tau Kok and 100m downstream for work in the sea channel. Monitoring upstream should be sufficiently for away from the activity such that undisturbed background levels are obtained.

In addition to the above the Engineer should monitor water quality trends so that corrective action may be taken if a decreasing trend becomes apparent. Table 6.4 presents an action plan for works quality should trigger, action or target levels be exceeded.

Table 6.4 Construction Water Quality Action Plan

Event	Action	
	Engineer	Contractor
Exceedance of trigger level for one sample	Repeat measurement as soon as possible	-
Exceedance of trigger level for more than one consecutive sample	Repeat measurements Notify contractor	-
Exceedance of action level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of action level for more than one consective sample	Increase freqency of monitoring to daily Notify contractor Require contractor to make proposals to reduce water pollution	Review plant and methods Submit proposals for improving water quality to Engineer Implement remedial actions
Exceedance of target level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of target level for more than one sample	Increase frequency of monitoring to at least daily Notify contractor Notify EPD Require contractor to implement immediate steps to reduce dust	Review plant and methods Submit proposals to improve water quality to the Engineer Implement measures to improve water quality immediately Notify Engineer of action taken

6.3 Operation Phase Impact Assessment

6.3.1 Sea Channel

The objective of providing the sea channel is to prevent the build up of pollutants in Tung Chung Bay by maintaining or improving, the existing flow in and out of the Bay, and existing circulation and quality of water within the Bay. Design of piers, abutments and foundations for the NLE sea channel bridges should therefore avoid restricting the water flow to ensure that this objective is not compromised.

The detailed design of the sea channel has yet to be completed and will depend in part on the results of a current metering survey which will determine existing flows.

6.3.2 Storm Water Drainage

In comparison with many other roads in Hong Kong, the predicted traffic volumes for the NLE in 2011, as given in Chapter 3, are high with a large proportion of heavy vehicles and surface contamination of the road from tyres, and exhaust fumes etc.

Surface water will thus be relatively polluted, particularly during the 'first flush' after periods of low rainfall.

If the NLE was to drain into the western channel the discharge would be conveyed directly into the sea channel risking pollution of the water in Tung Chung Bay and ingress of polluted water upstream from the water control structures located in the Tung Chung drainage scheme. Outfalls from the NLE drains should therefore be located to the east minimising the risk of pollution to the sea channel. In Figure 6.5 the NLD surface run-off between Tai Po and the LAL crossing of the NLE drains north out into the open sea via drainage channels east of the interchange and it is recommended that drainage from the NLE uses the same channels.

6.3.3 Accidental Spillages

There is a risk on all roads of an accident resulting in a large spill of oil or chemicals. The risk on a road such as the NLE is higher than on other less heavily trafficked roads but nevertheless such accidents are very rare. Spills from such an accident may be cleaned up using the procedures defined in the spill action plan below but no special methods of containment are considered necessary.

Should any spillages from the NLE affect water quality, then post spillage monitoring of the water body will be required following clean-up operations. The frequency and extent of such monitoring will depend upon specific incidence.

6.3.4 Mitigation Measures

Once the NLE is operational and under normal conditions of use the only impact on adjacent receiving waters should be from highway drainage and accidental spillages from vehicles, There should be no impact from the ARL or LAL. Consideration should therefore be given to establishing a spill action plan to minimise the impact of possible spillages on the water column during operation. The specific aims of the spill action plan should be to:

(a) provide guidelines for immediate handling of oil based compounds or hazardous materials;

(b) provide procedures for each category of spillages of light petroleum based compounds, cement etc;

(c) immediately restore the receiving waters to pre-spillage conditions;

(d) provide details and location of pollution control equipment;

(e) provide for post spillage monitoring; and

(f) consider adopting centralised pollution control with the Provisional Airport Authority and other relevant authorities.

Pollution control equipment should at least include the following items:

(a) containment booms for dealing with oil-based spills;
(b) skimmers for similar types of spillages;
(c) adsorbent material to collect oils;
(d) surfectants to break up oil slicks; and

(e) protective clothing for operatives.

6.3.5 Monitoring and Audit

As the receiving waters for the Tung Chung Section of the NLE, the North Lantau Developments, and the New Airport are essentially the same water body, it is recommended that post project auditing for the projects be coordinated to maximise the amount of data which can be collected and to minimise the expenditure on this item. Monitoring of water quality for the NLE alone should not be necessary.

6.4 Conclusions

The main factors to be drawn from this assessment are as follows:

(a) the primary sensitive receivers during construction and operation of the North Lantau Expressway will be the sea channel and the waters of Tung Chung Bay and East Tung Chung Bay. Consequently the maintenance of existing water quality, movement and flows, will be critical in preventing the build up of pollution in Tung Chung Bay. The channel should be designed to take account of the presence of the bridge and its supports but in addition the bridge piers and anchor blocks should be designed to avoid restricting flows into or out of the sea channel;

(b) mitigation measures may be required to minimise the impact of construction and operation of the NLE on water quality of sensitive receivers;

(c) monitoring of significant sized discharges during construction is recommended to ensure compliance with the Water Quality Objectives and Effluent Standards applicable to this project;

(d) post spillage monitoring may be necessary during construction and operation; and

(e) a combined post project audit could be considered as a coordinated effort between the New Airport, North Lantau Development and the North Lantau Expressway.

Figure 6.1
Water Movements During Low Ebb Tide 22/6/90, 1530 Hours

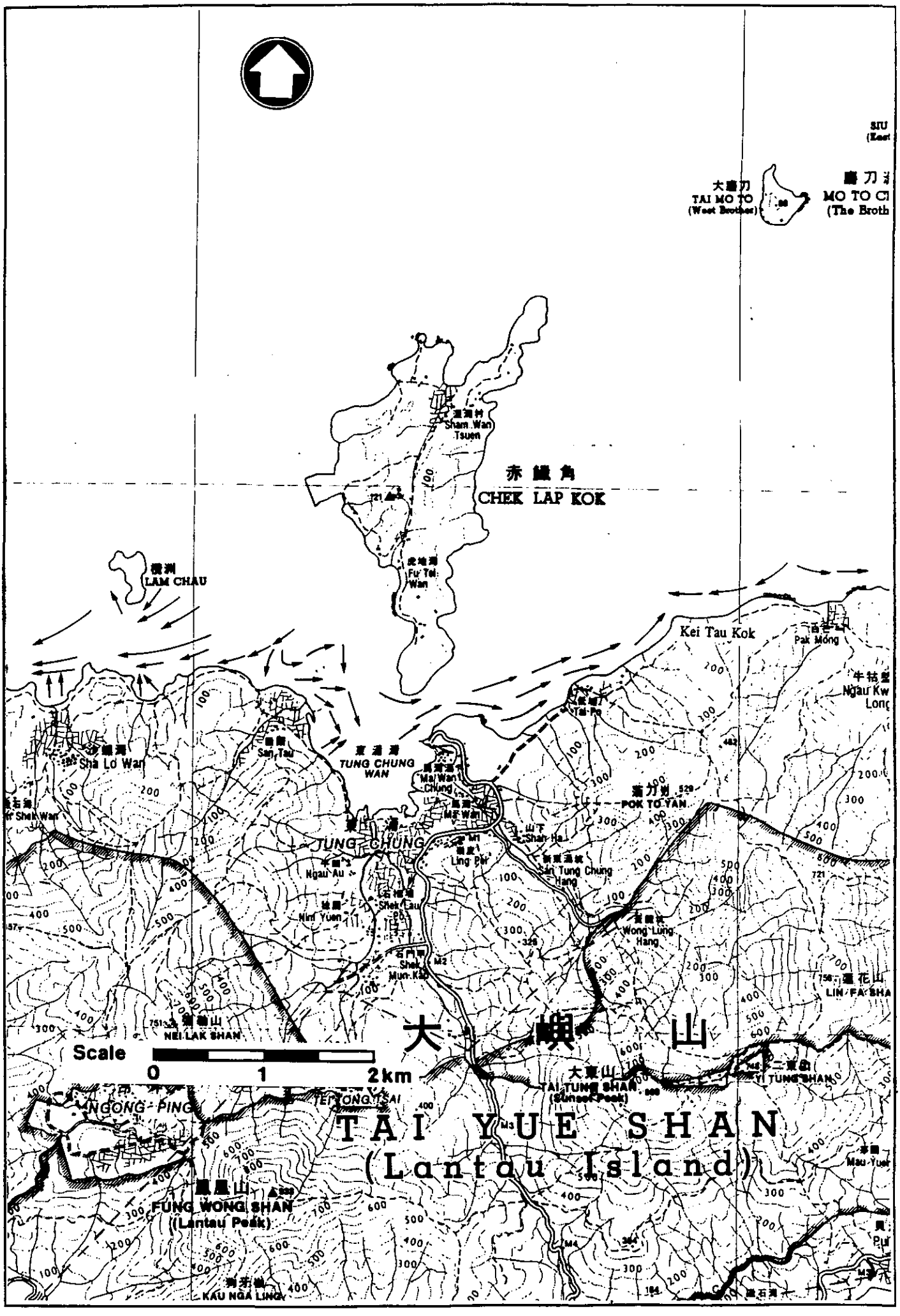


Figure 6.2
Water Movements During Flood Tide 01/12/89, 1010 Hours

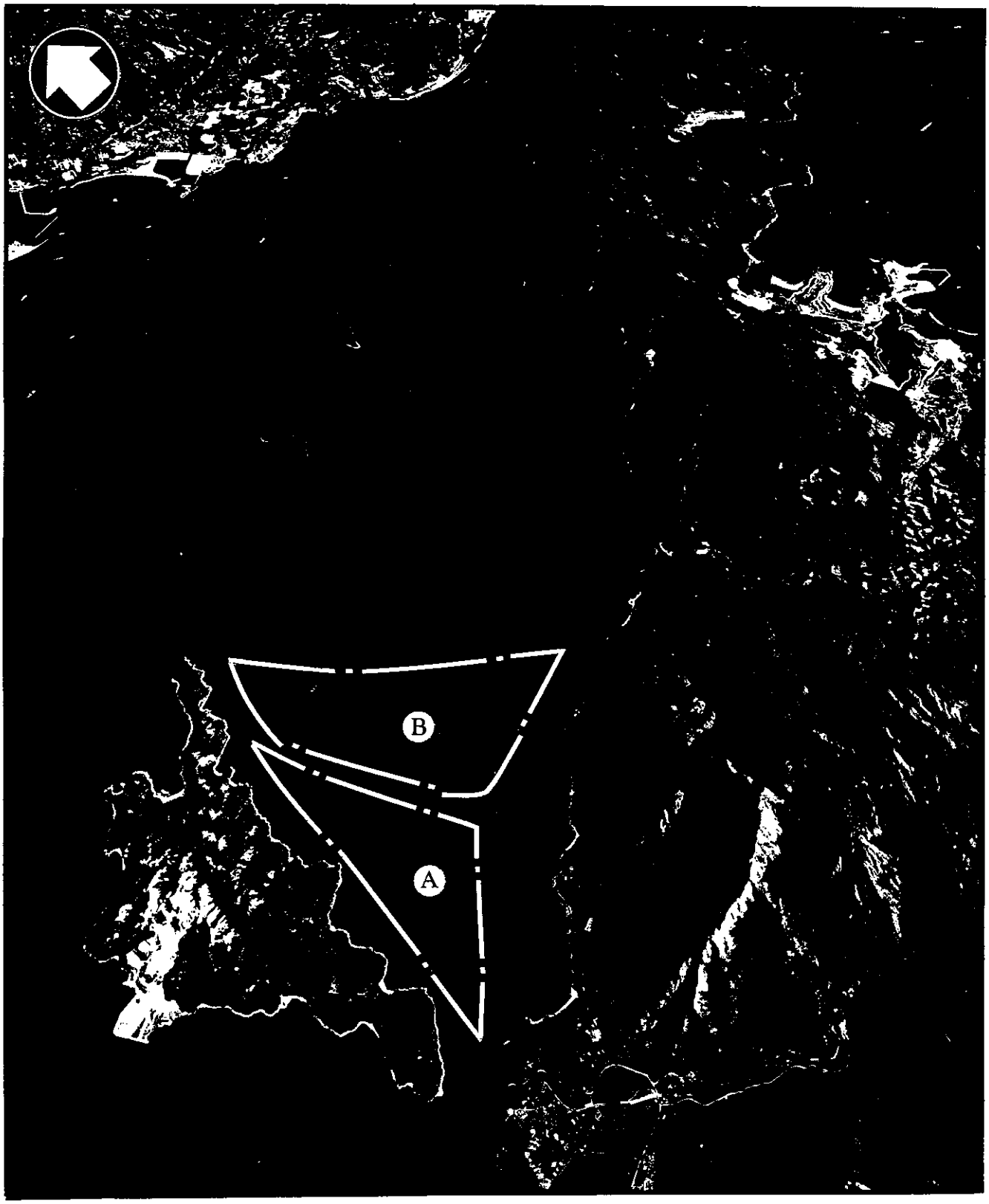


Figure 6.3
Water Quality Monitoring Stations

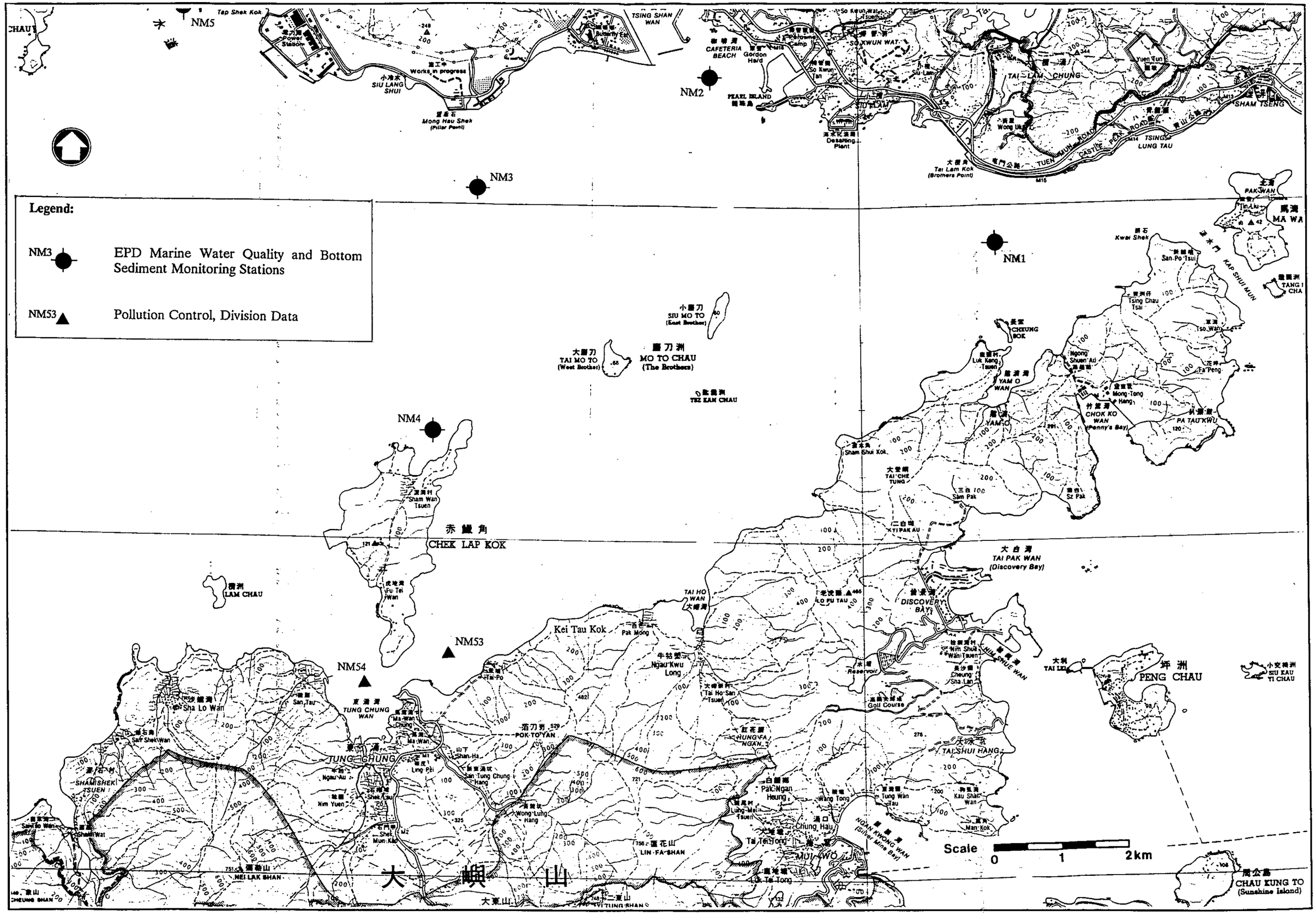


Figure 6.4
Sediment Sampling Locations for the NLDS

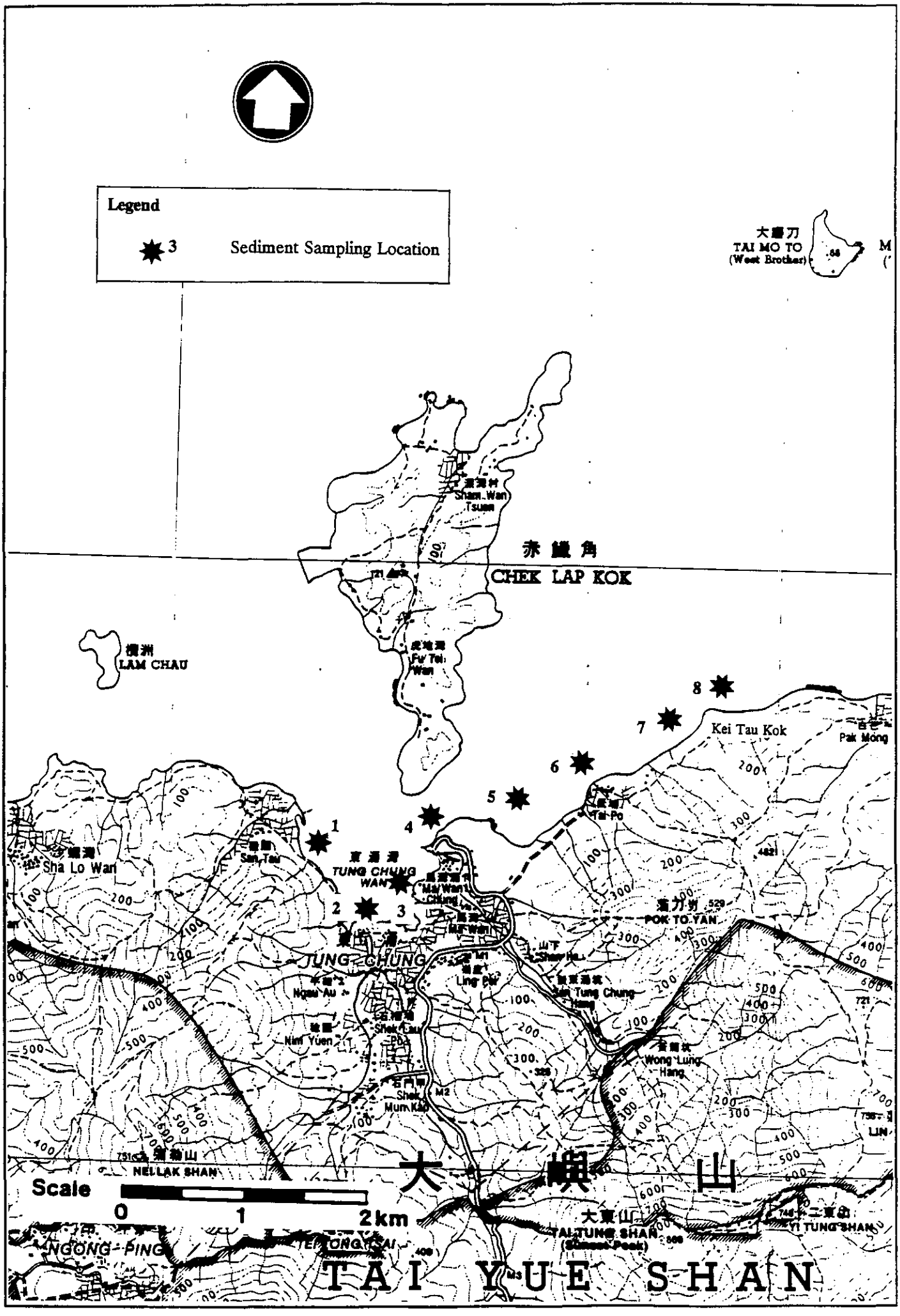


Figure 6.5
Sequence of Tung Chung Land and Drainage Development Scheme

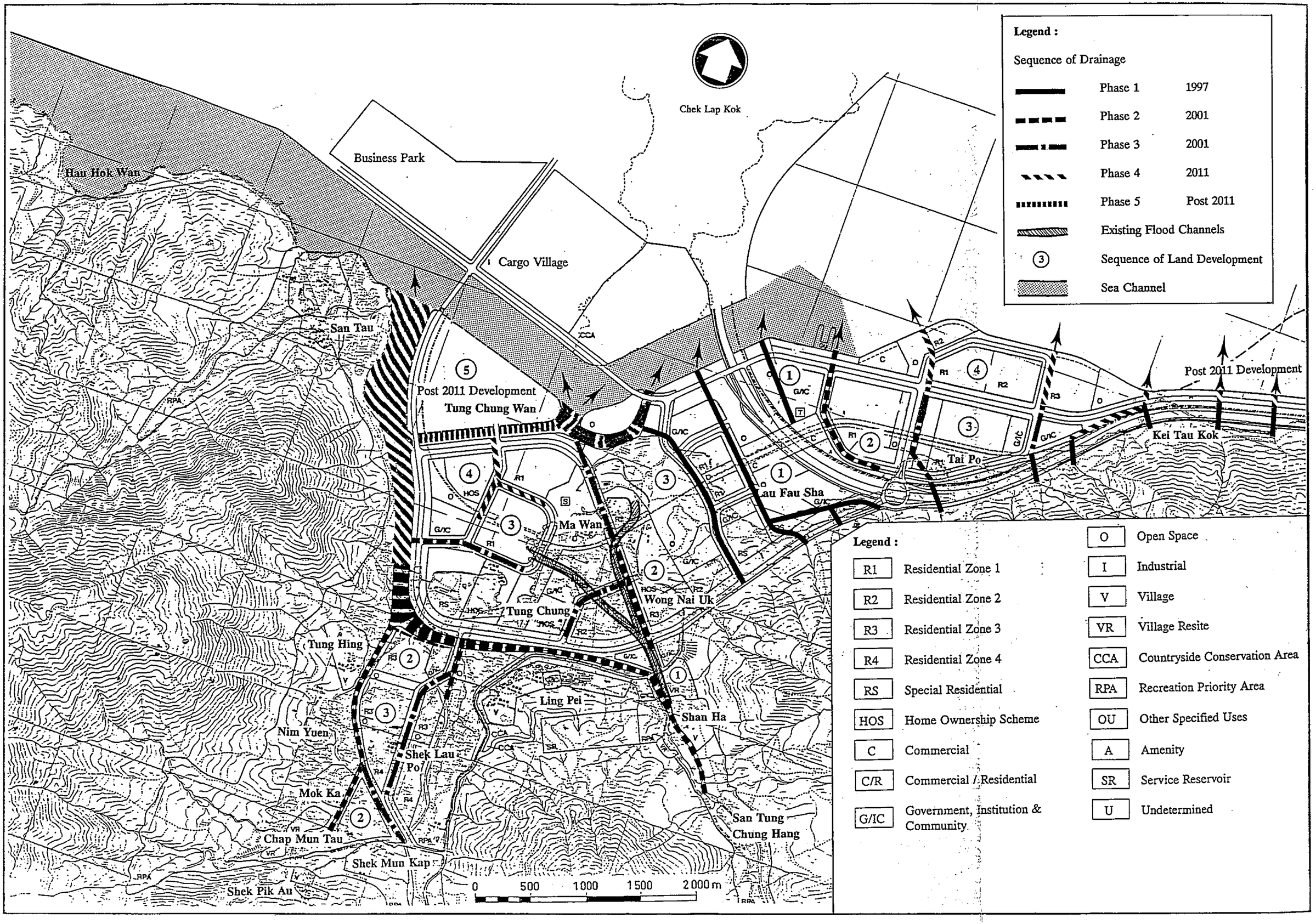


Figure 6.6
Phase One of Tung Chung Land and Drainage Development Scheme

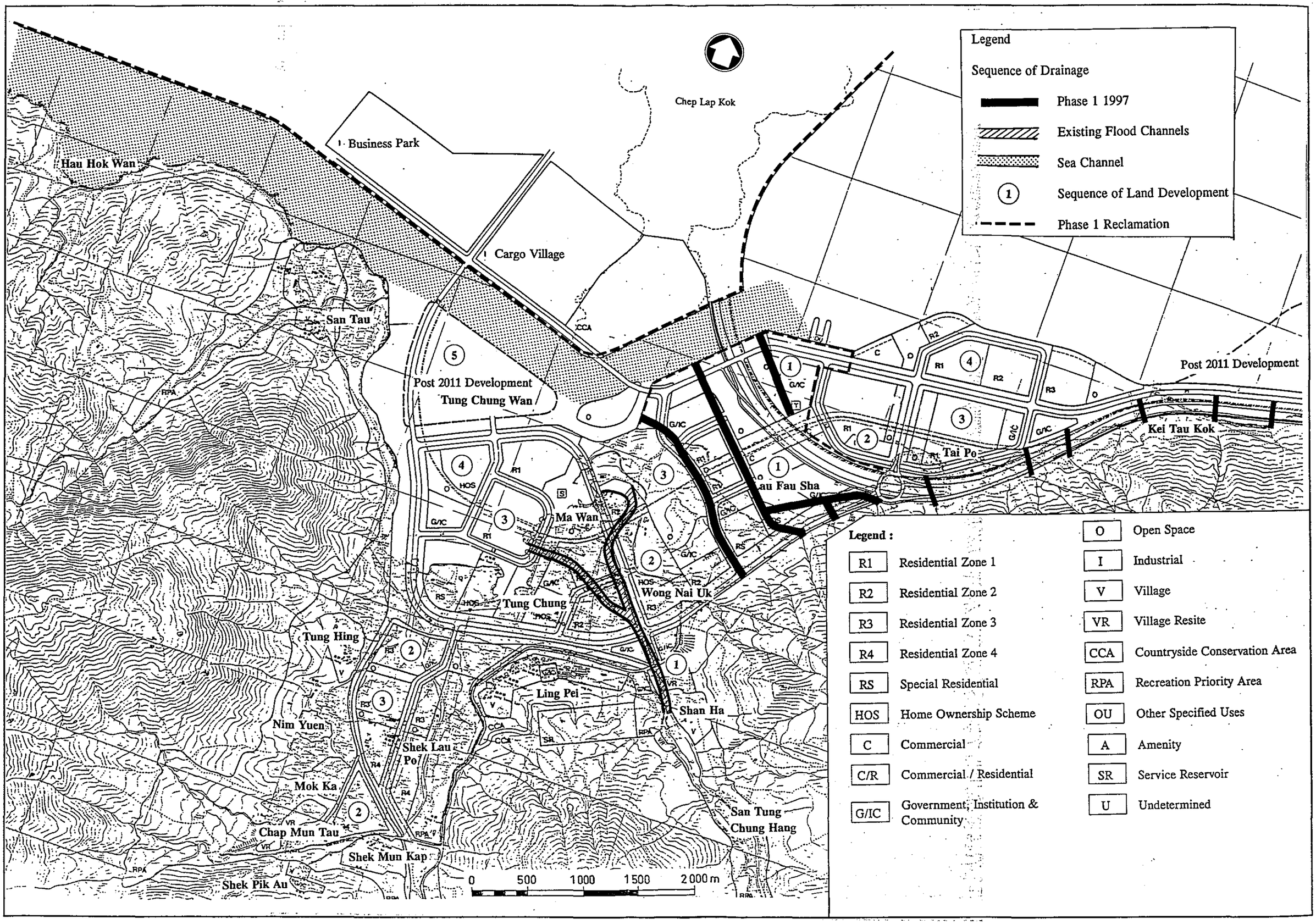
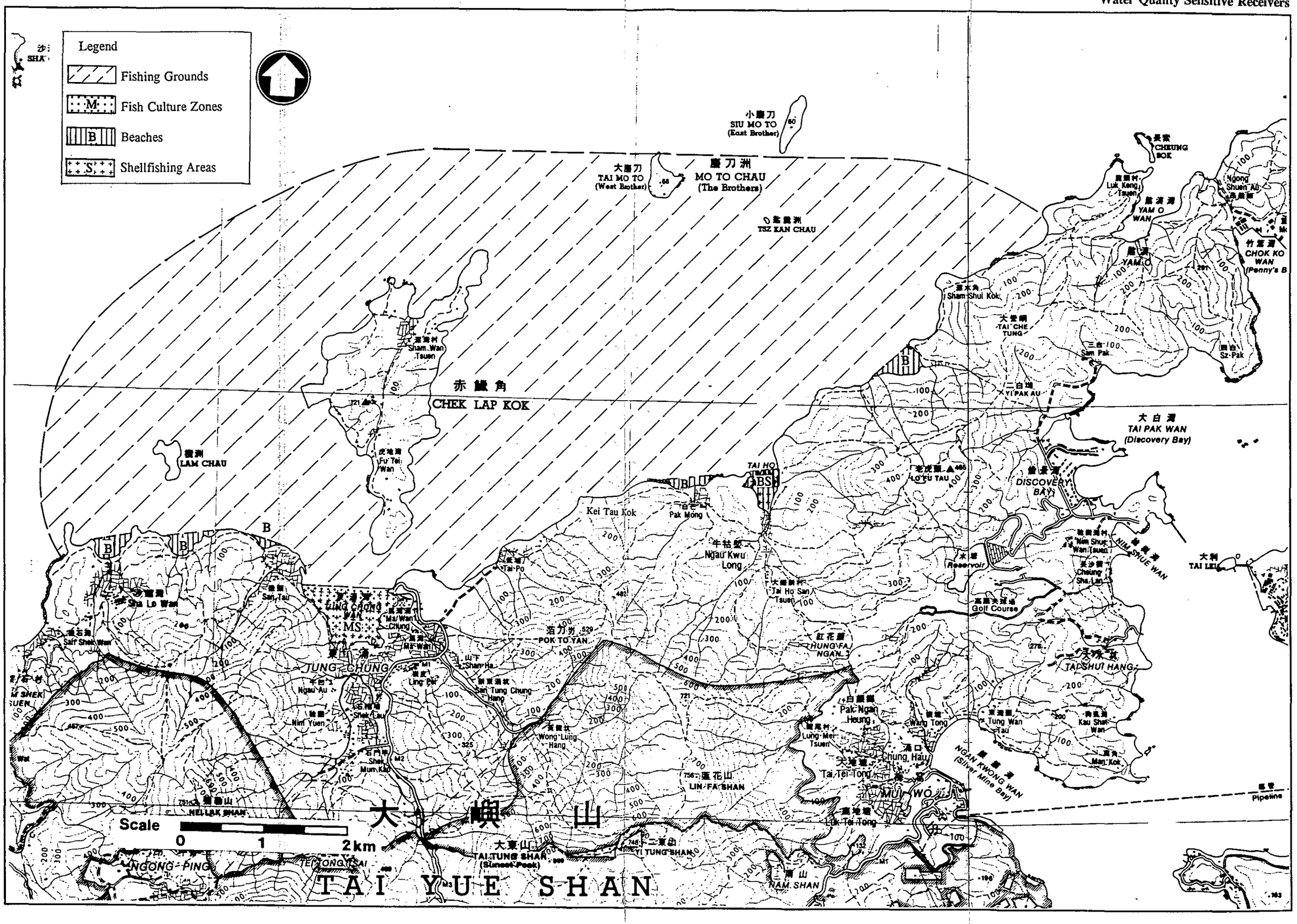


Figure 6.7
Water Quality Sensitive Receivers



7. VISUAL INTRUSION AND LAND USE

7. VISUAL INTRUSION AND LAND USE

7.1 Existing Environment And Baseline Surveys

This section of the report examines the visual aspects of the western most portion of the NLE from Kei Tau Kok, through the reclamation for the NLD, up to the airport fringe at Chek Lap Kok. The assessment focuses upon the visual impacts predicted for local and distant viewer as well as car users. Visual character in the context of NLD is also examined although it should be noted that this has been done in the absence of final details of the NLD RODP or the Master Landscape Plan for that project. The NLDS Topic Report TR14, "Mastre Landscape Plan" should be referred to for more details.

A review and photographic survey of the existing site conditions has been undertaken to provide the basis for identification and analysis of the visual impacts of the western section of the NLE. The main visual features from this section of the alignment are illustrated in Figure 7.1.

7.2 Methodology And Impact Assessment Criteria

The methodology for this assessment is similar to that adopted for the Yam O and Tai Ho assessment, though simplified due to the location of the alignment.

This assessment takes into account the NLD Technical Note, TN 1, Landscape Issues as well as NLDS Topic Report, TR8, Preferred Concept Plan and Land Requirement for First Phase.

The visual impact of specific elements of the NLE have been studied in relation to the existing landscape into which they will be placed. A comprehensive approach has been adopted to evaluate the site, its visual prominence, the project characteristics and their impacts leading to a classification of impact and identification of the need for mitigation.

The view from the proposed alignment has also been considered in terms of design solutions which could be introduced to either screen, or open up views from the road. Adjacent future development will greatly affect the eventual visual character of the area as a whole.

7.3 Landscape Visual Character

The visual character of the North Lantau hillsides and coastal zones is dramatic and exceptional in its untouched qualities. The physical landscape character zones that combine to create this exceptional visual quality are shown in Figure 7.2 and are as follows:

(a) steep hill slopes;
(b) major ridgelines;
(c) coastline;
(d) natural valley areas; and
(e) small coastal knolls and bays.

The visual character of the study area is primarily dominated by the landform and its distinctive vegetation patterns. The prominent steep hillslopes that define the overall character of the island are primarily covered by grassland and some scrubland within small drainage valleys. Coastal vegetation is restricted to narrow areas on the edges of Kei Tau Kok and along the Tai Po headland. Significant woodland areas have not been identified.

The 'sea' aspect of the study area also contributes significantly to the overall visual character providing a dramatic setting for the island coastal edge.

Taking all these aspects into account the Tung Chung section of the NLE can be divided into Kei Tau Kok, Kei Tau Kok and Tai Po Headland, and Tai Po Headland.

Kei Tau Kok

A small coastal landform spur punctuating the coastline. The rock sea edge and coastal vegetation strip lend a strong visual character to this landform.

Kei Tau Kok and Tai Po Headland

A strong and varied coastal strip with several rock formations and scattered vegetation groups along the sea edge, backed by the steep slopes of Por Kai Shan and Pok To Yan rising to a height of 482 metres and 529 metres respectively. Several minor stream courses meet the coast on this section. The landform has been modified by small scale agricultural plots near Tai Po.

Tai Po Headland

This comprises a headland knoll rising to 30 metres as well as a lowland coastal strip. Settlement on this knoll has altered the landscape and agricultural activities are evident on the lowland. Planted tree groups compliment the scattered indigenous coastal vegetation. A small sandy beach area is located just to the east of the knoll.

The interface of such a landscape with the flat sea is a major visual feature attracting the eye. Care should therefore be taken to achieve sympathetic modification of this edge for construction of the NLE as disturbance will be highly visible and visually disruptive.

7.4 Site Visibility And Prominence

The visual prominence of the work site areas on North Lantau has been assessed on the basis of the number of people who can actually see the area. A site area seen by many people will be more prominent than if seen by few or at an oblique angle. The degree of visibility can therefore change if major new development occurs increasing or decreasing the viewer group numbers.

Construction works in the western section of the NLE will be the farthest removed for viewers from Tuen Mun to Sham Tseng and visible only on the clearest days.

From a more immediate site area such as the country park on Lantau and Tung Chung, visibility of the construction works will be far more immediate. However, these views will become obscured to a certain extent as planned development takes place.

The alignment area not screened by future development and thus open to long views will be the Kei Tau Kok section. Formation and roadworks here will be visible to long distance viewers in clear atmospheric conditions and to adjacent development areas at an oblique angle.

The area from Kei Tau Kok to Tai Po will be visible primarily from adjacent development though the natural landforms behind will help ameliorate these impacts.

The NLE section on the reclamation area will be clearly visible and prominent to the development areas on both sides. This section however will be almost completely screened from long distant views.

The view from the road is also a critical factor in this section of the NLE as it will form the initial impression of Hong Kong for airport users.

7.5 Visual Sensitivity

Visual sensitivity for a site can be assessed by combining the landscape character zones with the visibility of the site from surrounding areas. The assessment of visual sensitivity therefore pinpoints the distinct characteristics of the land that combine to create this quality, their visibility, and potentially adverse visual impacts when disturbed. The three basic categories of visual sensitivity are 'very high', 'high', and 'moderate'. Figure 7.3 shows the 'very high' and 'high' areas of visual sensitivity.

Very High Visual Sensitivity

Site areas which if disturbed, would produce a visual impact evident to a large number of potential viewers.

High Visual Sensitivity

The same as 'very high' but with less visible impact.

Moderate Visual Sensitivity

Areas presenting restricted views which would have less impacts when disturbed.

As primary viewer groups are quite distant from the site, the degree of visual sensitivity will be very much a function of site formation levels across the study area.

Disturbances high up the slopes will be far more visually sensitive than those nearer the coastline. Although reclamation of the foreshore areas will not directly impact the existing landscape, the characteristic rock coastline edge will be visually impacted for near views. The foreshore has therefore been denoted as having moderate visual sensitivity.

7.6 Project Visual Characteristics

7.6.1 Construction Phase

The major construction activities are shown on Figure 7.4. The main visual impact during construction will be from formation of slopes.

7.6.2 Operational Phase

At the Kei Tau Kok headland, the NLE will be located on land created by the cutting through the knoll. Just past this area, a short stretch of reclamation will be required. Beyond this, the alignment is once more on formed land created by the cutting of low hill slopes adjacent to the coast.

The knoll at Tai Po will be entirely removed to accommodate the alignment and as at Kei Tau Kok, there will be formed cutslopes.

The main intersection for this section of the NLE will include an elevated roundabout with associated slip roads on the lowland coastal area just west of Tai Po headland.

On the reclamation north of the Tai Po interchange, the road will be constructed at grade, passing between development areas. A raised structural podium may be built across the alignment at the centre of this area, cancelling the alignment below.

The sea channel between Chek Lap Kok and the new development areas, will be bridged by the NLE. At present, it is considered that the cross road on the southern side of this channel will be built over the expressway.

The NLD Consultants have recommended noise barriers alongside the expressway and railway as they have found it difficult and, certainly not cost effective, to meet the set backs for noise. These will be 6m high earth bunds with 3m high solid barriers on top for the road and 1.5m high barriers for the railway. The barriers will only be built where necessary and will not be the full length of the NLE.

7.7 Physical Extent Of Impact

The physical extent of modifications to the landscape required for the operation of the NLE are shown on Figure 7.5 by showing the land area which will be altered to accommodate the final road alignment.

A major factor in addressing the extent of impact is the fact that major areas will be constructed on reclaimed land and impact the existing landscape. These areas occupy the foreground of this dramatic natural landscape, and will be visually intrusive. The physical extent of the works has been categorised as 'major' and 'moderate'.

Major Physical Extent

Areas of land requirements involving the existing landscape and the sea for reclamation, plus major structures and major cut slope areas.

Moderate Physical Extent

Reclamation areas where small portions of the existing landscape are affected or where development onto reclamation only is required.

It is therefore evident that the two areas which would have major physical impacts are the cutting at the Kei Tau Kok headland and the cut slopes and structures at Tai Po and to the immediate west of Tai Po.

Moderate extents of impact include the works along the reclamation and the sea channel bridges.

Establishing the physical extent of construction activities enables the actual physical impact on the landscape to be evaluated, independent of any qualitative assessments arising from our studies of site conditions, landscape quality or visibility. This gives a clear overview of the extent to which the landscape is likely to be disturbed.

7.8 Project Visual Impact Assessment

An assessment of the visual impact has been made by synthesising the site visual sensitivity with the physical extent of the works resulting in 'very high' and 'high' visual impacts, as shown in Figure 7.6.

Very High Visual Impact

Occurs where there is major physical modification to the landscape, in any area, regardless of visibility. This is particularly relevant where major portions of the natural landscape, all being considered to have high visual quality on North Lantau, will be modified by the works. The primary very high visual impacts will occur on the alignment where major cut slopes and structures will be constructed such as the Tai Po area and the Kei Tau Kok cut slope section.

High Visual Impact

Occurs where there is a moderate physical impact in the natural landscape within a highly visible area. The proximity of future development is also to be taken into account. On the reclamation area for new development, an expressway would have little impact on remote viewers as the areas are isolated. However, since viewers will eventually be immediately adjacent to and above the roadway in large buildings, the impact must be considered as high, with appropriate mitigation measures devised to deal with these impacts.

7.9 Mitigation Measures

Design of the NLE alignment and probable future development are the major factors likely to affect the range of mitigation measures possible for amelioration of the identified visual impacts.

Alignment of the NLE has been governed by railway curves, gradient restrictions, and highway expressway standards, and studied within the NLD Study. The current NLD Study has also proposed land uses to be sited directly adjacent to this section of the NLE. Concurrent with this, a model section has been developed to deal with those areas where the alignment passes between and adjacent to developed areas.

It should be noted that the NLD will effectively screen the expressway and associated works from long distance views.

The various mitigation measures which can be utilised for the amelioration of visual impacts are as follows:

(a) design of cut and fill slopes;
(b) slope treatment;
(c) planting design;
(d) roadside and median screening design;
(e) proposals for works areas; and
(f) design of bridges and associated structures.

Design of Cut and Fill Slopes

The formation of cut slopes will have a more significant impact on the landscape than construction of the NLE itself. Careful landform design is therefore essential to ensure

that the slopes will merge into the natural landscape and be capable of receiving treatments to promote the eventual establishment of a new and environmentally balanced condition. To achieve these objectives much greater volumes of material will need to be excavated than are absolutely necessary and all slopes will require laying back to 1 on 1.2 - 1.5.

Design of the cut slopes could include terracing, with plant pockets created on engineered berms, reducing the linear surface of the rock face. Large scale cut slopes could be minimised by the formation of rock walls to create plant beds on berm areas. Use of selected reclaimed rock from the site to construct these walls would help to blend them more naturally with the surrounding rock face.

Fragmented rock will generally need to be stabilised prior to planting. This can be done using plant material and geotextiles. The use of concrete, shotcrete or chunam should be avoided on aesthetic and environmental grounds.

In areas of soft subsoil, there are opportunities for sympathetic ground modelling. Berms and straight line drainage should be avoided and blending of the modified slope with the surrounding landform should be a priority.

Slope Treatment

The visual impact of any modified slope depends on the relationship of several factors, such as those mentioned above, to such considerations as, geological constraints, slope disturbance, vegetation removal, drainage pattern, scope for reinstatement, and the potential for simulating natural topographical forms.

The junction between the natural and engineered topography will be critical to the general appearance. If sensitively, handled, the impact of a man-made slope can be minimised. Likewise, drainage should be carefully integrated into slope design.

Planting Design

Planting design should consider the most appropriate method for re-establishing a sound vegetation cover for any particular site using predominantly indigenous species which are ecologically appropriate and require minimal maintenance.

On steep slopes, hydroseeding with grass, shrub and tree seeds has proven to be a successful method of plant establishment creating a rapid vegetation cover. This method also physically assists in slope stabilisation and prevention of erosion, by the binding action of the developing plant root system. The use of various types of geotextiles can also assist this process.

On less steep slopes, larger plant material can be established by notch planting directly into the slope surface, or planting in naturally formed crevices, on ledges and man-made berm planters.

Preservation of existing vegetation wherever possible should be utilised as a mitigation measure. Once identified for retention, the plant material should be suitably protected throughout construction.

Roadside and Median Screening Design

Where sightlines, levels and structural constraints allow, planting along roadsides and at interchanges can help to reduce the impact of the road on adjacent areas, improve appearance of the road, and provide visual diversity for the road user. Much of the landward side of the alignment will also be suitable for planting, blending up into the natural hill sides.

The typical cross-section for the alignment in the urban areas will rely on a combination of mounds up to six metres in height, major revegetation and a comprehensive system of noise barriers. It is important that the landscaping design takes suficient note of the noise barriers on the expressway to avoid a 'tunnel' effect for road users. The material for the barrier should be chosen carefully to enhance the visual aspect.

Footpaths, cycleways and open space uses could be incorporated into these amenity strips with footbridges providing convenient linkages between developments on both sides of the alignment.

Proposals for Works Areas

Although the location of work sites for the project have not yet been decided upon, temporary screening of works should be incorporated using the following measures which could be appropriate for site edges where works and access will not be unduly hampered:

(a) landform edge mounding two to three metres high to mask low level views of ground clutter within the works area; and

(b) for works areas that are to be active for several years, tree planting utilising fast growing species should be undertaken in conjunction with mounding.

In principle, it is important to note that the above measures should be designed with a view to the eventual after use of these land areas, especially if they are to become parkland or amenity areas. Barge loading areas may also be redeveloped as public amenity areas with water related activities. These measures are now commonly adopted for many roadwork projects being undertaken in Hong Kong.

Design of Bridges and Associated Structures

Design of large scale engineering elements such as bridges, viaducts and associated architectural structures need to be carefully considered in relation to their setting, overall form, choice of materials and detailing. Where the road passes through sensitive, high quality landscape areas, the design of such roadside structures should be simple and understated, with minimal impact allowing the natural landscape to dominate.

In certain instances, such as the construction of a bridge which is of such a scale in relation to its surroundings that a substantial visual impact is inevitable, an opportunity can be taken to create a positive visual impact which contributes to the quality of the landscape setting.

Lighting columns, road signs, barriers and all highway furniture should be co-ordinated in design and colour to reduce visual clutter.

7.9.1 ACABAS Statement

For the eastern end of the alignment, concept and preliminary design proposals for bridge and viaduct structures and other associated columns have been presented and discussed in detail with ACABAS. Further refinement and details are underway to ensure full compliance with comments received, and a full set of documents will be submitted for approval. These approved details should be carried forward to the western end of the project to ensure design continuity.

7.10 Conclusions

This visual assessment has identified those impacts which will affect potential viewers. In the long term, the greater impacts will be for adjacent developments and road users. Mitigation measures can reduce these impacts, especially in the long term as environmental regeneration becomes firmly established. The main points arising from this assessment are:

(a) the North Lantau coastline is virtually untouched at present and exhibits high environmental visual quality. Construction of the North Lantau Expressway and other related developments will dramatically alter this landscape;

(b) the alignment and associated works for this project cannot be viewed in strict isolation as future development will screen the alignment to a large extent from long distant views and be sensitive to short distant views to the alignment and the works;

(c) extensive co-ordination of landscape proposals for the NLE and adjacent development should be undertaken in order to achieve the full realisation of visual mitigation measures proposed;

(d) the site development areas immediately adjacent to the NLE should include major landform mounding and planting to screen the expressway from short distant views as well as enhance the view from the road; and

(e) mitigation measures which include less severe slope profiles, extensive planting and widened medians will have environmental benefits as well as distinct cost implications.

It should be noted that the visual assessment included in this report has been prepared on the basis of the latest information available on other projects on North Lantau. These projects are still in their initial planning stages and there may be changes to layouts, and therefore visual impacts, as plans for these projects become more firm.

Figure 7.1
Site Analysis

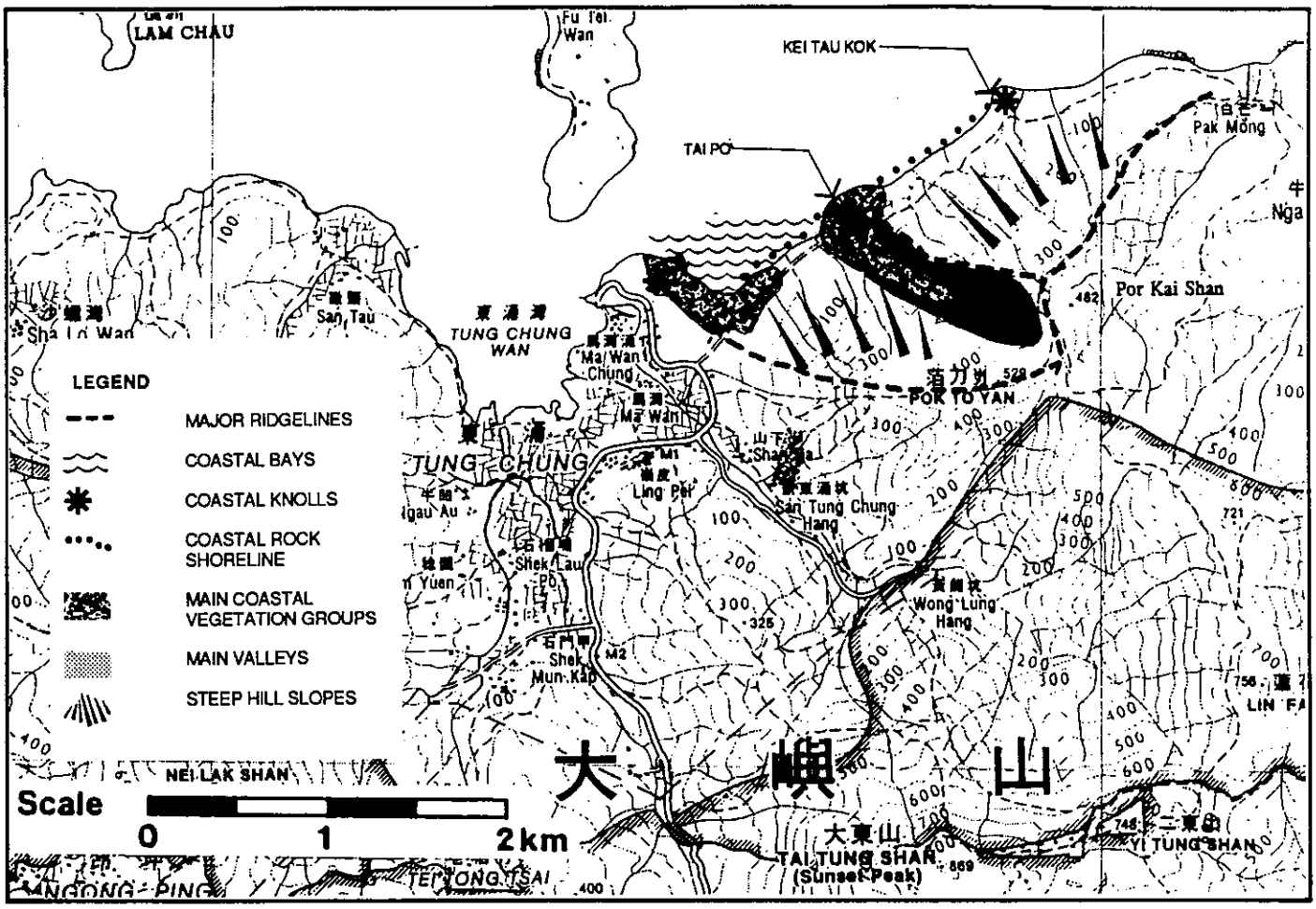


Figure 7.2
Landscape Character Zones

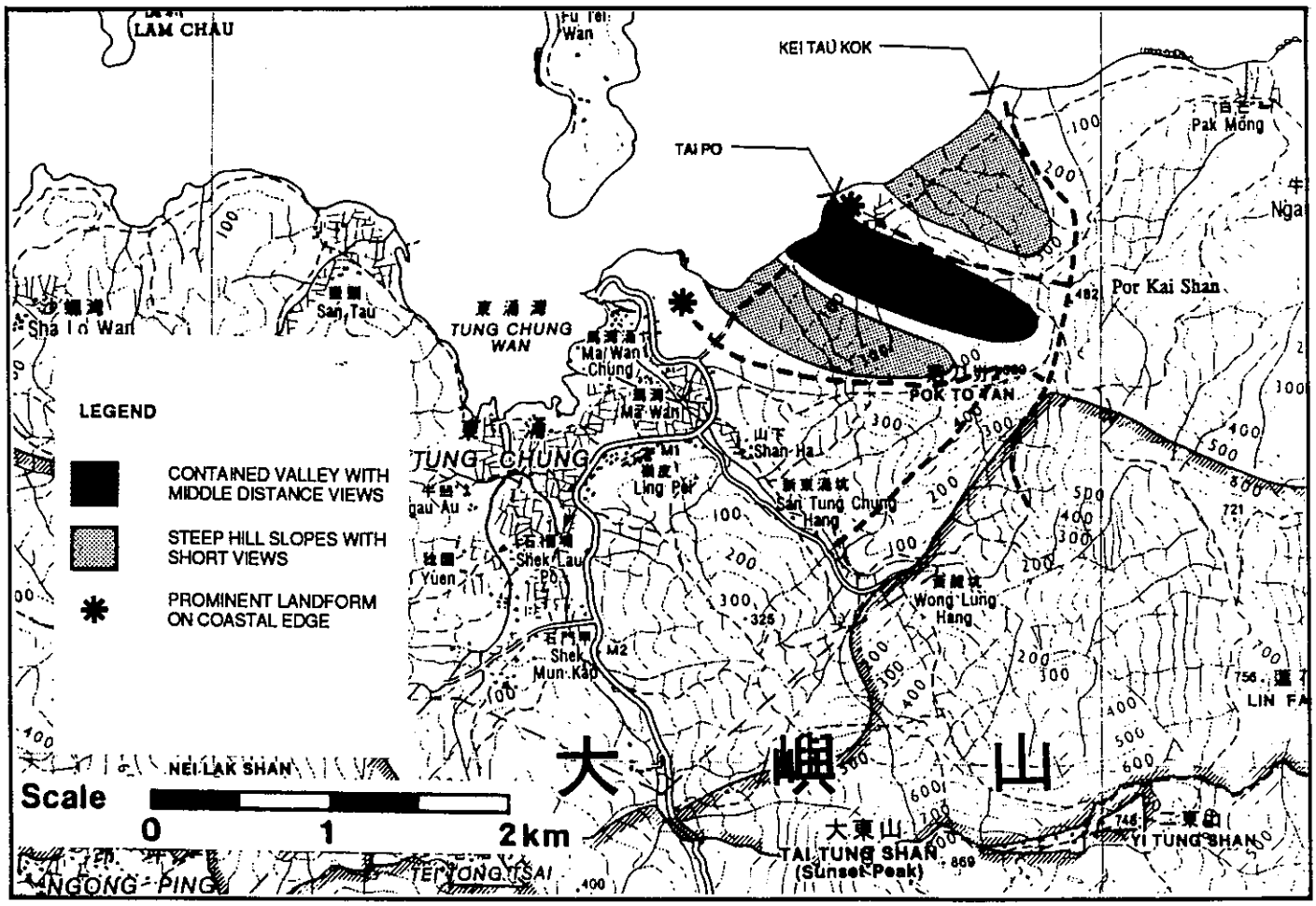


Figure 7.3
Visual Sensitivity

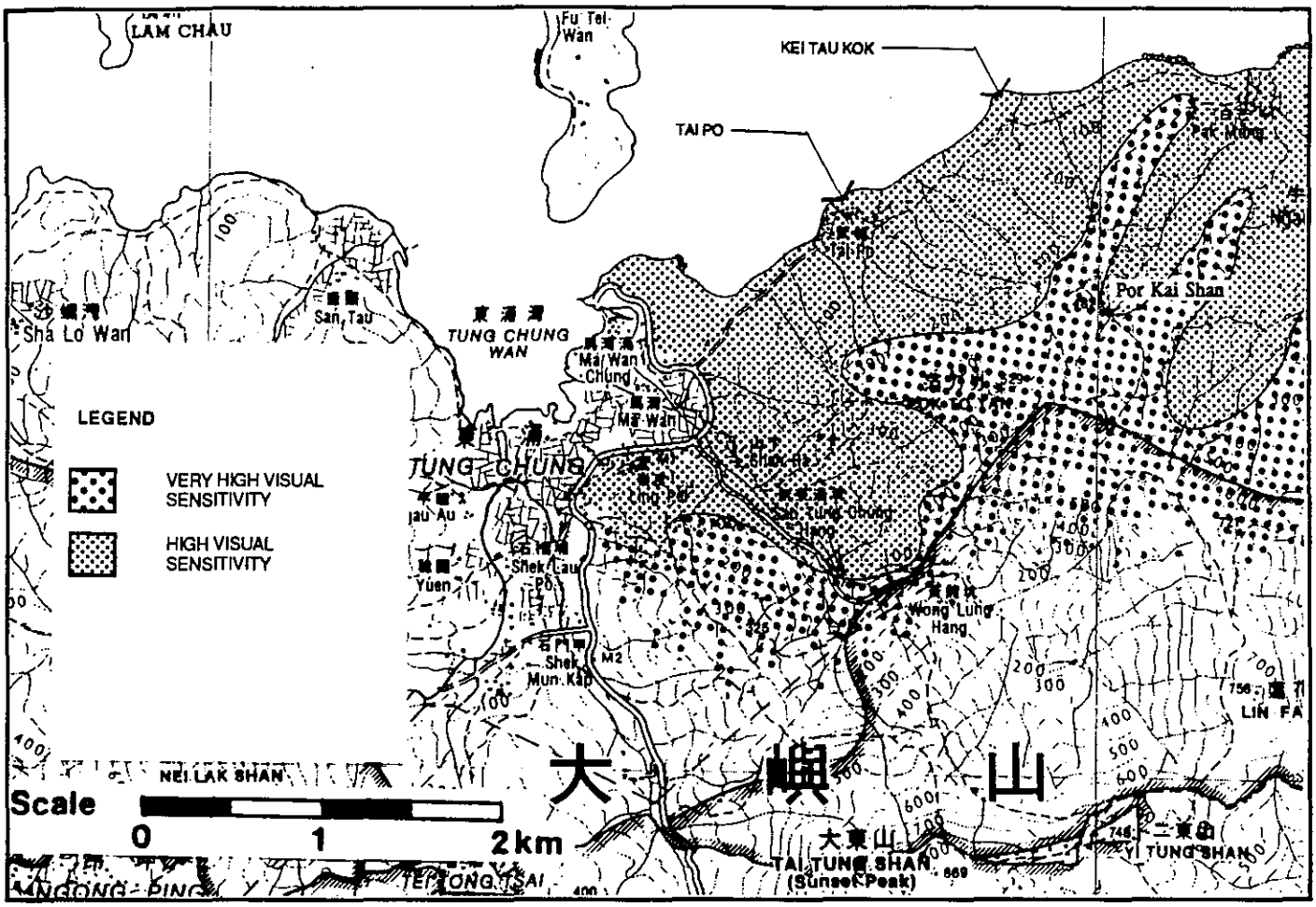


Figure 7.4
Project Visual Characteristics

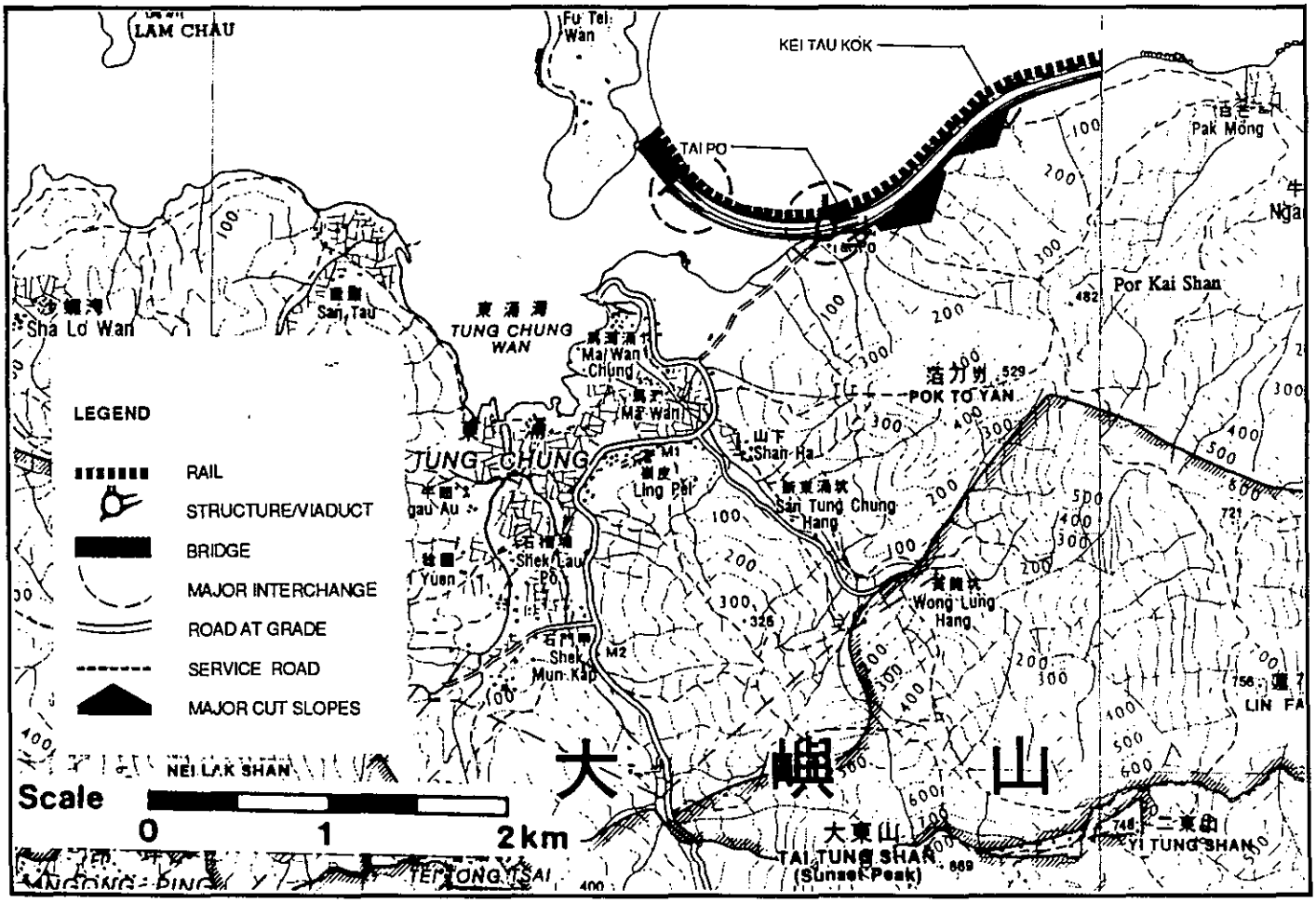


Figure 7.5
Physical Extent of Impact

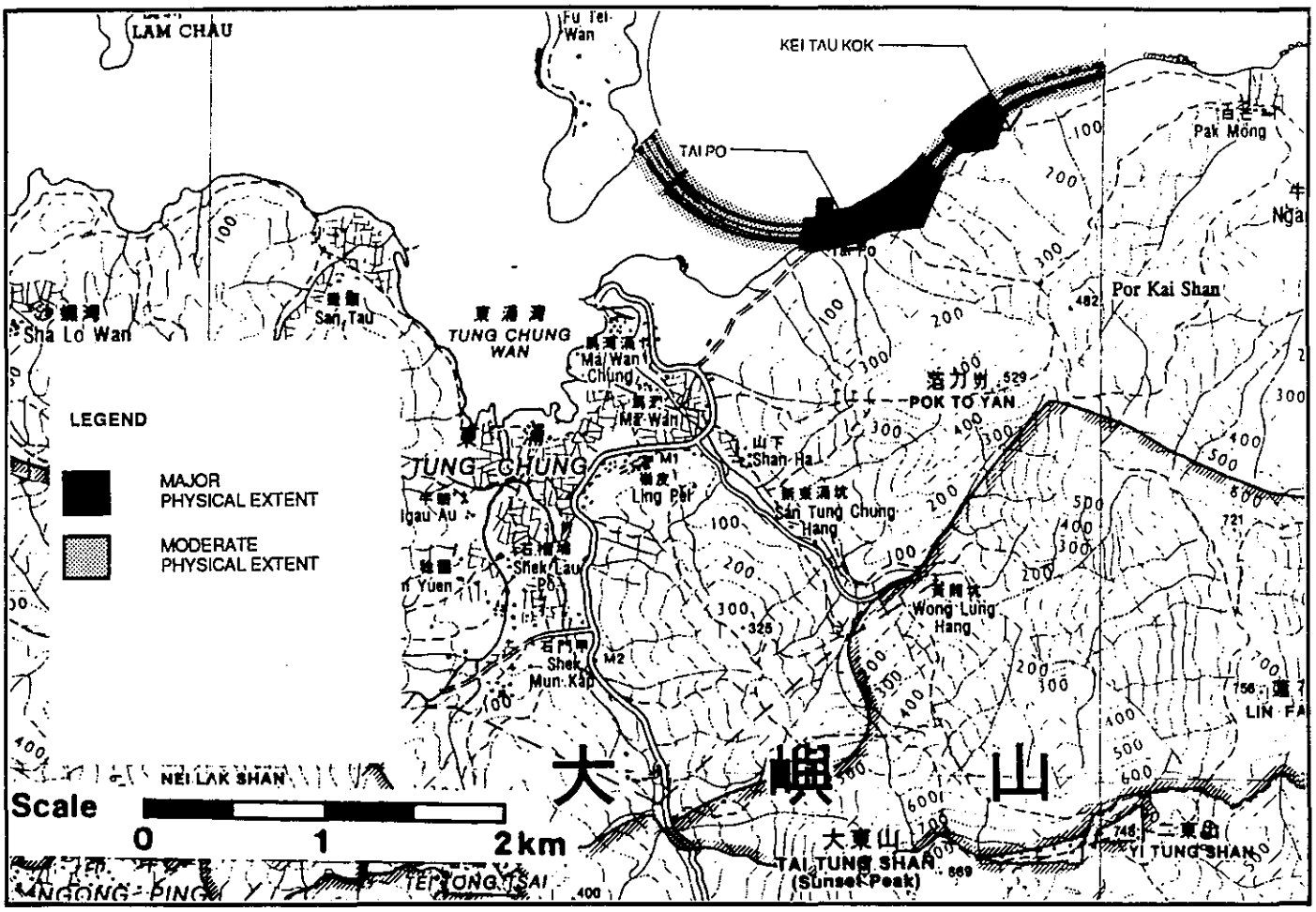
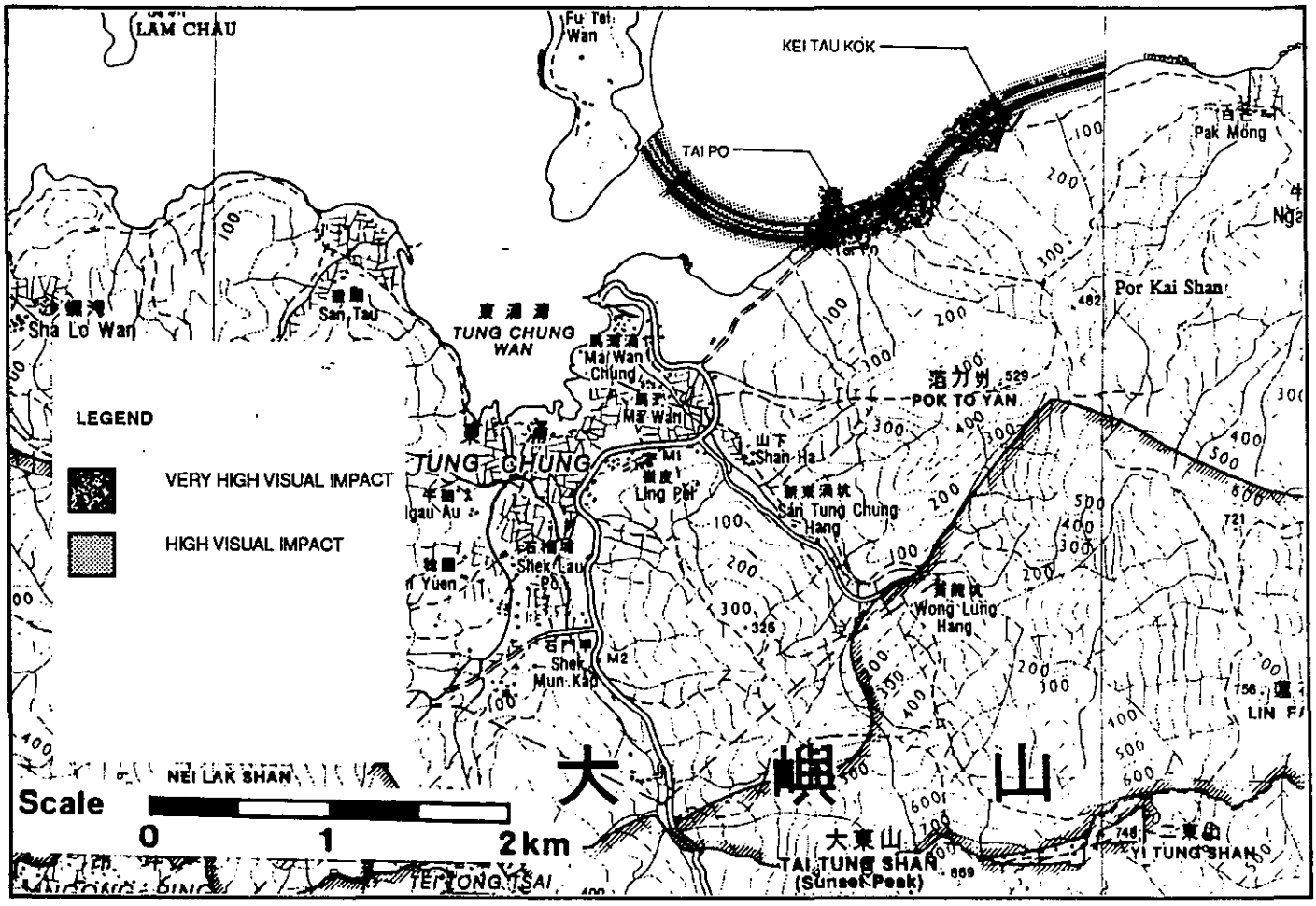


Figure 7.6
Visual Impact



8. ECOLOGY

8. ECOLOGY

8.1 Existing Environment

The direct ecological impact from construction of the Tung Chung section of the NLE, an area of limited conservational value, will be limited and confined to the coastal zone and lower slopes of the hills behind.

Previous human impact has been concentrated within this zone so few habitats or species of special conservational significance survive. Further upslope valuable primary woodland may suffer indirectly from construction activities and it is therefore also necessary to consider the ecological habitats upslope of the proposed route.

8.1.1 Marine Ecology

Boulder Shores

Boulder shores, are the principle habitat type within the Study area. These are somewhat limited in diversity and abundance of species.

On shore the increased wave action in the slightly more exposed areas and the generally harder substrate results in the proliferation of animals with holdfast mechanisms such as rock oysters *(Saccostria sp.)* and mussels (*Perna viridis*).

On the underside of cobbles and within sediments trapped beneath the stones, a broad range of annelid worms and gastropods occur. A large number of predatory muricid snails which feed on the rock oyster population are represented among the latter. The crustaceans are represented by species of *Grapsid* and *Xanthid* crabs.

8.1.2 Terrestrial Ecology

Grassland Shrubland and Woodland

As shown in Figure 8.1 the landward side of this section of the proposed NLE route is occupied by coastal scrub backed by continuously fire maintained grassland and shrubland extending to the summits of the highest hills. Within the ravines and valley bottons are small areas of planted woodland, mostly consisting of exotic species. These habitats are typical of other non-urban coastlines in Hong Kong with a fairly poor, stereotyped biota, but their extent makes them of some value for the probably mobile and ubiquitous wildlife they support.

At higher altitudes patches of woodland occupy many of the higher valleys particularly above 250m to 300m. The position, structure and flora of some of these woodlands suggest that they may be primary. Such upland woodlands are the most valuable habitats on Lantau.

Streams

Most of the streams in the area run unpolluted and unregulated from the upland headwaters to the sea. However no ecologically important streams are located within the Study area.

8.2 Assessment Methodology And Criteria

The most reliable method of assessing the conservational value of an area, is to focus on habitats. Habitat types are ranked on the basis of their rarity in the local and regional context, on their relative contribution to local biological diversity, and subsequently on the possibility of recreating an habitat elsewhere.

Hillside habitats can be ranked in terms of the height, density and area of tree and shrub cover since these factors correlate with their rarity, botanical diversity and value as animal habitat. In comparison the extensive fire maintained grasslands, with or without scattered shrubs are poor, supporting relatively few plant or animal species. Stream communities can be used as indicators of environmental quality as they are able to integrate changes in land use within their drainage basins. Within the boulder shore environment many species are less specialised and may therefore be able to adapt readily to a modified coastline. However, this remains unclear because of the limited number of detailed studies that have been carried out in the area.

8.3 Construction Phase Impact Assessment

In assessing the potential impact of the NLE construction, it is necessary to distinguish between direct on-site impacts where it is assumed that all habitats will be destroyed, and the much larger surrounding area which can be irreversibly damaged by indirect impacts.

8.3.1 Sensitive Receivers

The position of the Tung Chung section of the NLE in the sensitive coastal zone and its linear extent will inevitably result in major adverse ecological impacts due to construction. The following sensitive receivers have been identified:

(a) coastal habitat which will be reclaimed;
(b) streams crossing the NLE and in the vicinity;
(c) lower slope and hillside vegetation, and native upland woodland, vulnerable to the risk of fire.

8.3.2 Direct Impacts

The construction of the NLE, along the Tung Chung section, will result in permanent modification of the coastline with subsequent loss of the boulder shores and coastal scrubland. However, the distribution of boulder shore habitat and associated biota throughout the territory do not make it particularly unusual, and consequently of limited conservation value but, their near-total loss will still have an adverse impact on coastal wildlife in the area.

8.3.3 Indirect Impacts

Immediately adjacent to the construction sites, maximum potential damage may be from the uncontrolled dumping and movement of vehicles. Further afield the most serious threats are from fire, hunting, and stream pollution.

Construction of the NLE will bisect the lower reaches of almost all the streams in the area and if these are dammed or blocked, migrations of fish and crustaceans will be disrupted. Channelization of streams will reduce habitat heterogeneity and hence species diversity. Bisected streams will also receive increased sediment load and possibly other pollutants with a consequent detrimental effect on their biota.

The closed woodland in the uplands above the presently fire maintained grasslands and shrubland will only burn in exceptionally dry weather. The continuous presence of construction workers along the coast for several years will increase the risk of destructive fires unless adequate precautions are taken.

Hunting presents a special problem because of the low density of the local mammal fauna and the tendency of individual animals to use regular routes to feeding areas. One skilled hunter among the construction workers could devastate the mammal fauna.

Off-site discharges and accidental spillages into local littoral waters may occur during construction but significant adverse impacts are unlikely considering the existing conditions of the waters and assuming that action is taken to clean up any spills.

8.4 Mitigation Measures

Off-Site Construction Activities

Given the inevitable adverse impact of the NLE construction, mitigation is important. The proposed measures are intended to minimise adverse impacts of construction activity off-site, and to compensate, to a limited extent, for the loss of habitats on-site. Two general measures are available for the mitigation of off-site impacts, as follows:

(a) fencing of work areas before construction or excavation starts to allow strict control of dumping and the off-site movement of vehicles and workers. The position of the fence should be defined in the initial construction contracts.

(b) No living accommodation for construction workers should be permitted along the expressway route. Worker's accommodation should be concentrated at the construction support facilities site.

Streams

Alteration or damming of the course of streams must be avoided. Until permanent drainage is installed the contractor should introduce temporary drainage to convey the streams across the reclamation site.

Grassland and Scrubland

Construction of the NLE will directly destroy little native woodland and shrubland but will remove large areas of coastal scrubland and grassland. Compensatory planting of native tree and shrub species is a practical mitigation measure in this case. Moreover, it is recommended that all planting undertaken for landscaping or slope stabilisation along the NLE is seen as an opportunity for ecological mitigation and is done with appropriate native species. Plantations of *Acacia, Casuarina, Eucalyptus* and exotic pines may have desirable engineering properties but are virtually useless as wildlife habitat. Planting material of indigenous species is not widely available in Hong Kong at present, so it is essential that a native plant nursery is included in the initial plans and established as soon as possible.

Woodland Fires

Potentially most serious is the up-slope impact of fires. Primary upland woodlands cannot be adequately replaced by any amount of compensatory planting and should receive absolute protection. Fires can only be prevented by careful planning and continued vigilance on the part of the contractors involved. The following are therefore recommend:

(a) no burning of construction wastes should be permitted except in designated areas surrounded by adequate fire breaks;

(b) hillslopes should be protected by a firebreak of adequate width up-slope of all construction activity;

(c) all construction workers and their supervisors should be educated about the dangers of hillfires; and

(d) the contractors should be required to supply adequate manpower and equipment to fight any fires that do occur.

8.5 Compliance Monitoring

The monitoring and enforcement of compliance with legal requirements has been the major failure in the history of environmental protection in Hong Kong. To avoid a repeat of this experience in North Lantau, it is recommended that an individual with appropriate training in ecology and environmental management is appointed by the Government to oversee the environmental aspects of all developments in the area during the construction phase. The role of this individual would not only be to ensure compliance with mitigation measures included in construction contracts but also to liaise with site supervisors to minimise unforseen adverse impacts that may arise. This would have to be a new, full-time post with adequate support in terms of manpower and transport.

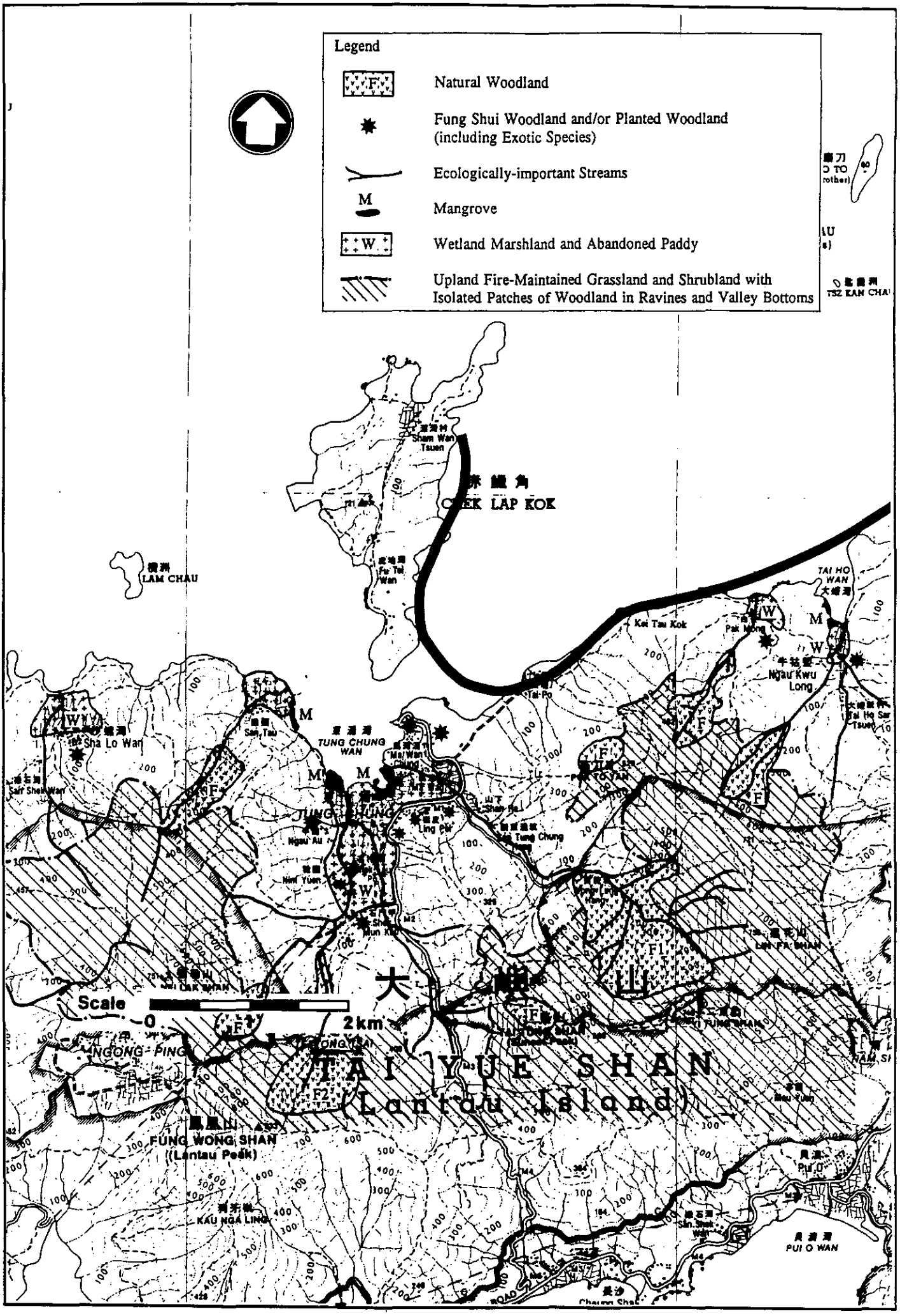
8.6 Post Project Audit

The operation of the NLE is unlikely to have further significant ecological impacts. However, a post-project audit would be useful to check the long-term effectiveness of mitigation measures, in particular to ensure the success of the planting of species for landscaping and slope stabilization.

8.7 Conclusions

Major adverse ecological impacts on the ecology of the Tung Chung section as a result of the expressway construction are unavoidable. Marine impacts will be confined to the boulder shore and terrestrial impacts will be largely confined to the back-of-beach area and lower slopes. These habitats are not considered to be of high ecological and conservation importance as the ecology of some of the impacted area has already been significantly modified by man. In spite of this the damage must be kept to a minimum by preventing the spread of impacts beyond the area directly affected by construction as streams and valuable upland woodland risk potential impact. This will require the effective implementation of the suggested mitigatory measures, adequate monitoring and enforcement of further remedial action where necessary. In addition, Government should urgently consider the compensatory, permanent protection of similar habitats elsewhere in Hong Kong.

Figure 8.1
Terrestrial Ecology



APPENDIX A

STUDY BRIEF FOR THE ENVIRONMENTAL ASSESSMENT

APPENDIX A · STUDY BRIEF

Environmental Assessment Study
Scope of Work

1. Purpose of the Environmental Assessment Study

1.1 The purpose of the assessment is to provide information on the nature and extent of potential environmental impacts associated with the proposed North Lantau Expressway (including the service road) and Airport Railway projects. This information will contribute to decisions on :

(i) the conditions for the detailed design, construction and operation of the proposed projects;

(ii) the acceptability of any adverse environmental consequences that are likely to arise from the construction and operation of the new projects and related facilities; and to

(iii) identify constraints on planning of development.

2. Objective of the Environmental Assessment Study

2.1 The objectives of the assessment are as follows :

(i) to describe the proposed installations and related facilities and the requirements for their development;

(ii) to identify and describe the elements of the community and environment likely to be affected by the proposed development;

(iii) to minimize pollution and nuisance arising from the development and its operation and environmental disturbance during construction and operation of the projects;

(iv) to identify and evaluate the net environmental impacts and cumulative effects with other transport modes expected to arise during the construction and operation phases of the development in relation to the community and neighbouring land uses;

(v) to identify and specify methods, measures and standards to be included in the detailed design, which may be necessary to mitigate these impacts and reduce them to acceptable levels; and

/....

(vi) to design and specify the environmental monitoring and audit requirements necessary to ensure the effectiveness of the environmental protection measures adopted.

3. Requirements of the Environmental Assessment Study

3.1 The assessment shall consist of the following :

(i) an Environmental Assessment Report and associated Working Papers which satisfies the requirements of the objectives in Section 2.1;

(ii) an Executive Summary Report in English and Chinese for the total study highlighting the major aspects of the net environmental impacts and the cumulative effects, the issues of concern to the community, recommendations for implementation of the projects and the basis for these and the implications of those recommendations. It is intended that the information contained therein should assist the Government in undertaking any requirement for public consultation.

4. Technical Requirements of the Environmental Assessment Study

The Environmental Assessment Study with respect to representative sensitive receivers agreed with DEP shall include, but shall not necessarily be limited to, the following :

4.1 Construction Phase Assessment

4.1.1 Noise Impact Study

Task 1 : Identification of Sensitive Receivers

From a consideration of existing and future land-use in the Study area prepare schedules and plans identifying sensitive receivers. Noise sensitive receivers should include those described in the Environment Chapter of the Hong Kong Planning Standards & Guidelines. The future land-uses should refer to those that will be occupied by the time construction works commence for each phase of the works.

Task 2 : Analysis of Construction Activities

From a knowledge of the likely type, sequence and duration of construction activities required for project implementation, identify those activities likely to have an impact on noise sensitive receivers.

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Task 3 : Assessment of Construction Noise Levels

Identify interactions between sensitive receivers and, construction activities to determine the extent of potentially unacceptable construction noise impacts. The assessment should follow the requirements contained in all Ordinances & their Regulations for the time being in force in Hong Kong governing the control of construction noise and follow guidelines advised by DEP.

Task 4 : Proposals for Noise Control Measures

Formulate appropriate noise control measures for inclusion in contract documentation.

4.1.2 Air Pollution Study

Task 1 : Identification of Sensitive Receivers

From a consideration of existing and future land use in the study area, prepare plans identifying sensitive receivers in the vicinity of the proposed project (including off-site works areas). The future land-uses should refer to those that will be occupied by the time construction works commence for each phase of the works.

Task 2 : Analysis of Construction Activities

Identify those construction activities likely to cause potential dust (or other air pollutant) problems to sensitive receivers.

Task 3 : Dust (or other air pollutant) impact assessment

Assess the dust (or other air pollutant) level at the sensitive receivers due to the proposed project (including constructional traffic arising) using a dispersion model to be agreed by DEP.

Task 4 : Proposals for Dust (or other air pollutant) Control Measures

Recommend appropriate dust (or other air pollutant) control measures for inclusion in contract documentation.

4.1.3 Water Quality Impact Study

Task 1 : Identification of Sensitive Receivers

From the proposed route alignments identify the watercourses/water bodies which may be affected.

/....

Task 2 : Analysis of Construction Activities

From a knowledge of the likely type, sequences and duration of construction activities required for project implementation, identify those likely to have an impact on the affected watercourses/water bodies.

Task 3 : Assessment of Water Pollution Problems

Identify interactions between sensitive receivers and construction activities to determine the adverse effects (if any) of construction on water quality of watercourses/water bodies. This should include the impact of any proposed dredging and reclamation activities.

Task 4 : Proposals for Water Pollution Control Measures

Recommend appropriate control measures for inclusion in contract documentation. Where appropriate, make suggestions for practical mitigation measures and monitoring for compliance.

4.1.4 Impacts on Sites of Archaeological and Historical Significance

Task 1 : Assessment of Impacts

Assess the impact of the proposed project (including all on- and off-site works areas) on known sites of archaeological and historical significance. These sites should also include any with Fung Shui attributes/ characteristics.

Task 2 : Proposals for Mitigation Measures

Recommend appropriate mitigation measures such as site survey, rescue excavations, monument conservation programmes to minimise the adverse effects identified in Task 1. Special attention should be paid to the scheduling of any rescue excavations/conservation programmes on affected sites.

4.1.5 Ecological Impact Study

Task 1 : Assessment of Impacts

Identify flora, fauna and ecological habitats to be affected. Special attention should be paid to the rare & protected species.

Task 2 : Proposals for Mitigation Measures

Recommend appropriate mitigation measures for resiting and relocation.

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4.2 Operating Phase Assessment

4.2.1 Traffic Noise Impact Study

Task 1 : Identification of Sensitive Receivers

Identify noise sensitive receivers, as described in the Environment Chapter of the Hong Kong Planning Standards & Guidelines, for both existing and planned uses.

Task 2 : Calculation of Future Noise

Calculate future railway noise using the methods described in the U.K. Noise Advisory Council's publication "A Guide to the Measurement and Prediction of the Equivalents Continuous Sound Level (Leq)" published by H.M. Stationery Office. Calculations are to be based on railway projections for the design year which is defined as the year when the Airport Railway has been in operation for a period of 10 years.

Future traffic noise is to be calculated at the nearest facade of any existing building classified as a noise sensitive receiver. For planned developments, representative points are to be selected as shown on draft Layout Plans if available. Noise contours in L_{10} (1 hr) should be presented on a plan of suitable scale showing the noise sensitive receivers as identified in Task 1 above.

Future railway noise is to be calculated at the nearest facade of any existing building classified as a noise sensitive receiver. For planned developments, representative points are to be selected as shown on draft Layout Plans if available. Noise contours in Leq (24 hr) and $L_{A\ max}$ should be presented on a plan of suitable scale showing the noise sensitive receivers as identified in Task 1 above. Quantitative assessment at the identified Noise Sensitive Receivers (NSRs) for each alignment on existing and planned NSRs shall be quantified by estimating the total number of dwellings and/or classrooms that will be exposed to levels above the HKPSG criteria.

Task 3 : Presentation of Existing Noise Levels

Measure existing noise levels in Leq (24 hr) and L_{90} (1 hr) at the identified NSR and present them on a plan of suitable scale. This information may be required in the context of Task 5.

Task 4 : Assessment of Need for Noise Amelioration Measures

Assess the need for noise amelioration measures in relation to the extent to which an existing or planned building classified as a noise sensitive receiver would be subjected to a predicted traffic noise level in the design year which is 1 dB(A) or more in excess of the maxima recommended in the Hong Kong Planning Standards &

/....

Guidelines (HKPSG). The appropriateness of this criteria is dependant on the results of Task 3 above and will be advised by DEP.

Task 5 : Proposals for Noise Amelioration Measures

Propose noise amelioration measures for each situation where the predicted noise level exceeds the HKPSG maxima, or appropriate criteria as advised by DEP. In the case where an existing building is already subject to noise levels equal to, or in excess of, the recommended maximum, measures to avoid (as far as possible) deterioration of the situation are to be put forward. Proposals for the implementation of noise amelioration measures are to be framed with regard to their cost effectiveness in terms of the following parameters :

(a) Estimated number of persons affected

(b) Effective reduction in predicted noise level

(c) Estimated construction costs

4.2.2 Air Pollution Modelling Study

Task 1 : Identification of Sensitive Receivers

From a consideration of existing and future land-use in the study area, prepare plans identifying sensitive receivers within 50 m of the proposed project.

Task 2 : Assess Air Pollution Impact

Assess the air pollutant levels at the sensitive receptors due to the proposed projects using a dispersion model to be agreed with the DEP.

The report should contain sample calculations and input parameters used in the modelling.

Task 3 : Assessment of Air Pollution Impact from Tunnel Portals and Approach Roads

Assess the air pollution impacts within 300m of any tunnel portals and 200m on either side of the tunnel approach roads using a model. The consultant shall agree the assessment methodology with DEP prior to commencing this task.

Task 4 : Proposals for Amelioration Measures

Propose cost effective amelioration measures in situations where the predicted air pollutant levels exceed the Hong Kong Air Quality Objectives.

/....

4.2.3 Water Quality Impact Study

Task 1 : Assessment of Water Pollution Impact

Assess the adverse effects (if any) of traffic & the route alignments on water quality of the watercourses/water bodies traversed by the routes. This should include surface runoff and spillages due to railway accidents. The route alignments need to be examined for water quality impacts on water bodies.

Task 2 : Proposals for Amelioration Measures

Recommend appropriate cost effective amelioration measures to minimise any adverse affects identified in Task 1.

4.2.4 Visual and Land Use Impacts

Task 1 : Assessment of Visual Impacts

Assess the visual impacts, if any, caused by the proposed project.

Task 2 : Assessment of the Implications on Land Use

Assess the implications on land use in the vicinity of the project (including works areas), both long and short terms implications have to be assessed.

Task 3 : Proposals for Mitigation Measures

Recommend appropriate cost effective mitigation measures such as detailed landscaping plans to minimise any adverse effects identified in Task 1 and 2 above.

Special attention should be paid to minimise the restraints on the development potential of the area in the vicinity of the project.

4.3 Monitoring and Post-Project Audit Requirement

4.3.1 Environmental Monitoring

Define environmental monitoring requirements including any necessary programmes for baseline, impact and compliance monitoring.

4.3.2 Post-Project Audit

Formulate environmental audit requirements including any necessary compliance and post-project audit programmes to review the environmental monitoring data. Assess compliance with regulatory requirements, policies and standards and identify any remedial works required to redress unacceptable consequential or unanticipated environmental impacts.

APPENDIX B

NOISE

APPENDIX B1

Brief Description Of Major Construction Activities

CONSTRUCTION ACTIVITY		TYPE	LOCATION
ID	DESCRIPTION		
1	Earthworks (Reclamation/Dredging)	M	Along coastline from Tai Po to Kei Tau Kok
2	Earthworks (Cutting/Excavation)	M	Tai Po to Kei Tau Kok
3	Concrete	S	Batching plant to be located in vicinity of Tai Po elevated interchange
4	Bridges and Viaducts	M	Tung Chung to Chek Lap Kok
5	Bridges and Viaducts	M	Tung Chung to Chek Lap Kok
6	Bridges and Viaducts	S	Tai Po Interchange
7	Paving	M	Along Expressway and service road
8	Finishes	M	Along Expressway and service road
9	Utility Installation	M	Along Expressway and service road
10	Railway Construction	M	Railway line
11	LAL Station under NLE	S	Tung Chung planning areas 6 and 14
12	LAL Station approaches	M	East of LAL station box, planning areas 15, 16, 18, and 19

Note S : Stationary Activity
M : Mobile Activity

Types, Numbers And Sound Power Levels Of Items Of PME For Major Construction Activities

ACTIVITY ID	EQUIPMENT	QUANTITY	SWL
1.1	Barges	2	104
	Grab dredger	1	112
	Tug boat	1	110
	Launch	1	110
1.2	Bulldozers	2	115
	Dump trucks	7	117
1.3	Bulldozer	1	115
	Suction dredger	1	112
	Sand pumps on dredger	4	103
2	Trucks	5	117
	Bulldozers	2	115
	Compactors	2	105
	Compressor	1	100
	Drills	2	128
3	Batch plant	1	108
4	Piling plant	8	115
	Excavators	2	112
	Trucks	4	117
	Mobile cranes	4	112
	Concrete pumps	2	109
	Vibrators	6	112
5	Piling plant	8	115
	Excavators	2	112
	Trucks	4	117
	Mobile cranes	4	112
	Concrete pumps	2	109
	Vibrators	6	112
6	Piling plant	8	115
	Excavators	2	112
	Trucks	4	117
	Mobile cranes	4	112
	Concrete pumps	2	109
	Vibrators	6	112
7	Asphalt mix plant	1	103
	Trucks	12	117
	Pavers	2	109
	Rollers	4	108

ACTIVITY ID	EQUIPMENT	QUANTITY	SWL
8	Small cranes	2	95
	Trucks	2	117
	Light truck (vans)	6	112
9	Trucks	8	117
	Excavators	4	112
	Compactors	4	105
10	Track layer	1	112
	Cranes	2	112
	Work trains	2	100
11	Piling plant	2	105
	Generator	2	100
	Dump truck	2	117
	Poker vibrator	4	113
	Concrete lorry mixer	2	109
	Generator	2	100
12.1	Sheet piling rig	1	115
	Excavator	1	112
	Dump truck	2	117
12.2	Poker vibrator	4	113
	Concrete lorry mixer	2	109
	Generator	2	100
	Batching Plant	1	108

APPENDIX B3

Noise Neighbourhoods For Construction Noise Assessment

NOISE NEIGHBOURHOOD	VILLAGE
1	Tai Po, Buddhist Youth Camp
2	Ma Wan Chung, Ma Wan
3	Shan Ha
4	Fui Yiu Ha, Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai, Lung Tseng Tau
5	Sha Tsui Tau, Outdoor Recreation Camp
6	Shek Lau Po
7	Shek Mun Kap, San Keng, Shek Pik Au
8	Mok Ka, Nim Yuen, Tung Hing, Ngau Au
9	Kan Liu, San Tau, Tin Sam

APPENDIX B4

Predicted Noise Levels For Single Activities Over The 24 Hour Period

Activity ID	Noise Neighbourhood								
	N1	N2	N3	N4	N5	N6	N7	N8	N9
1.1	66	38	38	35	35	33	31	33	42
1.2	76	48	48	45	45	43	41	43	52
1.3	68	39	39	37	37	34	33	34	44
2	88	55	55	52	52	49	48	49	58
3	57	31	31	28	28	25	24	25	34
4	64	54	49	49	60	46	44	56	58
5	64	53	49	49	60	46	44	56	58
6	78	51	51	48	48	45	44	45	55
7	83	54	51	50	60	46	44	56	58
8	78	49	46	44	55	41	39	51	53
9	82	53	50	48	59	45	43	55	57
10	79	44	42	40	50	37	35	46	48
11	63	49	46	45	45	41	40	41	51
12.1	67	45	43	41	41	38	36	38	48
12.2	66	45	42	41	41	38	36	38	48

Note: The shaded boxes show those activities which would exceed the ANLs during the recommended period one or period two.

APPENDIX C

AIR QUALITY

APPENDIX C1

Coordinates of Air Sensitive Receivers

		Easting	Northing	Level (mPD)
1.	Tai Po	812800	816890	15
2.	Tai Po Buddhist Youth Hostel	812540	816560	25
3.	Ma Wan Chung	811430	816315	5
4.	Ma Wan	811580	815950	7
5.	Shan Ha	812140	815550	25
6.	San Tung Chung Hang	812520	815030	40
7.	Wong Lung Hang	813030	814890	74
8.	Fui Yiu Ha (School)	811820	815560	20
9.	Ling Pei (School)	811460	815440	20
10.	Lung Tseng Tau	811240	815300	15
11.	Shek Lau Po	810890	815030	15
12.	Shek Mun Kap	811020	814520	25
13.	Tung Hing	810590	815300	15
14.	Sha Tsui Tau	811100	815800	5
15.	Outdoor Recreation Camp	810840	815670	5
16.	Mok Ka	810730	814650	22
17.	Shek Pik Au	810750	814200	70
18.	ASR (West of Youth Camp)	810550	815740	5
19.	San Tau	809960	816560	15
20.	Pak Mong	815080	817400	20
21.	Ngau Kwu Long	815640	816930	50

Emission Rates of Stationary Sources

1. Blasting

Mass Fraction : 0 - 10 μm = 20%
10 - 30 μm = 80%

Emission Factor for TSP $E_{TSP} = \frac{344\ (A)^{0.8}}{D^{1.8}\ M^{1.9}}$ kg/blast

where A = area blasted m^2
D = hole depth m
M = % moisture content (assumed 1.5%)

Emission Factor for RSP $E_{RSP} = 0.2 \times E_{TSP}$

Location	Area m^2	Depth m	Volume/day m^3	Emission Factor g/s/m^2		
				24-hr Avg		1-hr Avg
				<30μm	<10μm	<30μm
5	280	5	1400	4.10×10^{-4}	8.20×10^{-5}	9.84×10^{-3}
6	280	5	1400	4.10×10^{-4}	8.20×10^{-5}	9.84×10^{-3}
7	280	5	1400	4.10×10^{-4}	8.20×10^{-5}	9.84×10^{-3}
8	280	5	1400	4.10×10^{-4}	8.20×10^{-5}	9.84×10^{-3}
9	280	5	1400	4.10×10^{-4}	8.20×10^{-5}	9.84×10^{-3}

2. Drilling

Mass Fraction : 0 - 10 μm = 10%
10 - 30 μm = 90%

Emission Factors : E_{TSP} = 0.4 g/Mg
E_{RSP} = 0.04 g/Mg

Location	Area m^2	Volume/day m^3	Volume/hr m^3	Emission Factor g/s/m^2		
				24-hr Avg		1-hr Avg
				<30μm	<10μm	<30μm
10	280	1400	117	7.20×10^{-7}	7.20×10^{-8}	1.44×10^{-6}
11	280	1400	117	7.20×10^{-7}	7.20×10^{-8}	1.44×10^{-6}
12	280	1400	117	7.20×10^{-7}	7.20×10^{-8}	1.44×10^{-6}
13	280	1400	117	7.20×10^{-7}	7.20×10^{-8}	1.44×10^{-6}
14	280	1400	117	7.20×10^{-7}	7.20×10^{-8}	1.44×10^{-6}

3. Concrete Batching

Assume the emission factors for uncontrolled and controlled batching are 0.12 and 0.012 kg/m^2 respectively.

Location	Area m^2	Volume/day m^3	Volume/hr m^3	Emission Factor g/s/m^2	
				24-hr Avg $<30\mu m$	1-hr Avg $<30\mu m$
42	300	80	6.7	3.70×10^{-4}	7.40×10^{-4}

4. Rock Crushing

With mitigation, 94% particulates reduced

Emission Factors : $E_{TSP} = 0.14$ kg/Mg
$E_{RSP} = 0.0085$ kg/Mg

Location	Area m^2	Volume/day m^3	Volume/hr m^3	Emission Factor g/s/m^2		
				24-hr Avg		1-hr Avg
				$<30\mu m$	$<10\mu m$	$<30\mu m$
20	50	1400	117	1.13×10^{-1}	6.88×10^{-3}	2.27×10^{-1}

5. Haul Roads

Based on AP42: "Compilation of Air Pollutant Emission Factors"

$$\text{Emission Rate (kg/v-km)} = k(1.7)\left(\frac{s}{12}\right)\left(\frac{S}{48}\right)\left(\frac{W}{2.7}\right)^{0.7}\left(\frac{w}{4}\right)^{0.5}$$

where k = particle size multiplier
s = silt content of road surface material
S = mean vehicle speed km/h
W = mean vehicle weight Mg
w = mean number of wheels

Typical values for these parameters were taken as:

s = 26%
S = 20km/h
W = 25 Mg (loaded), 10 Mg (unloaded)
w = 10
k = 0.36 for particulate < 10 μm
= 0.8 for particulate < 30 μm

Location	Area m^2	Emission Factor $g/s/m^2$		
		24-hr Avg		1-hr Avg
		$<30\mu m$	$<10\mu m$	$<30\mu m$
1	10000	$1.07x10^{-4}$	$4.80x10^{-5}$	$2.13x10^{-4}$
2	5625	$1.35x10^{-4}$	$6.04x10^{-5}$	$2.70x10^{-4}$
21	22500	$4.08x10^{-4}$	$1.85x10^{-4}$	$8.34x10^{-4}$
22	22500	$4.08x10^{-4}$	$1.85x10^{-4}$	$8.34x10^{-4}$
23	22500	$4.08x10^{-4}$	$1.85x10^{-4}$	$8.34x10^{-4}$
24	22500	$4.08x10^{-4}$	$1.85x10^{-4}$	$8.34x10^{-4}$
25	22500	$4.08x10^{-4}$	$1.85x10^{-4}$	$8.34x10^{-4}$
26	10000	$9.18x10^{-4}$	$4.16x10^{-4}$	$1.88x10^{-3}$
27	10000	$9.18x10^{-4}$	$4.16x10^{-4}$	$1.88x10^{-3}$
28	22500	$1.08x10^{-3}$	$4.92x10^{-4}$	$2.22x10^{-3}$
29	22500	$1.08x10^{-3}$	$4.92x10^{-4}$	$2.22x10^{-3}$
30	22500	$1.08x10^{-3}$	$4.92x10^{-4}$	$2.22x10^{-3}$
31	22500	$1.08x10^{-3}$	$4.92x10^{-4}$	$2.22x10^{-3}$
32	22500	$1.08x10^{-3}$	$4.92x10^{-4}$	$2.22x10^{-3}$
33	10000	$2.46x10^{-3}$	$1.11x10^{-3}$	$5.00x10^{-3}$
34	10000	$2.46x10^{-3}$	$1.11x10^{-3}$	$5.00x10^{-3}$
43	22500	$7.24x10^{-5}$	$3.24x10^{-5}$	$1.74x10^{-4}$
44	22500	$7.24x10^{-5}$	$3.24x10^{-5}$	$1.74x10^{-4}$
45	22500	$7.24x10^{-5}$	$3.24x10^{-5}$	$1.74x10^{-4}$
46	22500	$7.24x10^{-5}$	$3.24x10^{-5}$	$1.74x10^{-4}$
47	22500	$7.24x10^{-5}$	$3.24x10^{-5}$	$1.74x10^{-4}$
48	10000	$1.63x10^{-4}$	$7.30x10^{-5}$	$3.91x10^{-4}$
49	10000	$1.63x10^{-4}$	$7.30x10^{-5}$	$3.91x10^{-4}$
50	10000	$1.63x10^{-4}$	$7.30x10^{-5}$	$3.91x10^{-4}$
51	10000	$1.63x10^{-4}$	$7.30x10^{-5}$	$3.91x10^{-4}$
52	10000	$1.63x10^{-4}$	$7.30x10^{-5}$	$3.91x10^{-4}$
53	16900	$9.64x10^{-5}$	$4.32x10^{-5}$	$2.31x10^{-4}$
54	16900	$9.64x10^{-5}$	$4.32x10^{-5}$	$2.31x10^{-4}$
55	16900	$9.64x10^{-5}$	$4.32x10^{-5}$	$2.31x10^{-4}$
56	16900	$9.64x10^{-5}$	$4.32x10^{-5}$	$2.31x10^{-4}$
57	16900	$9.64x10^{-5}$	$4.32x10^{-5}$	$2.31x10^{-4}$

6. Loading/Unloading

Based on AP42: "Compilation of Air Pollutant Emission Factors"

$$\text{Emission Rate (kg/Mg)} = \frac{k\,(0.0009)\left(\frac{S}{5}\right)\left(\frac{U}{2.2}\right)\left(\frac{H}{1.5}\right)}{\left(\frac{M}{2}\right)^{2}\left(\frac{Y}{4.6}\right)^{0.33}}$$

where k = particle size multiplier
S = material silt content in %
U= mean mind speed m/s
H= drop height m
M= material moisture content in %
Y= dumping device capacity m^3

Typical values for these parameters were taken as:

S = 2%/26% (depends on soil type)
U= 2m/s
H= 1m for loading
3m for unloading
M= 1.5%/16% (depends on soil type)
Y= $8m^3$ for unloading
= $1.5m^3$ for loading
k= 0.73 for particulate < 30 μm
0.36 for particulate < 10 μm

Location	Area m^2	Volume/day m^3	Volume/hr m^3	Emission Factor g/s/m^2		
				24-hr Avg		1-hr Avg
				<30μm	<10μm	<30μm
3	10000	566	47	1.32×10^{-7}	6.53×10^{-8}	2.65×10^{-7}
4	5625	566	47	2.35×10^{-7}	1.16×10^{-7}	4.71×10^{-7}
15	22500	1400	117	7.40×10^{-7}	3.64×10^{-7}	1.48×10^{-6}
16	22500	1400	117	7.40×10^{-7}	3.64×10^{-7}	1.48×10^{-6}
17	22500	1400	117	7.40×10^{-7}	3.64×10^{-7}	1.48×10^{-6}
18	22500	1400	117	7.40×10^{-7}	3.64×10^{-7}	1.48×10^{-6}
19	22500	1400	117	7.40×10^{-7}	3.64×10^{-7}	1.48×10^{-6}
35	22500	860	72	5.16×10^{-8}	2.56×10^{-8}	1.03×10^{-7}
36	22500	860	72	5.16×10^{-8}	2.56×10^{-8}	1.03×10^{-7}
37	22500	860	72	5.16×10^{-8}	2.56×10^{-8}	1.03×10^{-7}
38	22500	860	72	5.16×10^{-8}	2.56×10^{-8}	1.03×10^{-7}
39	22500	860	72	5.16×10^{-8}	2.56×10^{-8}	1.03×10^{-7}
40	10000	1131	94	2.65×10^{-7}	1.31×10^{-7}	5.30×10^{-7}
41	10000	1131	94	2.65×10^{-7}	1.31×10^{-7}	5.30×10^{-7}

7. Asphalt Mixing

Assuming 0.5% sulphur in diesel fuel all oxidized to SO_2 (maximum % as defined by "Shell Products", 0.25% average). Particulate emission control by cyclone and wet scrubber.

Emission Factor:
particulates 137 g/Mg)
sulphur dioxide 73 g/Mg) of asphalt
nitrogen oxides 18 g/Mg) produced
carbon monoxide 19 g/Mg)

Mass Fraction:
0 - 10 μm = 90%
10 - 30 μm = 10%

Location	Production rate		Emission Factor g/s								
			24 - hr Avg				8-hr Avg	1 - hr Avg			
	t/day	t/hr	<30μm	<10μm	SO_2	NO_2	CO	<30μm	SO_2	NO_2	CO
58	1200	100	1.903	1.713	1.014	0.250	0.528	3.806	2.028	0.500	0.528

APPENDIX C3 (i)

Coordinates of Construction Activities

Activity	Easting	Northing	Level (mPD)	Width (m)	Emission Height (m)
A. Reclamation					
1 Hauling	813420	817340	5	100	0
2 Hauling	813280	817220	5	75	0
3 Unloading	813420	817340	5	100	1.5
4 Unloading	813280	817220	5	75	1.5
B. Rock Excavation					
5 Blasting	813540	817400	30	150	0
6 Blasting	813360	817200	20	150	0
7 Blasting	813230	817070	10	150	0
8 Blasting	813100	817000	10	150	0
9 Blasting	812970	816850	10	150	0
10 Drilling	813540	817400	30	150	0
11 Drilling	813360	817200	20	150	0
12 Drilling	813230	817070	10	150	0
13 Drilling	813100	817000	10	150	0
14 Drilling	812970	816850	10	150	0
15 Loading	813540	817400	30	150	2
16 Loading	813360	817200	20	150	2
17 Loading	813230	817070	10	150	2
18 Loading	813100	817000	10	150	2
19 Loading	812970	816850	10	150	2
20 Rock Crushing	812630	816750	5	7	3
C. Hauling to Reclamation Area					
21 Hauling	813540	817400	30	150	0
22 Hauling	813360	817200	20	150	0
23 Hauling	813230	817070	10	150	0
24 Hauling	813100	817000	10	150	0
25 Hauling	812970	816850	10	150	0
26 Hauling	812850	816780	5	100	0
27 Hauling	812730	816710	5	100	0

Activity	Easting	Northing	Level (mPD)	Width (m)	Emission Height (m)
D. Hauling to Tai Po Interchange					
28 Hauling	813540	817400	30	150	0
29 Hauling	813360	817200	20	150	0
30 Hauling	813230	817070	10	150	0
31 Hauling	813100	817000	10	150	0
32 Hauling	812970	816850	10	150	0
33 Hauling	812850	816780	5	100	0
34 Hauling	812730	816710	5	100	0
E. Soil Excavation					
35 Loading	813540	817400	30	150	2
36 Loading	813360	817200	20	150	2
37 Loading	813230	817070	10	150	2
38 Loading	813100	817000	10	150	2
39 Loading	812970	816850	10	150	2
F. Unloading at Tai Po Interchange					
40 Unloading	812620	816690	5	100	2
41 Unloading	812520	816680	5	100	2
G. Concrete Batching Plant					
42 Concreting	812630	816750	5	17	3
H. Hauling along Expressway					
43 Hauling	813540	817400	30	150	0
44 Hauling	813360	817200	20	150	0
45 Hauling	813230	817070	10	150	0
46 Hauling	813100	817000	10	150	0
47 Hauling	812970	816850	10	150	0
48 Hauling	812850	816780	5	100	0
49 Hauling	812730	816710	5	100	0
50 Hauling	812620	816690	5	100	0
51 Hauling	812520	816680	5	100	0
52 Hauling	812420	816680	5	100	0
53 Hauling	812290	816670	5	130	0

Activity	Easting	Northing	Level (mPD)	Width (m)	Emission Height (m)
54 Hauling	812160	816700	5	130	0
55 Hauling	812030	816740	5	130	0
56 Hauling	811900	816790	5	130	0
57 Hauling	811770	816900	5	130	0
I. Asphalt Mixing Plant					
58 Asphalt mixing	812630	816750	5	-	16

APPENDIX C4

Sensitive Receivers For Air Quality Impacts During Operation

Air Sensitive Receiver Location	Village
2	Tai Po Buddhist Youth Camp (YC)
3	Ma Wan Chung (MWC)
4	Ma Wan (MW)
5	Shan Ha (SH)
6	San Tung Chung Hang (STCH)
7	Wong Lung Hang (WLH)
8	Fui Yiu Ha, School (FYH)
9	Ling Pei, School (LP)
10	Lung Tseng Tau (LTT)
11	Shek Lau Po (SLP)
12	Shek Mun Kap (SMK)
13	Tung Hing (TH)
14	Shan Tsui Tau (STT)
15	Outdoor Recreation Camp (ORC)
16	Mok Ka (MK)
17	Shek Pik Au (SPA)
18	ASR West of Youth Camp (ASRX)
19	San Tau (ST)

Link Coordinates for the Operation Phase

Link	Easting 1	Northing 1	Easting 2	Northing 2	Type *	Height (m)	Mixing Width (m)
Airport							
1	811856	818504	811586	818039	AG	6	28
2	811586	818039	811520	817886	AG	6	28
3	811520	817886	811501	817742	AG	6	28
4	811501	817742	811531	817544	AG	7	28
5	811531	817544	811596	817328	AG	9	28
6	811596	817328	811734	817099	AG	14	28
7	811734	817099	811954	816902	AG	16	28
8	811954	816902	812219	816783	AG	11	28
9	812219	816783	812504	816752	AG	6	28
Tung Chung							
10	812504	816752	812793	816801	AG	6	28
11	812793	816801	813008	816911	AG	7	28
12	813008	816911	813125	817014	AG	9	28
13	813125	817014	813462	817369	AG	8	28
14	813462	817369	813614	817472	AG	6	28
15	813614	817472	813795	817547	AG	6	28
16	813795	817547	814219	817650	AG	6	28

* AG - At Grade

Vehicle Speed and Emission Rates

Link	Vehicle Speed (km/hr)	Emission Rate (g/veh-mile)				
		CO		NO_x		RSP
		1 hr	8 hr	1 hr	24 hr	24 hr
1	60	2.351	2.351	3.383	3.264	0.3058
2	60	2.351	2.351	3.383	3.264	0.3058
3	60	2.351	2.351	3.383	3.264	0.3058
4	60	2.351	2.351	3.383	3.264	0.3058
5	60	2.351	2.351	3.383	3.264	0.3058
6	60	2.351	2.351	3.383	3.264	0.3058
7	60	2.351	2.351	3.383	3.264	0.3058
8	60	2.351	2.351	3.383	3.264	0.3058
9	60	2.351	2.351	3.383	3.264	0.3058
10	60	2.464	2.464	3.982	2.839	0.2731
11	60	2.464	2.464	3.982	2.839	0.2731
12	60	2.464	2.464	3.982	2.839	0.2731
13	60	2.464	2.464	3.982	2.839	0.2731
14	60	2.464	2.464	3.982	2.839	0.2731
15	60	2.464	2.464	3.982	2.839	0.2731
16	60	2.464	2.464	3.982	2.839	0.2731

APPENDIX C7

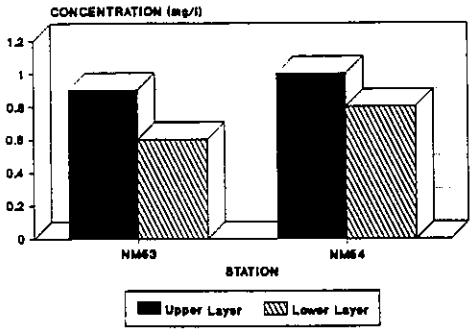
Predicted Air Pollution - Operational Phase
(Including Background Levels)

Receiver	CO (1 hr) ppm	CO (8 hr) ppm	NO_2 (1 hr) ppm	NO_2 (24 hr) ppm	RSP (24 hr) $\mu g/m^3$
1. TP	0.21	0.21	0.06	0.06	24
2. YC	0.21	0.21	0.06	0.06	26
3. MWC	0.21	0.11	0.05	0.05	20
4. MW	0.11	0.11	0.05	0.05	18
5. SH	0.11	0.11	0.05	0.05	18
6. STCH	0.11	0.11	0.05	0.05	17
7. WLH	0.11	0.11	0.05	0.05	17
8. FYH	0.11	0.11	0.05	0.05	18
9. LP	0.11	0.11	0.05	0.05	17
10. LTT	0.11	0.11	0.05	0.05	17
11. SLP	0.11	0.11	0.05	0.04	17
12. SMK	0.11	0.11	0.04	0.04	16
13. TH	0.11	0.11	0.05	0.04	17
14. STT	0.11	0.11	0.05	0.05	18
15. ORC	0.11	0.11	0.05	0.05	17
16. MK	0.11	0.11	0.04	0.04	16
17. SPA	0.11	0.11	0.04	0.04	16
18. ASRX	0.11	0.11	0.05	0.05	17
19. ST	0.11	0.11	0.05	0.05	17
Background	0.11	0.11	0.04	0.04	15
AQO	26.2	8.7	0.16	0.08	180

APPENDIX D

WATER QUALITY

BOD



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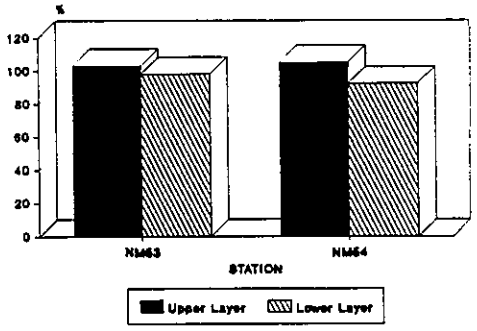
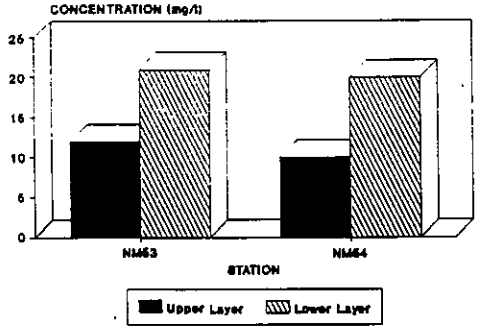
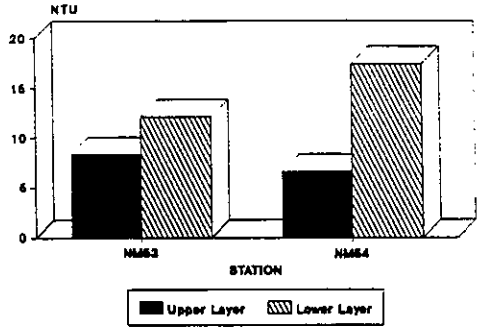


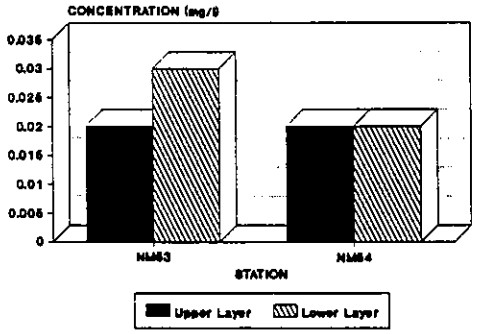
SS



TURBIDITY



NH4-N



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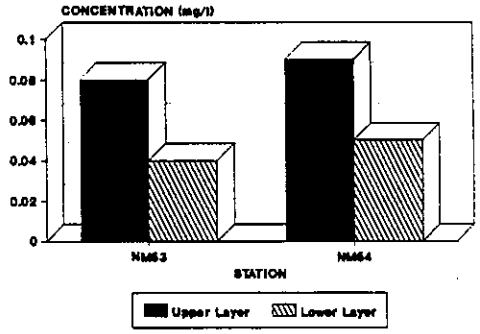

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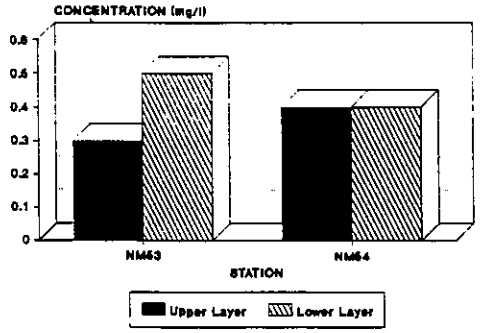

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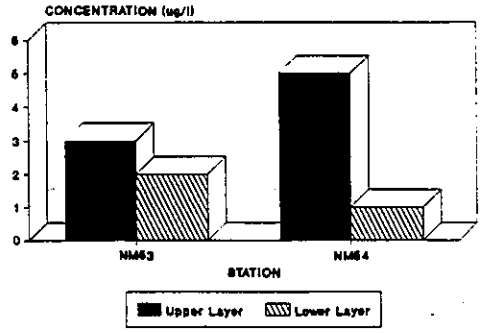

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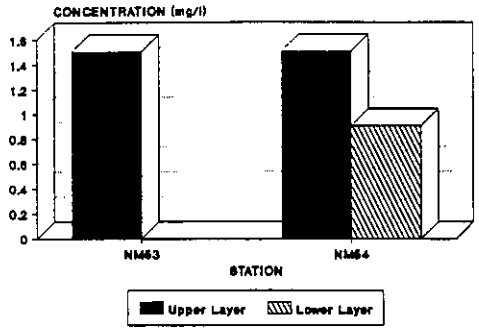

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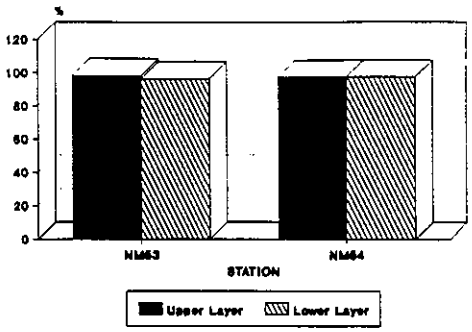

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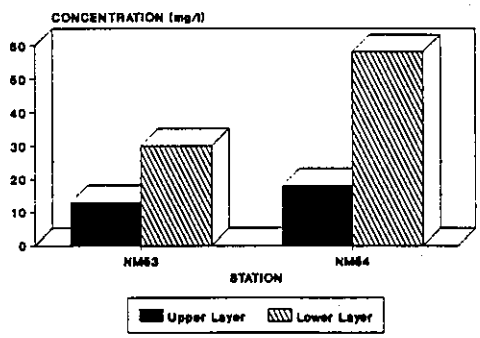

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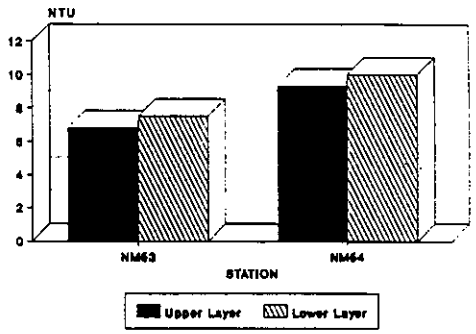

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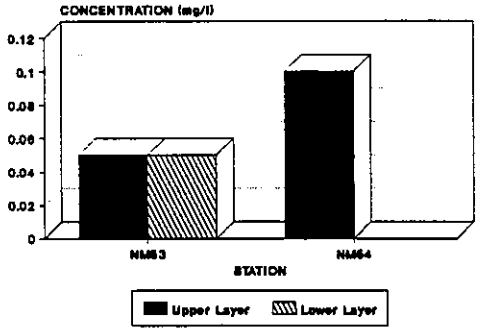

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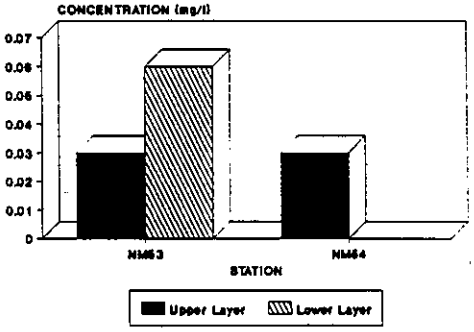

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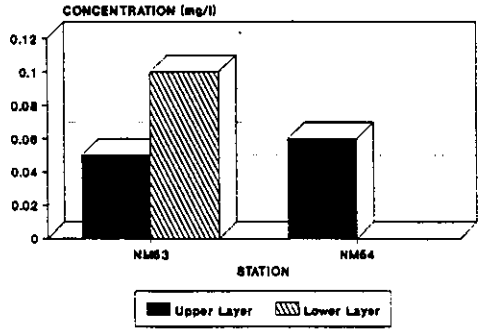

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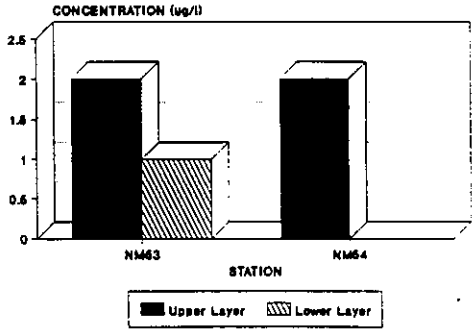
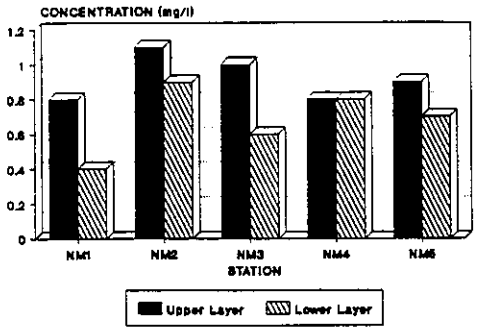


Mean Water Quality in North Lantau Water Control Zone

Period : 1/1/88 - 31/7/90						
Wet Season (March - October)						
Station		**NM1**	**NM2**	**NM3**	**NM4**	**NM5**
BOD_5	mg/l	0.6	1.0	0.8	0.8	0.7
DO	mg/l	5.9	6.5	6.0	6.8	6.2
DO%	%	80	89	82	92	84
pH		8.31	8.38	8.32	8.39	8.30
Salinity	%	29.33	25.98	27.73	25.13	25.68
SS	mg/l	7.2	9.6	8.1	10.7	10.3
Temperature	°C	23.1	24.3	23.7	24.4	24.0
Turbidity	NTU	7.5	10.3	10.5	11.1	13.0
E.Coli	No/100ml	67	267	286	16	251
NH_4-N	mg/l	0.073	0.069	0.072	0.057	0.081
NO_2-N	mg/l	0.018	0.030	0.026	0.037	0.042
NO_3-N	mg/l	0.144	0.231	0.188	0.287	0.275
Dry Season (November - February)						
Station		**NM1**	**NM2**	**NM3**	**NM4**	**NM5**
BOD_5	mg/l	0.6	0.7	0.7	0.9	0.6
DO	mg/l	6.2	6.3	6.5	6.0	6.4
DO%	%	79	80	83	88	81
pH		8.32	8.22	8.18	8.26	8.21
Salinity	%	31.69	31.36	31.34	31.34	31.20
SS	mg/l	12.4	13.8	10.6	10.3	10.3
Temperature	°C	19.1	19.1	18.9	19.9	18.9
Turbidity	NTU	11.0	12.8	9.5	7.7	10.5
E. Coli	No/100ml	94	118	510	5	296
NH_4-N	mg/l	0.075	0.088	0.065	0.039	0.086
NO_2-N	mg/l	0.019	0.023	0.023	0.025	0.030
NO_3-N	mg/l	0.076	0.108	0.107	0.100	0.124

BOD = Biological Oxygen Demand
DO = Dissolved Oxygen
SS = Suspended Solids

BOD



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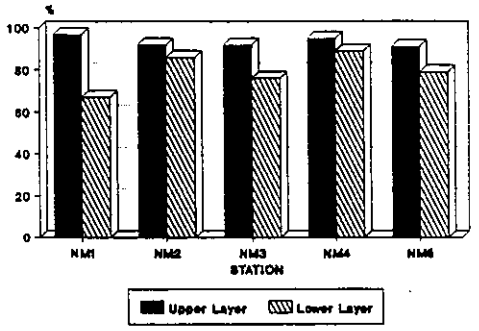

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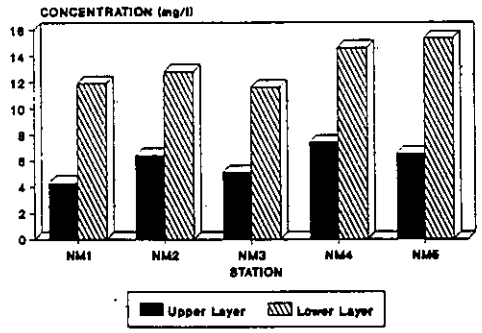

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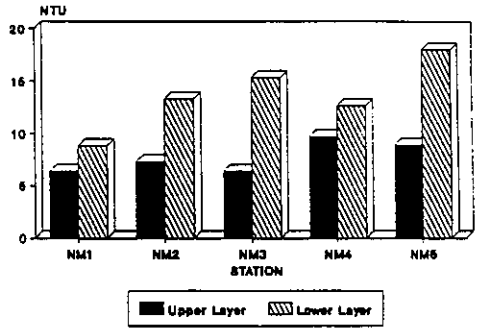

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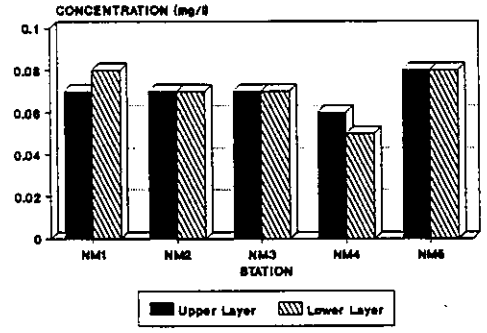

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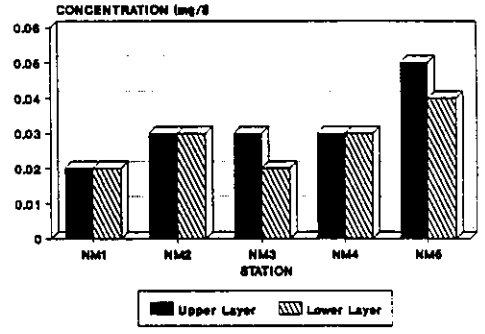

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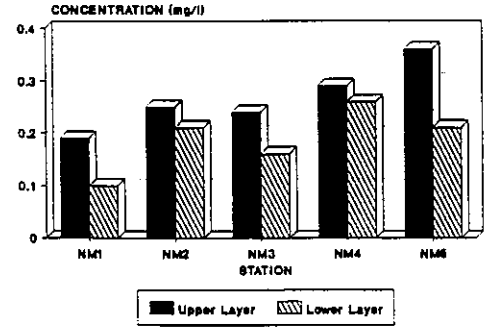

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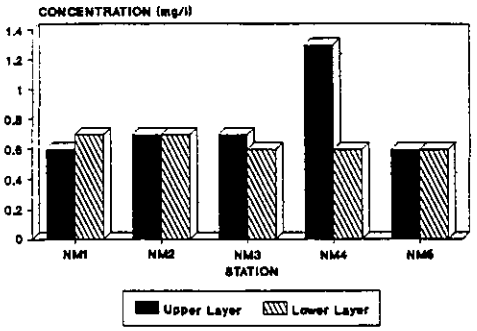

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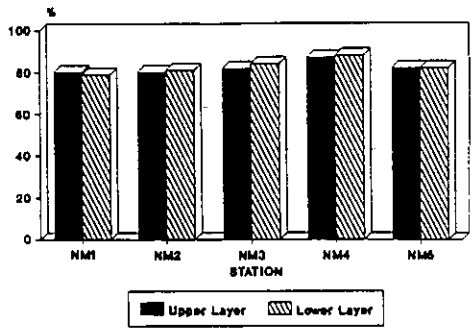

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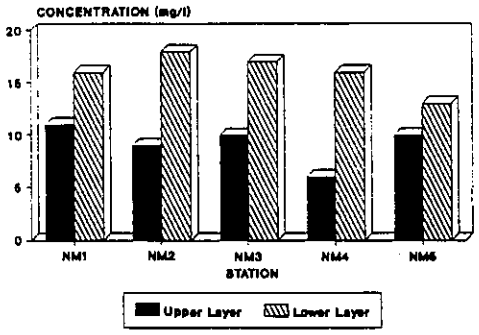

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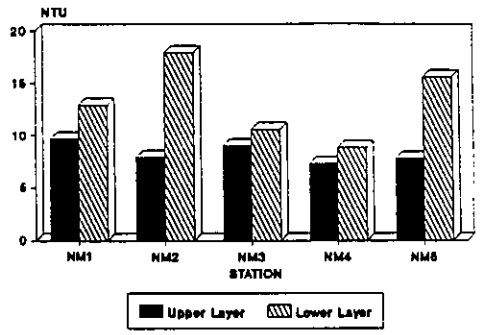

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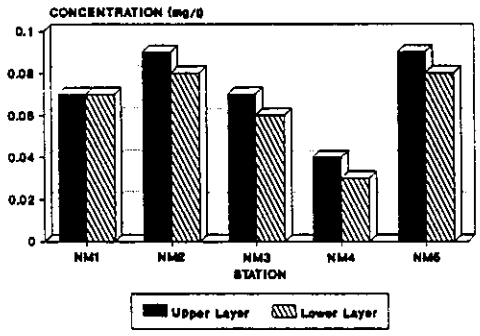

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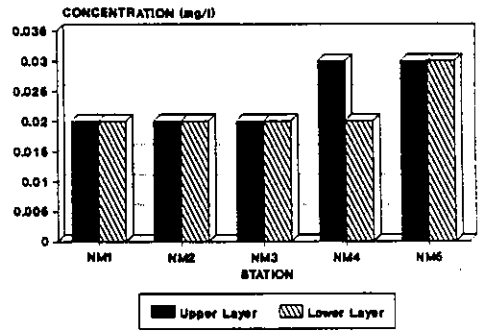

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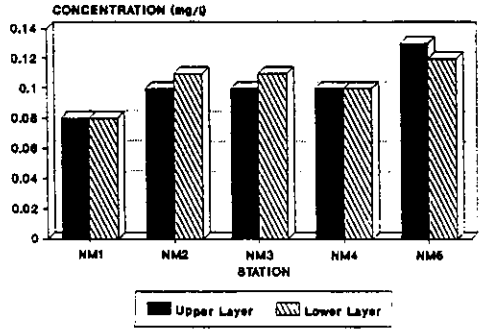

Beneficial Use (BU)	North Western Waters	Aesthetic	Bacterial (E.coli 100ml)	DO(depth average, mg/l	pH	Ammonia (unionised NH3-N, depth and annual,mg/l)	Temp(°C)	Colour (PC Units)	SS (mg/l)	Salinity (ppt)	Dangerous Substances	Total Inorganic Nitrogen (Depth and Annual Average Mg/l	Mixing Zone Allowed
BU-1 Human Food (1)	(5)												
BU-2 Commercial fisheries	(5)	(3)	<1000, 60% ile	> 5mg/l 90% ile	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	No
BU-3 Marine Life	(4)	Prevention of objectionable odours and visual impacts	(2)	> 4mg/l 90% ile	6.5 8.5	<0.021 mg/l	Not to extend natural range > ± 2°	Not to extend natural by > ± 10%	Not to extend natural by > ± 30%	Not to extend natural range > ± 10%	Apply Interim Effluent Guidelines	0.1/0.3/0.5, depends on location	Yes
BU-4 Bathing	(5)	(3)	<1000, 90% ile	(3)	(3)	(2)	(2)	(3)	(3)	(2)	(3)	(3)	No
BU-5 Secondary Contract Recreation	(5)	(3)	<1000, 60% ile	(3)	(3)	(2)	(2)	(3)	(3)	(2)	(3)	(3)	Yes, but not in upper 6m
BU-6 Domestic/Industrial	(5)	(3)	<20000, 90% ile	>2 mg/l 90% ile	(2)	(2)	(2)	(3)	(2)	(3)		(3)	No
BU-7 Navigation/Shipping	(4)	(3)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	Yes
BU-8 Aesthetic	(4)	(3)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	Yes

Source : Sewage Strategy Study, July 1989

Note : (1) Objectives for BU-1 (Human Food) are applied to food, not the water
(2) Means "no WQO required"
(3) Means "as BU-3"
(4) Applies throughout zone
(5) Applies in part of zone

APPENDIX E

RESPONSES TO COMMENTS ON DRAFT REPORT

NORTH LANTAU EXPRESSWAY
ENVIRONMENTAL ASSESSMENT - TUNG CHUNG SECTION
DRAFT REPORT

Comments	Responses
Item 1 : Project Manager/SWNT - Ref. ( ) in SW 4/1/180V - dated 4 November 1991	
I refer to your above quoted memo enclosing a copy of the captioned report.	
2. I have the following comments on the report:	
Chapter 1 - Introduction (i) Figure 1.2 is the 'baseline' cross-section of the NLE not the 'typical' one for the NLE Tung Chung section. This needs to be explained and the actual sections shown in the final version of the report.	Agreed. This will be clarified in the Final Report. We have been advised that there will be no landform mounding or landscaping in the NLE project but that there are funds being made available by PM/SWNT for landscaping in Tung Chung.
Chapter 2 - Construction Activities (ii) Is the "Tai Po interchange" in section 2.5 the same as the Tung Chung east interchange? There is apparently no mentioned of the Tung Chung west interchange in this section. This should be covered in the final version.	This will be clarified in the Final Report.
Chapter 3 - Operation (iii) The last paragraph of section 3.3 states that the utilities must be commissioned by July 1995. Is this target date still valid?	Programme dates are being dealt with by NAPCO and the date of July 1995 is now not relevant to all utilities. This will be clarified in the Final Report.

Comments	Responses
Chapter 4 - Noise (iv) The selected sections for noise contour plots shown on Figure 4.4 should be reproduced in the final version of the report ie as per the Interim RODP phase I planning layout for the NLE/AR corridor.	The noise contour plots were based on the latest version of the RODP that was available at the time of the assessment. The RODP has been subject to changes in the course of the NLD study after the assessment for this report was completed. It has been agreed that this report should use the layouts available from the North Lantau Development Consultants when the Study was undertaken. These will not, of course, be the layouts proposed by the NLDS Consultants in their Final Report as these were prepared after completion of the NLE environmental assessment. This will be reflected in an additional section in this report which will discuss the relationship between the NLE and NLD studies and the final RODP.
(v) Figures 4.2-4.4 are based on the draft RODP which has already been superseded by the Interim RODP. For example, the NLE/AR corridor is now elevated across primary distributor P1. Does this change affect the noise contour plots shown on Figures 4.5-4.7?	In deriving the noise contours, it was assumed that the NLE/AR corridor is elevated across primary distributor P1. This was as shown in the RODP at that time. The contours would not be significantly different if P1 is beneath the NLE.
(vi) The road noise mitigation measure proposals are explained in terms of reduced setback distances. The implications of these setbacks in planning terms and in relation to the layout plan are however not explained. The consultants should show on a plan (e.g. as per Fig. 43) the final road noise contours at 30mPD based on the road and rail corridor design adopted in the phase I layout plans.	In planning terms, the reduced setback distances for a straight road segment provide an indication of the effectiveness of the proposed mitigation measures for decision-making by the Government. For a given road segment, the setback distance will vary depending on the traffic volume, the curvature of the road and the noise contribution from the neighbouring road segments. The provision of noise barriers for individual road segments depends on the land use affected. The exact locations of these noise barriers affects the overall noise environment and the final contours. This work has been carried out by the NLD Consultants based on the noise criteria developed under this Study.

Comments	Responses
(vii) The without mitigation rail noise contours on Figures 4.8 and 4.9 are derived on the basis of an at-grade AR land underground LAL. However, the overhead LAL option is still a viable one that is under consideration. The consultants must produce rail noise contours assuming that the AR is at-grade and the LAL is at-grade from Kei Tau Kok to PA19 and on viaduct from PA19 to PA5 as a separate exercise.	It is understood that the underground option is still the most preferred one. In any case, noise contours for the viaduct section running from PA19 to PA5 will be parallel to the track alignment in that section with the criteria lines displaced at the setback distances given in Table 4.6.
(viii) Is it the case that the train noise is subsidiary to that of the road when the 1.5m high trackside barriers are installed? If so then the road noise contours shown on the plan prepared in response to (vi) will provide the critical noise factors to which the planning layout will require to respond. Nevertheless, a plan similar to Figs. 4.8 and 4.9 showing the rail noise contours with 1.5m high trackside barriers should be included in the report. As the elevated option LAL has not been ruled out, rail noise contour plans are required for both underground and elevated LAL options to be included in the report.	It is true that train noise will be subsidiary to that of the road when the 1.5m high trackside barriers are installed. In fact, noise contours with 1.5m barriers installed as in Fig. 4.19 have been prepared. However, the criteria lines become so close to the track with the given scale of drawing that no information can be extracted from such a drawing.
(ix) The final AR/LAL corridor cross-section as per the planning layout should be included in the report. An extract planning layout with the section locations indicated is also required.	Planning layouts for the NLD have been by the NLD Consultants revised since this report was prepared. The layouts in the report are the latest that were available when the assessment was carried out. It would be misleading to include later layouts. However an additional section will be included in the report describing the relationship between the NLE and NLD Studies.

	Comments	Responses
(x)	The need for noise barriers on the Tung Chung west interchange should be covered - this will be built in conjunction with the NLE. Also same for Tung Chung east interchange. How is the cumulative noise of aircraft (take-off/landing) and NLE/AR/LAL traffic on the planning proposals to be demonstrated? The various noise assessments made by AMP Consultants, NLE Consultants and NLD Consultants need to be co-ordinated into one cumulative effect report. What suggestions do the consultants/EPD have on this issue?	The need for noise barriers has been discussed in general terms. It was not the intention of this report to specify where to install noise barriers, and therefore no specific recommendation has been made for the locations of noise barriers. Certainly, if noise sensitive land use is proposed in the close vicinity of the Tung Chung west interchange, noise barriers should be considered by the NLD Consultants. At present, no noise sensitive land use is proposed for this area in the Interim RODP. It is difficult to calculate cumulative effects since aircraft, road and rail noise are measured differently and the response of people affected is different. The HKPSG do not require any such 'addition'.
(xi)	The road noise mitigation measures noise contour Figures 4.11, 4.12, 4.14, 4.16 and 4.18 appear to have been produced on the basis of a "Typical straight section of the NLE", whereas the without mitigation noise contour plots on Figures 4.5 to 4.7 are on Sections A-A, B-B, and C-C. Surely the design of the noise mitigation measures should follow the actual circumstances ie to mitigate noise on Sections A-A, B-B, and C-C?	Sections A-A, B-B and C-C are typical sections of the NLE where noise mitigation may be required and they are included in the report for illustrative purpose. The actual locations where noise mitigation measures are implemented should be based on the RODP which is being prepared by the NLD Consultants.
(xii)	The last sentence of the first paragraph under section 4.4.2 is incorrect. The issue of funding of noise barriers was discussed at the NLDS EI Working Group Meeting on 24.6.91. See extract of the notes of meeting attached. It is noted that HyD has yet to respond to the proposal of transferring the necessary funds for noise barrier construction from the NLE vote to the new town vote.	It is for Government to decide who is funding the noise barriers. However we understand this issue has now been resolved and the report will be amended accordingly.

Comments	Responses
Extract of Notes of Environmental Impact Working Group Meeting held on 24 June 1991 to Discuss NLD Study Topic Report No. 10 "Environmental Assessment"	
The issue relating to funding of noise barriers was raised. Highways Department said that funds could be provided under the Expressway project but the difficulty was to maintain the project vote open for a long time until the barriers were required to be constructed. TDD suggested that an appropriate sum of money could be transferred from the Expressway project to the new town vote for the purpose of constructing the barriers at a later time. Highways Department agreed to consider.	
(xiii) Generally, the report lacks adequate consideration of the implications of noise on the planning layout and what would be the noise situation with the proposed noise mitigation measures in place.	The report has shown conclusively that traffic noise will be a major constraint in land use development in Tung Chung. For strategic planning purpose, it has been recommended that noise sensitive development should be placed beyond 200m from the centreline of the road and that landscaped earth banks six metres high with three metre high noise barriers on top and trackside barriers 1.5 metre high should be installed if needed. No further planning details can be given at this stage as the actual location of these earth banks and trackside barriers would depend on the final land use proposals to be prepared by the NLD Consultants. At the time of writing the report, only the draft RODP was available. Fig. 4.19 was shown for indicative purpose only.
Chapter 5 - Air Quality (xiv) Section 5.4.2 says that the pollution levels predicted are relatively low and that constraints to development posed by noise would outweigh constraints posed by air pollution from vehicle emissions from the NLE. However, what is the air pollution effect when the airport air pollution and NLE air pollution are both taken into account in the Tung Chung phase I area bisected by the NLE.	It is not part of the Brief to consider air pollution from the airport. We suggest this question is directed to the PAA.

Comments	Responses
Chapter 6 - Water Quality	
(xv) The water quality baseline monitoring work now being carried out under the NLDS has not been mentioned. Would the results be also useful to the NLE project?	They will be useful in determining background conditions. A reference will be added in the Final Report.
Chapter 7 - Visual Intrusion and Land Use	
(xvi) This chapter is very generalised. If this is because the subject has been adequately covered elsewhere in NLDS reports then these sources of further information should be referred to in the text of this EAR. The 4 measures in 7.9(a) to (d) ie design of cut and fill slopes, slope treatment, planting design, roadside and median screening design can presumably be demonstrated in this report by including sections and an extract plan based on the planning layout and material in the MLP.	The master landscape plan and details in the North Lantau Development Study contain detailed information and solutions for this section of the road as it relates to future development. This material will be referenced. Further development of the concepts illustrated in this report would be part of detailed design of the landscaping.
(xvii) The last sentence of section 7.6.2 regarding primary distributor P1 is not correct. Presumably the fact that P1 will now be built underneath the NLE will have an effect on the visual impact assessment.	The sentence is correct based on the layout used for the assessment. The report clearly cannot reflect changes made in layouts after it was written. The layout of this junction was determined by the NLD Consultants and we understand they considered the visual aspects. A reference to subsequent changes will be added to the reports..
3. The noise aspects of the NLE have frequently been cited as detrimental to the planning layout (eg by SPEL etc and this was also referred to at ADSCOM). The consultants must be made to do better and to take the NLDS planning layout into account.	Planning layouts for the NLD are the responsibility of the NLD Consultants. There has been extensive liaison between the two teams and conflits between the NLD and NLE have been resolved. We are not aware of any significant outstanding issues.

Comments	Responses
Item 2 : Director of Environmental Protection **- Ref. ( ) in EP 2/N9/20 Annex 1 - dated 4 November 1991**	
General (i) Although this is titled Final Report, it is a draft, but is final in a sense, being the last report in the series on the NLE.	Agreed.
(ii) This report does not provide suggested clauses for environmental mitigation and monitoring contract conditions. Is the Consultant prepared to have a separate report to cover these?	Contract conditions are being developed by the engineering design team and will allow for recommendations for mitigation and monitoring made in this report.
(iii) The sections 4.2.5, 4.3.4, 6.3.4, 6.4, 8.5 and 8.6 covering environmental monitoring and audit are cursory and should be expanded to include functional requirements of EM & A.	These sections will be expanded.
(iv) There is no provision of monitoring and audit for the Air Quality Section i.e. S.5.	These sections will be expanded.
Section 1 - S 1.3 I do not agree that the study brief requires no assessment of cumulative impact. If this report does not cover such, where else has this been contained. Please refer to S 2.2.1 (vi) of the Brief.	Presumably this comment refers to para 2.1(iv) which states "... cumulative effects with other transport modes...". Para 1.3 is intended to draw the reader's intention to impacts from, for example, industry on the airport and NLD, which are not included in the Brief. The report will be amended to amplify this.
Section 2 - S 2.3(a) The Consultant should note that the marine disposal ground at South of Cheung Chau is restricted to uncontaminated mud only. As such the analysis and sampling of mud should consult Solid Waste Control Group of this department.	Noted. This will be done by the detailed design team.

Comments	Responses
Section 3 - S 3.2 Since the airport will be operating for 24 hours, won't the ARL do likewise ? (see Table 4.4)	Not according to the ARFS or to more recent information from MTRC. Apparently it is the intention that the railway will close down during the night.
Section 4 - General	
Noise	
(i) The Consultant has anticipated that most of the construction activities can be carried out within the normal 12-hour working day, as such it seems that there is no need to relax the Basic Noise Levels specified in the Technical Memorandum on Noise from Construction Work other than Percussive Piling (TM) at this stage.	Noted.
(ii) Unless prior approval from SPEL is obtained, a construction noise permit will not be issued to any proposed construction works that will likely exceed the strict statutory noise limits in the TM.	Noted.
Specific S 4.2.2 & Table 4.1	
(i) The ASR does not depend on the scale and social implications of the project. Their classification should remain "A".	Noted. This section will be amended.
(ii) In view of the fact that the communities are in an exceptionally quiet rural environment, it is likely that the higher ANLs will be acceptable.	Presumably the comment should be "lower", not "higher". However, ANLs will have to be in accordance with the TM.
(iii) The Noise Levels given in Table 4.1 is extracted from Table 2 of the TM and they should be the Basic Noise Levels (BNLs) instead of ANLS.	The table shows ANLs which have been calculated from BNLs after applying the appropriate corrections (which happen to be nil in this case). This will be clarified.

Comments	Responses
S 4.2.3	
(i) S 2.3 states that the dredging and reclamation work will work within the 12-hour norm. This is in conflict with s 4.2.3. Please clarify.	The point being made is that the dredging and reclamation could be a daytime activity and our construction programmes have assumed that it will be. However contractors may wish to work at night or may need to work at night for the reasons stated in section 4.2.3.
(ii) The word "periods" in the first line of paragraph 3 should preferably be replaced by "hours".	Agreed.
(iii) Predicted Noise Impacts - It is assumed that the PNLs are in accordance with the TM. However, without showing details of calculation, the correctness of the PNLs cannot be verified. Please supply this department with details of calculation.	Noted. A typical noise calculation is given in Appendix A to these responses.
S 4.2.4	
(i) The word "noise" should be inserted before "sensitive" in the first line. This also applies to the second last line of the same paragraph.	Agreed.
(S 4.2.4)	
(ii) In para 2, the noise level of 76 dB(A) is for Activity ID 1.2 only (as shown in Appendix B4). If all 3 of the reclamation/dredging activities are carried out concurrently, the noise level will be higher than 76 dB(A). The Consultant should clarify whether Corrections for Acoustic Reflections have been applied to all the Predicted Noise Levels (PNLs) in accordance with 2.11 of the TM.	Appropriate noise control measures will be imposed in the contract to limit the noise. Acoustic reflection has been applied to all the predicted noise levels in accordance with the TM.

Comments	Responses
(iii) Is the "reclamation and dredging refers to the minor dredging and reclamation works along the coastline from Kei Tau Kok to Tai Po? S 2.3 refers. Due to great exceedance of the future operating noise levels over the statutory limits, it is unlikely that a CNP will be issued for such works in the restricted hours. Approval from SPEL is required if 24-hour working is considered essential.	Noted.
Table 4.3 This table shows the "Maximum Permissible Noise Levels" and not "ANLs" which are statutory limits defined in the TM. Also it is not appropriate to show the Maximum Permissible Noise Levels for "no insulation" in this table.	Agreed. This will be amended.
S 4.2.5 Add to the title "and Audit", and address the subject.	This section will be expanded.
S 4.3 For all known or planned development along the railway, the noise from the railway should not exceed the criteria of the NCO. Self-protection at the receiver end should be treated as the last resort.	Agreed.
S 4.3.2 What is the proposed mitigation measures for future NSRs that are predicted to have noise levels exceed the HKPSG. Will the mitigation be at source or at receiver " On the other hand, if no mitigation is allowed for, should we require amendments to the RODP?	This has to be determined by the NLD Consultants.

Comments	Responses
S 4.3.4 A coordinated approach is sensible, however, we are not aware of this initiative being taken by the NLDS Consultants ! By the time the NLE is operational there will be other noise sources within the area which will cause difficulties with specific noise monitoring of NLE. For this reason, mathematical modelling is usually the only recourse.	Noted.
S 4.4.2 (i) The funding of the necessary mitigation needs to be sorted out and a commitment made to its implementation. Should it be agreed to proceed with the mound and barrier mitigation option, then assurances from the PM(SWNT)/BLD need to be forthcoming to resolve the residual impacts by using the suggested techniques. Moreover, according to Table 4.9, the setback would need to be 37m to meet the NCO.	Noted. The setback is only 37m where the ARL and LAL are alongside each other or on the same track.
(ii) If funding for noise barrier for future NSRs is uncertain, it would be better to adopt the HKPSG's set back distance in the RODP at this point of time.	It would be much better to agree on the funding for the noise barriers. The additional setback will be very wasteful of land.
Table 4.9 It is surprising that the NCO criteria is more stringent that the HKPSG since planning requirements usually are more stringent.	Nevertheless this appears to be the case.

Comments	Responses
Section 5 - S 5.1 Air Quality CO_2 in line 6 should read CO.	Agreed.
S 5.2.3 (i) According to AP-42, the estimated effective reduction by watering is up to 50% and that of chemical stabilization is 80%. The assumed reduction % in this report therefore appears high. Would the consultants provide supporting evidence to show that the stated reduction can be achieved?	The mitigation measures assumed are a combination of speed control (to 8 kph) and watering for A and speed control and chemical stabilisation for B.
(ii) In view of the high dust impact at the Buddhist Youth Camp, the suggestion to locate the rock crushing plant away from it is supported.	Noted.
(iii) To ensure strict dust control measures are employed, the consultant should proposed detailed mitigation measures to be incorporated in the construction contract conditions.	Contract conditions are being drafted by the engineering design team.
Fig 5.16 24 hour in the title should read 8 Hour.	Agreed.
S 5.13 It seems the predicted 1 hour TSP concentration for period 1 cannot meet EPD's requirement. What would be the implications if no mitigation is possible?	Either the works will not be able to proceed or the requirement will be exceeded.

Comments	Responses
S 5.23 If watering (Method A) can effective abate the dust level to AQO requirement, it should be the preferred method when compared with surface chemical treatment (Method B).	Agreed.
Section 6 - S 6.2.1 Water Quality The North Western Water Control Zone will be gazetted by the end of this year. Full enforcement will be effected in 1992. Nevertheless, I have no objection to the inclusion of the Standards in Technical Memorandum (TM) in the construction contract.	Noted.
S 6.2.5 para 3 It is mentioned that "significant volumes will have to be involved before having to comply with the pollution control limits in the TM". This is not clear because the lowest flow band in the TM goes down to discharges less than 10 cu.m. per day.	This will be clarified in the Final Report.
Section 7 - General Visual Intrusion The report has identified the major impacts and most of the possible mitigation measures. However, no mention has been given on how those measure could be implemented. If design are not possible at this stage then at least practical guidelines should be formulated.	It is unclear at this time how and when mitigation measures are to be implemented. We would recommend that these efforts be included in the engineering contract for the roads and be carried out during the contract for the earliest possible establishment of the landscape.

Comments	Responses
S 7.5 Visual sensitivity analysis should preferably include reference to major potential view points and their extent so that amelioration strategies could be designed.	It is stated that almost all views to the alignment will be from adjacent development, and the hills above. This same development will block views to the road from distant vantage points.
S 7.6.1 Apart from mitigation measures suggested for final landform treatment, the construction phase should provide interim hydroseeding of cut/fill slopes to reduce the visual intrusion, dust problem and potential siltation/wash off due to erosion.	Agreed. Also planting can be carried out immediately after grass has established. Many slopes are rock however, which require special landscape measures if a quarry-like face is to be avoided.
S 7.8 This section has concluded correctly that very high visual impacts will occur where major cut slopes are formed. If this is the case, minimizing such must be a key mitigation measure. To be effective and proactive, the EIA should be allowed to influence the design of the NLE which should logically by followed by slight realignment of the NLE.	Agreed, and more importantly, the landscape design should progress with the engineering to produce the best possible solutions.
Section 8 - S 8.1 Ecology The impression given from reading this section is that there is no special habitats worth special protection in this section. In which case, are the statements at S 8.6 and S 8.7 appropriate?	Section 8.7 acknowledges that "the habitats are not considered to be of high ecological and conservation importance" and the recommendations have been made based on this conclusion.

Comments	Responses
Item 3 : District Planning Officer/Lantau & Islands **- Ref. (108) in LI 1/13/30 II - dated 4 November 1991** I would like to make the following comments on the aforementioned Report: (1) Para 4.3.2: Road Traffic (i) In deriving the Tung Chung Interim Recommended Outline Development Plan (RODP), the Consultants of North Lantau Development Study have assumed the incorporation of a three meter high noise barrier on top of a six meter earth mound as a mitigation measure along sections of the Expressway running through residential developments. Fig. 4.3 has only indicated the $L_{10\ (1\text{-}hr)}$ contour overlay on the RODP at no mitigation measure situation. I suggest that another plan indicating the "with mitigation measure (ie earth mound and barrier)" situation should be inserted. This office is particularly concerned whether the planned low rise G/IC buildings in Area 12 (ie schools) would be adequately screened from the road traffic noise after the incorporation of the proposed noise barriers along the Expressway. Based on the Noise Contour Plot of Earth Mound & Barrier situation (Fig. 4.18), it seems that the G/IC buildings (assume 30m +mPD) in these two areas would require a buffer distance of about 110m from the centre line of the Expressway such that nearly half of the Area 12 would not satisfy the 65 dB(A) standard requirement for schools. The Consultants are requested to clarify the situation and, if necessary, to liaise with the Consultants of North Lantau Development Study on this aspect.	Please see response to comments Pg. 3 (xi) and Pg. 4 (xiii). Fig. 4.18 is applicable where a receiver has 180 degrees angle of view of the road. In practice, however, substantial screening of the sensitive areas, for example, by building orientation or insertion of barrier blocks in between, reduces the noise exposure.

Comments	Responses
(2) Para. 4.4 This section only mentions the mitigation measures for the Buddhist Youth Camp at Tai Po upon the construction stage. It is recognized that the Buddhist Youth Camp will continue to suffer from excessive traffic noise impact at the operational stage. I consider that noise mitigation measures (such as noise barriers along the respective section of the Expressway or at the boundary of the Camp facing the Expressway) would also be required to mitigate the noise impact on the Youth Camp.	Agreed that noise barriers may be required for the Youth Camp in the operational phase. However, it was not the intention of the report to recommend noise mitigation for individual receivers in the operational phase where these are affected by the NLD rather than by the NLE only. This is being considered by the NLD Consultants who have proposed noise barriers between the road and the Youth Camp.
(3) Para. 4.4.2 To the best of my knowledge, it was confirmed at the 2nd Study Management Group Meeting on 21.2.91 that the cost of noise barriers would be borne by HyD. I consider that this general principle should also be adopted in the Tung Chung section. I am also of the view that the funding for such noise barriers should be arranged in advance such that the implementation of these barriers at a later stage would not be jeopardized because of any delay in or lacking of the necessary funding. This could avoid the situation that residential development would take place before the implementation of noise barriers, which is environmentally undesirable.	The funding of the noise barriers has now been resolved.
(4) Para. 4.3.3 Fig. 4.19 Could the Consultants clarify why trackside barriers for the LAL are not provided along the R1 site in Area 15? I would think that trackside barriers need not be provided along Area 15 only if the LAL railway alignment goes underground.	It was assumed that the LAL went underground in Area 15.

Comments	Responses
(5) Chapter 7 : Visual Impact of the Noise Barrier A section should be inserted to address on the potential visual impact of these noise barriers and the appropriate measures (eg. the choice of the material of noise barrier) to mitigate this visual impact.	Choice of material is a detail design matter. We can add some comments on the visual impact.
(6) Para. 7.9 and 7.10 The provision of landscaping works along the Expressway preferable at the initial stage, particularly through the Tung Chung urban area, is strongly supported by this office. While I appreciate the very fact that the Expressway Project is on a tight financial budget, I tend to concur with the Consultants' proposal that co-ordination could be made between the New Town development project and the Expressway Project regarding the provision of landscaping works.	We understand that landscaping has now been excluded from the NLE scope of work although there is some provision in the NLD scope of work.
Item 4 : Director of Environmental Protection **- Ref. ( ) in EP 2/N9/20 Annex 1 - dated 5 November 1991**	
Table 4.4 The LAL service frequencies of 2 to 4 mins. headway differ from the information in para. 2 of section 3.2 (which indicate a probable operation with 8 mins. interval). Clarification will be required.	Service frequencies from the Airport Rail Feasibility Study have been used. This will be clarified in the Final Report.
Section 4.3.2 - Para. 3 on p.14 From the draft RODP in TR11, it is indicated that education institutions will be on some G/IC sites. Mitigation measures should therefore be proposed to reduce the noise impact on these sensitive uses.	This is for the NLD Consultants to determine.

Comments	Responses
Section 4.3.2 - p.15 The assumptions for train operations in the assessment of train noise should be stated (e.g. train length/no. of cars), train speeds for ARL/LAL ... etc)	See above.
Section 4.3.3 - Road Traffic The Mitigation Option 4 (6m earth mounds + 3m barrier on top) recommended in 4.4.2 could not eliminate the noise problem. Other noise control techniques (e.g. a restricted angle of view for lowering the noise level per para. 4 on p.16) could be used. It is therefore necessary that the Consultants should compile a list of other effective measures for the land administrators' consideration in translating these measures into the land documents.	This is for the NLD Consultants to determine. Some suggestions are made in section 4.4.2. Final details of mitigation cannot be confirmed until detail layout plans are available.
Section 4.3.3 - Trains The noise reduction of 8 dB(A) for train noise with the provision of 1.5m track-side barriers could only be achieved for a low level receiver at 1.5m above track level. This reduction is unlikely to be attained for a high level receiver. The setback distances as contained in Tables 4.8 and 4.9 are therefore not generalised enough for the determination of the minimum setback against rail noise. The Consultants should recommend more effective and yet practical noise control measures at the source side and/or state the likely design constraints of nearby sensitive developments in terms of distance setback, height ... etc.	The trackside barriers should be of the absorptive type and be installed sufficiently close to the track or inwardly curved to contain the noise from wheel/rail interaction. Set back constraints will be clarified in the Final Report.
Section 4.4.2 The uncertainty regarding funding of the mitigation measures should be resolved at the Final Report stage.	This is a matter for Government but we agree it needs to be resolved.
Other aspects of the Conclusion should be modified subject to further findings with respect to above comments.	

Comments	Responses
Item 5 :Government Secretariat, Recreation and Culture Branch **Ref. (60) in RCB AM 15/3 X dated 4 November 1991** I refer to the subject report which was forwarded to us for comment by the Director of Environmental Protection. After going through the report, I regret to note that the impact of the construction of the Tung Chung section of the North Lantau Expressway on historical and archaeological sites not reflected in the report. If you could send me a plan which indicates the exact boundary of the study area, I would be happy to mark out sites of historical and archaeological interest for your reference.	We are not aware of any historical or archaeological sites in this section of the NLE. Nevertheless we have sent a drawing of the project to Antiquities and Monuments office for checking.
Item 6 Planning Department Hong Kong **Ref. ( ) in PADS G/TT/39 - dated 31 October 1991** Please be advised that I have no comment to make on the above Draft Report.	Noted.
Item 7 : Chief Engineer, Port Works, CEO, CED **Ref. (3) in PWO 44/3704/90 Pt 4 - dated 4 November 1991** I have no comments to offer on the captioned draft environmental assessment report in your above-quoted memo.	Noted.

Comments	Responses
Item 8 : Director Officer (Islands) **Ref. (29) in IS 111/3/11 VII - dated 4 November 1991** My comments on the draft report are:-	
(a) Para 4.2.2 The ASRs are supposed to be determined by the nature of the environment upon which with the noise is impacting, they are not supposed to be determined by the social implications of the project that is creating the noise. To change the rating so as to permit higher noise levels seems to me to be undermining the intentions of the Ordinance. If discovered, this could add considerable fuel to local complaints during the construction period.	Noted.
(b) Para 4.2.4 In addition to the air-conditioning and window installation already agreed as mitigation measures, the Buddhist Youth Camp has requested a public address system to enable them to make announcement to people using the outdoor facilities above the construction noise.	Noted.
(c) Para 5.2.3 Is it possible to specify a minimum distance to be maintained between the Youth Camp and the rock crushing plants?	We would not wish to specify a distance in the contract. The difficulty is that if a distance is specified and dust still causes a nuisance the Engineer's powers to further control the dust are limited.

Comments	Responses
(d) Para 6.2.6 I support the writing of mitigation measures into the contract. I note that there is some tension, however; between proposed item (d) - keeping use of liquids to the minimum - and the use of water sprays to keep down dust levels.	In practice there should not be a conflict. A contractor is not likely to spray so much water such that there would be significant run off as this would make his haul roads difficult to use.
(e) Para 6.3.4 Co-ordination between the NLE contract, NLOD contract and main airport contract to control pollution is essential. Clear operational plans and areas of responsibility must be drawn up and agreed so that there can be no disputes at the time of incidents as to who is responsible for clearing up.	Noted. The proposal to include a 'cleaning team' is intended to meet problems where there is some dispute as to responsibility for cleaning up.
(f) Para 7.9 The mitigation measures are fully supported, and should be read in conjunction with the landscaping masterplan for the North Lantau Development.	Agreed.
(g) Para 8.4 The mitigation measures are fully supported, in particular the requirement for the contractor and their workers to be briefed on the dangers of hill fires and to be trained and prepared to fight any fires that do occur. Given the specialized nature of hill fires, might it not be sensible to require contractors to employ a professional to train and direct their staff for this purpose?	Agreed. However this advice will be available from the Fire Services Department.

TYPICAL CALCULATION OF CONSTRUCTION NOISE LEVELS

A construction noise model has been developed to calculate the noise levels arising from stationary construction activities. All items of PME are considered to be grouped at a position mid-way between the approximate geographical centre of the construction site and its boundary nearest to the NSR.

The sound power levels of individual items of equipment have been estimated using the tabulated values in the Technical Memorandum on Noise from Construction Works Other than Percussive Piling (TM). In lieu of these data, tabulated sound power levels in BS5228 have been used.

The following factors have been considered in the prediction.

o Basic Noise Level (BNL)

The noise level, in terms of Leq (30 min), is calculated by the equation (BS5228).

$$BNL = Lw - 20 \log10 (R) - 8$$

where

BNL : Basic noise level in dB(A)
Lw : Sound power level in dB(A) re 10(12) W
R : Distance between the source and receiver in m

o Barrier Corrections (BC)

The screening effects due to local terrain have been considered. A noise reduction in the range of 0 to 10 dB(A) has been applied to the prediction in accordance with the guidelines described in TM.

o Facade Corrections (FC)

A correction of +3 dB(A) has been added to the predicted levels to account for the facade reflections at the receivers.

The procedure to predict noise level at Noise Neighbourhood N2 for Activity 2 has been summarised in the following table.

Lw	R	BNL	BC	FC	PNL
132	1260	62	-10	3	55

where PNL : Predicted Noise Level