Territory Development Department
South West N.T. Development Office

North Lantau Development

Topic Report TR20

Environmental Construction Manual

DRAFT

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NORTH LANTAU DEVELOPMENT

TOPIC REPORT TR20

ENVIRONMENTAL DEVELOPMENT MANUAL

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NORTH LANTAU DEVELOPMENT

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ENVIRONMENTAL DEVELOPMENT MANUAL

1. INTRODUCTION

1.1 Purpose of the Report

The Environmental Development Manual comprises the following:-

(i) a presentation of the results of an environmental impact assessment of construction aspects of Phase 2 and subsequent phases of the development;

(ii) the definition of environmental conditions to be included in future construction contracts; and

(iii) the definition of procedures to be followed in engineering designs and construction to minimise environmental impacts.

The Construction Impact Assessment has been presented in two parts. The first part considered construction of the First Phase and was presented in Topic Report TR18, "Environmental Impacts from Construction of the First Phase." Topic Report TR18 (Revised) was issued in advance of its designated date in the original Study programme in view of the urgency of proceeding with the design and contract documentation for the First Phase contracts and the need to include environmental conditions in these contracts. The second part of the Construction Impact Assessment is presented in this report. Topic Report TR18 should be referred to in respect of the first construction impacts of the First Phase. Figure TR20-1.1 indicates the overall construction phasing and sequence of development.

The objective of this report is to highlight the activities to be undertaken during the development of Phases 2 onwards of the New Town which have the potential to impact on air and water quality and on existing noise levels. In addition residual environmental impacts are also discussed and possible abatement measures are identified. Mitigation measures are proposed for activities both during and post construction to minimise wherever possible, the impacts of these major developments on environmental quality, and to set out standards to be followed to reduce such potential negative impacts on all environmentally sensitive receivers. The monitoring of and environmental auditing of these recommendations is discussed in Chapter 5.

Landscape, visual and ecological issues have been covered in Topic Report TR10 (Revised) 'Environmental Assessment', in Topic Report TR14 (Revised) "Master Landscape Plan" and Topic Report TR15 (Revised) "Rural Hinterland Strategy Plan". The Master Landscape Plan includes landscape and urban design proposals and guidelines for the New Town and proposed landscape design techniques for amelioration of environmental impacts on the surrounding area. The Rural Hinterland Strategy Plan includes a hinterland framework for North Lantau Development and provides guidelines for the planning, development control and management of the urban fringe of the New Town in North Lantau.

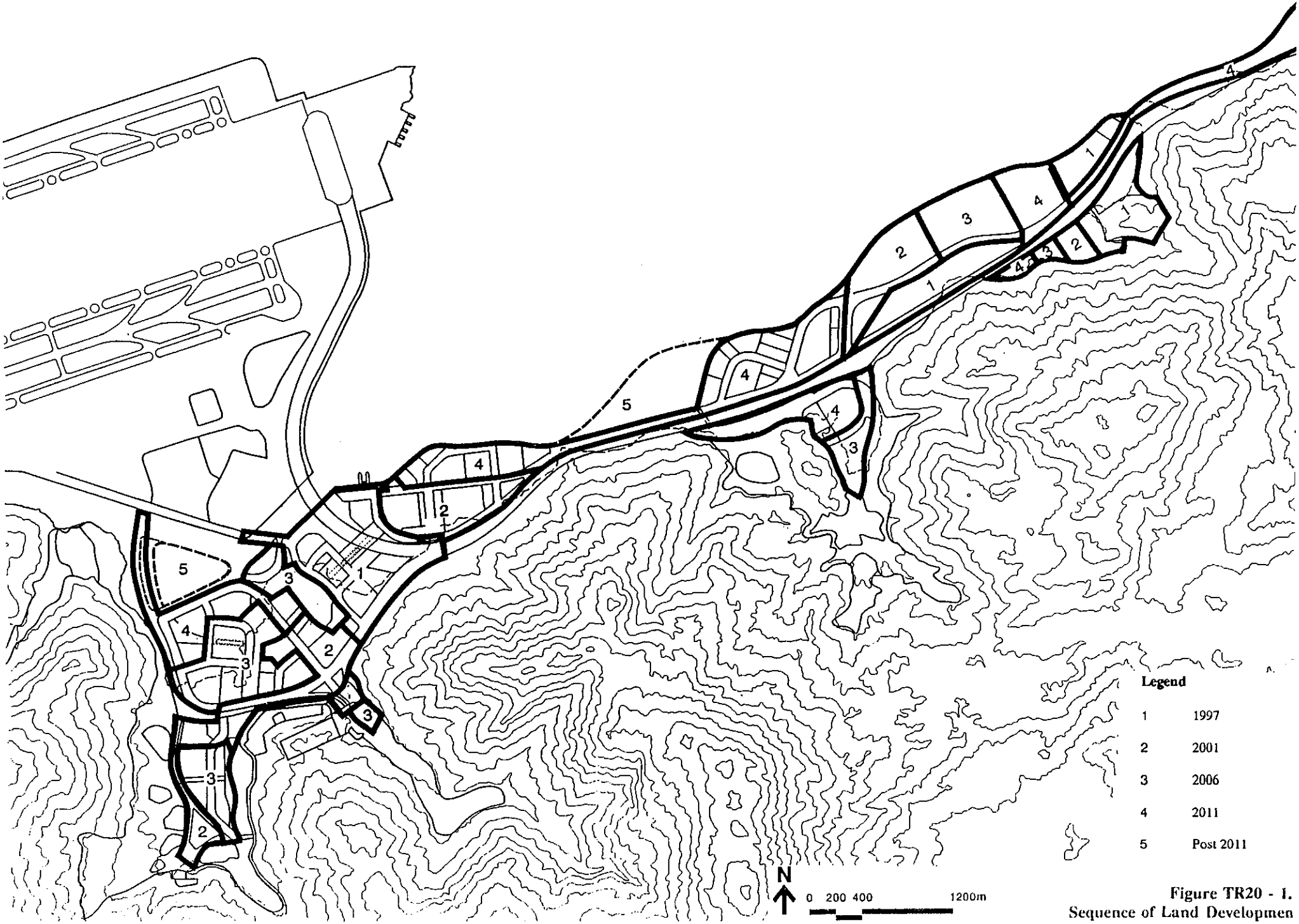


Figure TR20 - 1.
Sequence of Land Developmen

1.2 Background

The Interim Recommended Outline Development Plan (IRODP) was developed taking account of the results of the environmental assessment reported on Topic Report TR10 (Revised), "Environmental Assessment". The RODP is discussed in Topic Report TR11, "Draft Recommended Outline Development Plan" and the addendum to TR11, "Explanatory Statement for the Interim Recommended Outline Development Plan". These reports should be referred to for details of the development of the RODP and a detailed description of the RODP following suggested amendments to the RODP and taking account of subsequent decisions impacting on it a Final RODP was developed. This is shown in Figure TR20-1.2a and 1.2b.

Detailed planning layouts have been developed for the First Phase and these are described in Topic Report TR17 (Revised), "First Phase Development Layout Plans". These have been drawn up taking the conclusions of the environmental assessment into account to ensure that the environmental standards set for the RODP have been achieved. Any residual impacts are identified in this Topic Report (TR20) and proposals made for additional mitigation measures where these are appropriate.

Detailed planning layouts have not been prepared under this Study for subsequent phases of the development and these will need to be reviewed at the appropriate time to confirm that they meet environmental standards. This Topic Report outlines the key issues that will need to be addressed in these reviews.

The environmental assessment has considered the development as a whole and the impacts of components of the development have only been assessed where their impacts have been seen to form a major constraint in the formulation of the RODP. Industrial components of the development will need to be subject to the normal environmental review and assessment process as and when design details become available. Guidelines for the environmental reviews are included herein.

1.3 Components of the RODP

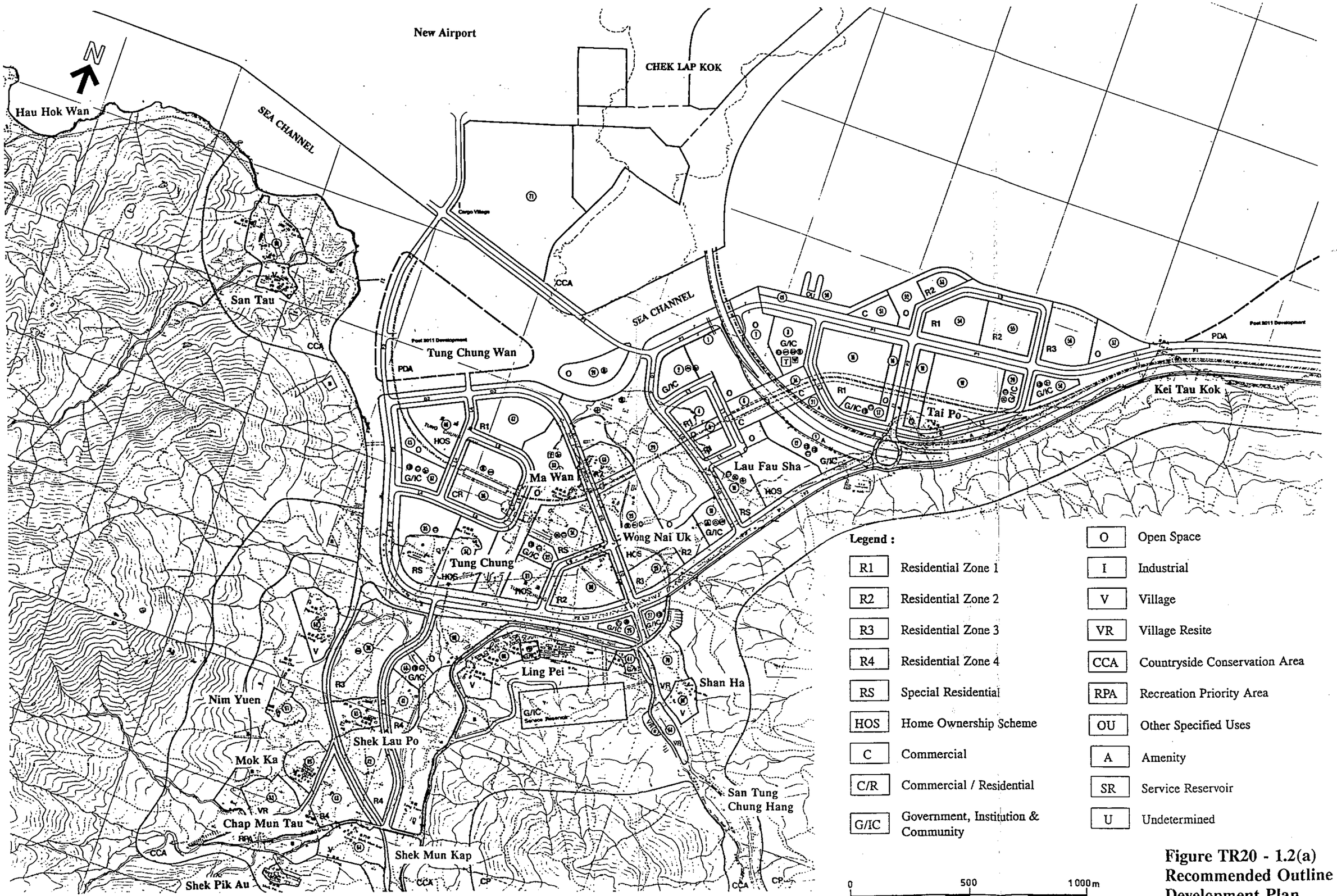
The RODP has been prepared taking the following environmental parameters into account:-

- all residential development has been located outside the 2000 and 2030 NEF 25 contours for the New Airport as shown in the New Airport Master Plan (NAMP) Working Paper No. 34, "Environmental Assessment of Operational Impacts. Any future change in the location of the NEF 25 contour could have a fundamental effect on the RODP;

- a Sea Channel has been included between the New Airport and the New Town to provide an environmental buffer and to encourage flushing of the East Tung Chung Bay. Detailed design of the channel is proceeding with a view to maintaining the existing flow in and out of this bay and also to preserve the fung shui features close to San Tau;

- the western coastline of Tung Chung Bay and the coastline to the west of San Tau have been preserved in their existing state. A SSSI is proposed on the western side of Tung Chung Bay and the development has been planned to avoid this area;

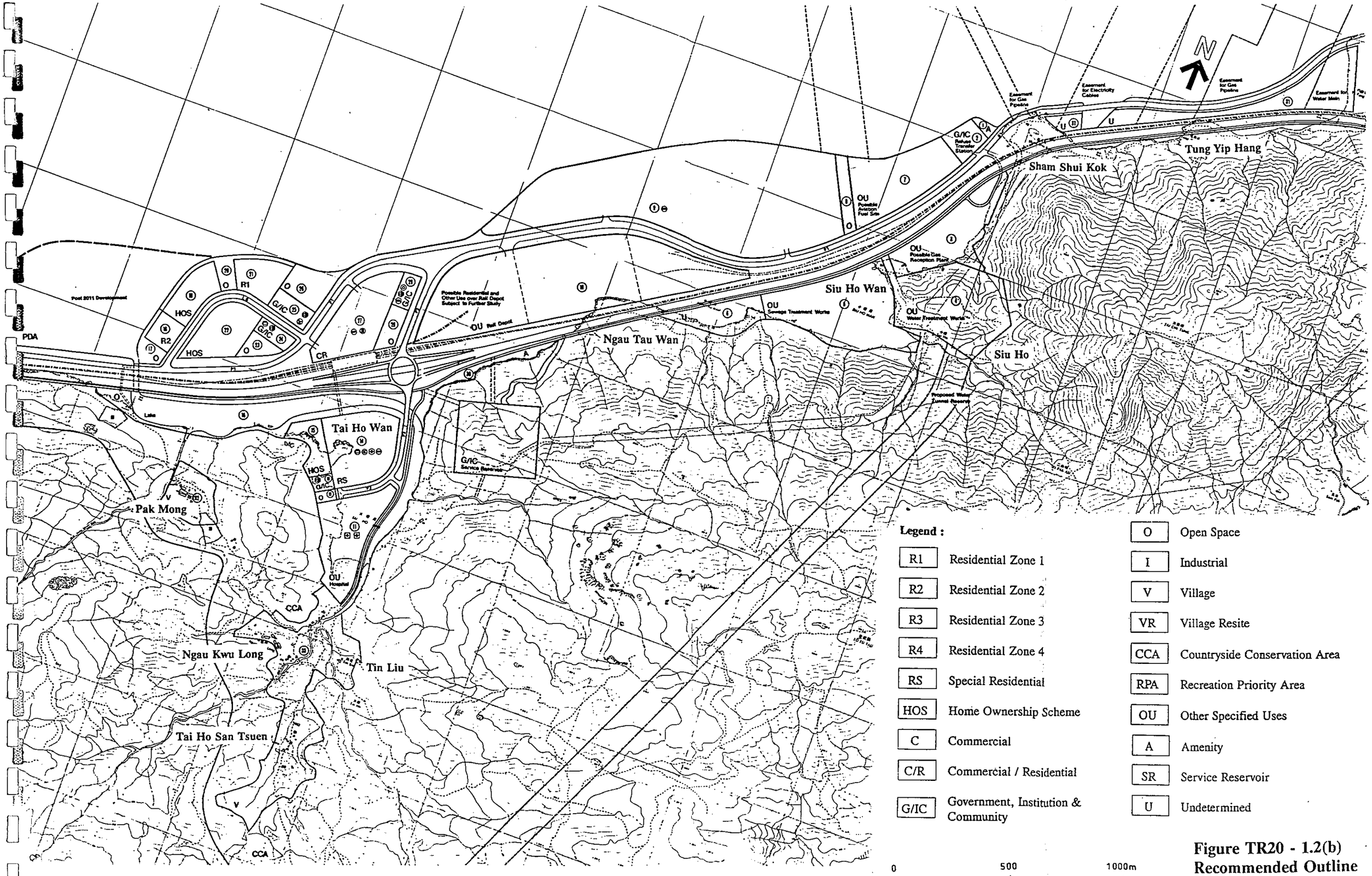
- the southern knoll of Chek Lap Kok will be retained as a landscape and environmental buffer;



Legend :

R1	Residential Zone 1	O	Open Space
R2	Residential Zone 2	I	Industrial
R3	Residential Zone 3	V	Village
R4	Residential Zone 4	VR	Village Resite
RS	Special Residential	CCA	Countryside Conservation Area
HOS	Home Ownership Scheme	RPA	Recreation Priority Area
C	Commercial	OU	Other Specified Uses
C/R	Commercial / Residential	A	Amenity
G/IC	Government, Institution & Community	SR	Service Reservoir
		U	Undetermined

Figure TR20 - 1.2(a)
Recommended Outline Development Plan (Tung Chung)



Legend :

R1	Residential Zone 1	O	Open Space
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C/R	Commercial / Residential	A	Amenity
G/IC	Government, Institution & Community	SR	Service Reservoir
		U	Undetermined

Figure TR20 - 1.2(b)
Recommended Outline Development Plan (Tai Ho Wan)

- o the North Lantau Expressway (NLE) is a three lane expressway running through the New Town. The Airport Railway (ARL) will run parallel to the NLE. Noise from the NLE will impose a significant constraint on development. Residential uses have been set back as necessary from the NLE to meet the standards set in the HKPSG on the basis that noise barriers will be built alongside the expressway. The noise barriers assumed are 6m high earth bunds with 3m barriers on top. Landscaping and earth mounding will be desirable to reduce the visual impact of these barriers to both road users and residents of the New Town.

1.4 Sequence of Development

Reclamation and site formation for the New Town will be in five phases, as shown on Figure TR20-1.1. The initial estimates for the quantities of mud to be dredged and the fill required to form the reclamation are shown in Table 1.1. These will be confirmed as detail and design of each of the phases proceeds but are shown here to give an indication of the magnitude of materials required to be moved in each phase. The civil engineering contracts will also include basic infrastructure. Development sites will subsequently be handed over to the responsible authority. This may be the Housing Authority, the MTRC or other Government agency, or plots may be sold to developers. In each case development conditions may include measures for environmental protection if appropriate.

Table 1.1 Approximate Quantities of Mud for Disposal and Fill

Phase	Year of First Occupation	Quantity of Mud to be Dredged (M cu m)	Quantity of Fill (M cu m)
1	1997	15.5	18.5
2	2001	2.5	6.5
3	2006	2.0	8.0
4	2011	1.0	4.7
5	post 2011	1.1	2.1

Source : Consultants Estimates

The New Town population build-up will be phased with an initial population of 20,000 persons in 1997 (Phase 1). This will increase to 60,000 by 2001 (although this may be accelerated to 1999), 120,000 in 2006, 200,000 by 2011 with a final post-2011 population of 260,000 persons (Phase 5). Thus there will be an increase in numbers of environmentally sensitive receivers with time which has been considered in this assessment. Additionally, the potential environmental impacts will increase through time as traffic flows and industrial development etc. increases. This has been discussed in the operational assessment.

2. AIR QUALITY

2.1 Background

Throughout the evolution of the Recommended Outline Development Plan (RODP) for the NLD, consideration was given to potential development impacts on air quality. Consequently many key air quality issues have been previously identified and mitigation measures have been included in the overall design to preserve and protect air quality in the long term and to minimise air pollution impacts on air quality sensitive receivers.

2.2 Construction Phase Assessment

2.2.1 Introduction

This Chapter of the report presents the results of an assessment of the air quality impacts due to construction of the development (with the exception of the First Phase which was included in Topic Report TR18 (Revised)). The NLD construction has been broadly divided into five phases as indicated on Figure TR20-1.1.

The construction activities which have been assessed are those which could generate dust impacts on the existing air sensitive receivers (ASRs) which will remain after the First Phase construction. In addition the construction of each subsequent phase will lead to the creation of new ASRs (new residential developments, schools etc.) which could be impacted by the next development phase construction activities. An asphalt plant could be constructed on the site formed for the construction support facilities and this could cause impacts from Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO). However, the assessment of Phase 1 reported on in TR18 (Revised) indicated that such occurrences were unlikely to cause significant impacts and this type of activity has not been reassessed for the later construction phases.

The aim of the air quality assessment has been to highlight activities to be undertaken during the development of Phases 2 onwards which will have the potential to impact on air quality. Residual environmental impacts will be discussed and possible abatement measures will be suggested.

Mitigation measures are proposed for both during and post construction periods to minimise (wherever possible) the impact of these major developments on air quality. Monitoring and environmental auditing recommendations are given in Chapter 5.

For background information and baseline environmental conditions pertinent to this assessment, reference has been made to the following:

- 'North Lantau Development Air Quality Survey';
- Technical Note TN3 (Revised) 'Air Quality Assessment: Details of the Wind Tunnel Study';
- Topic Report TR8 'Preferred Concept Plan and Land Requirements for the First Phase';
- Topic Report TR10 (Revised) 'Environmental Assessment';

- o Topic Report TR17 (Revised) 'First Phase Development Layout Plans'; and
- o Topic Report TR18 (Revised) 'Environmental Impacts from Construction of the First Phase'.

2.2.2 Air Sensitive Receivers

For the Air Quality Assessment sixteen air sensitive receivers (ASRs) have been modelled for each phase, except Phase 5 where fifteen ASRs have been modelled. The ASRs have been identified according to the definition of air sensitive uses in Hong Kong Planning Standards and Guidelines which could be affected by construction works. The location of the ASRs is different for each development phase. In Phase 2, the ASRs comprise the sensitive uses constructed in Phase 1 together with the remaining existing villages. In Phase 3 the ASRs comprise the sensitive uses constructed in Phase 1 and 2 plus the remaining existing villages. The Phase 4 ASRs comprise the sensitive uses constructed in Phases 1-3 and the remaining existing villages and in Phase 5 the ASRs comprise the sensitive uses constructed in Phases 1-4 and the remaining existing villages. The ASRs indicated are not exhaustive but are representative of the whole area near to the ASR, that is the worst affected area during the construction phases. These indicative ASR locations are shown on Figures, TR20-2.1a and b, 2.2a and b, 2.3a and b, and 2.4a and b.

2.2.3 Assessment Methodology and Criteria

Methodology

The only air pollutant from construction that has been considered in this assessment is dust. As noted, the assessment of Phase 1 Construction Impacts (reported on in TR18 (Revised)) indicated that an asphalt batching plant at either Tung Chung or Tai Ho Wan was not likely to have a significant pollution impact and thus this has not been modelled for subsequent construction phases. Other than dust, there are not likely to be any other significant air pollution sources from construction activities.

The Industrial Source Complex Short-Term (ISCST) has been used to predict dust impacts during the construction phase. The ISCST is a steady-state Gaussian plume model which can account for air pollutants having compositions with different mass fractions, reflection coefficients and settling velocities. This is suitable for modelling dust particles arising from construction sites.

Dust levels received at each ASR will, inter alia, depend on the distance between the ASR and the dust emission source and its source strength. These will change during the different construction phases and hence the time profile of dust levels at each ASR has been considered.

Construction Activities

Precise details of construction programmes and methods of working are not presently available and thus the air quality assessment has been based on the quantity of the materials likely to be handled in each phase, as indicated in Table 1.1. The location and nature of construction activities which are likely to be significant dust emission sources have been identified and the scale of these activities together with the quantity of construction plant required have been established based on the plant mixes established for the first phase construction assessment.

Schedule of Air Sensitive Receivers (Tung Chung Area) : Phase 2	
Ref. Point	**Location**
1	San Tau
2	Tung Hing
3	Mok Ka
4	Shek Mun Kap
5	Shek Lau Po
6	Sha Tsui Tau/Outdoor Recreation Camp area, Tung Chung Planning Area 34/35
7	Ha Ling Pei/Sheung Ling Pei area, Tung Chung Planning Area 66
8	Fui Yiu Ha/Sha Ha area, Planning Area 68 (Tung Chung)
9	Ma Wan Chung, Tung Chung Planning Area 33
10	Planning Area 13 (Tung Chung)
11	Planning Area 4 (Tung Chung)
12	Planning Area 12 (Tung Chung)
13	Tai Po Buddist Youth Hostel

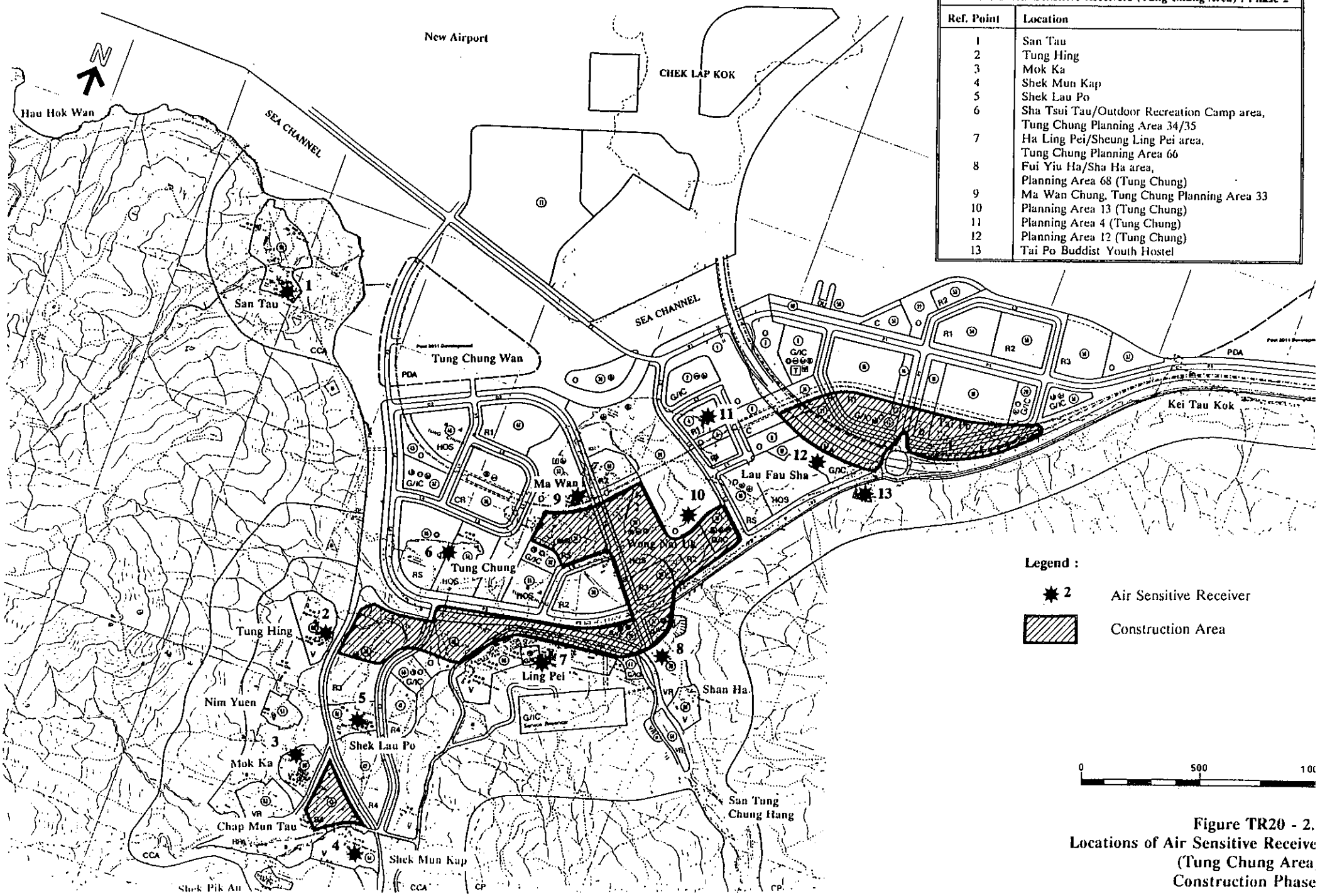
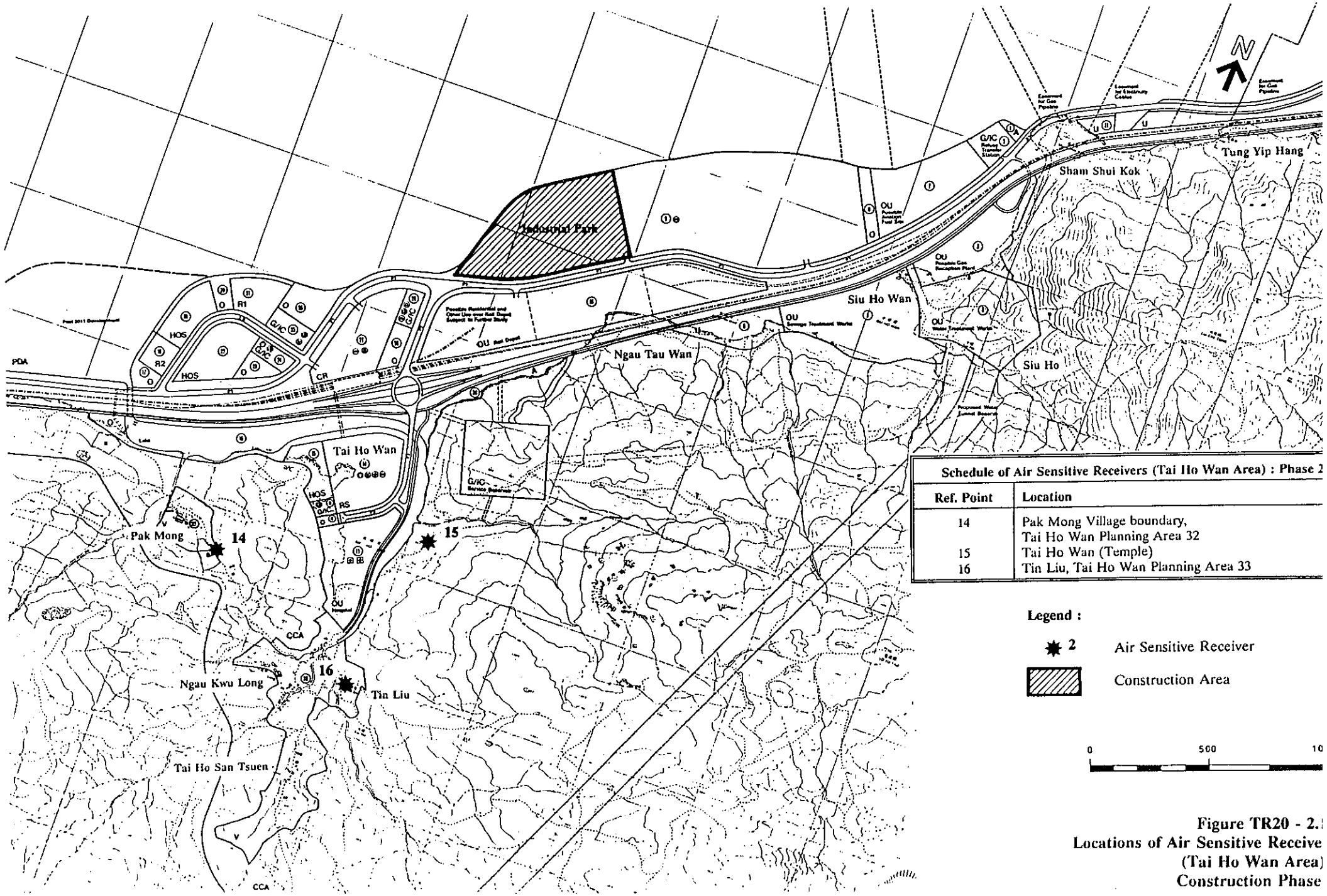


Figure TR20 - 2.
Locations of Air Sensitive Receive
(Tung Chung Area
Construction Phase



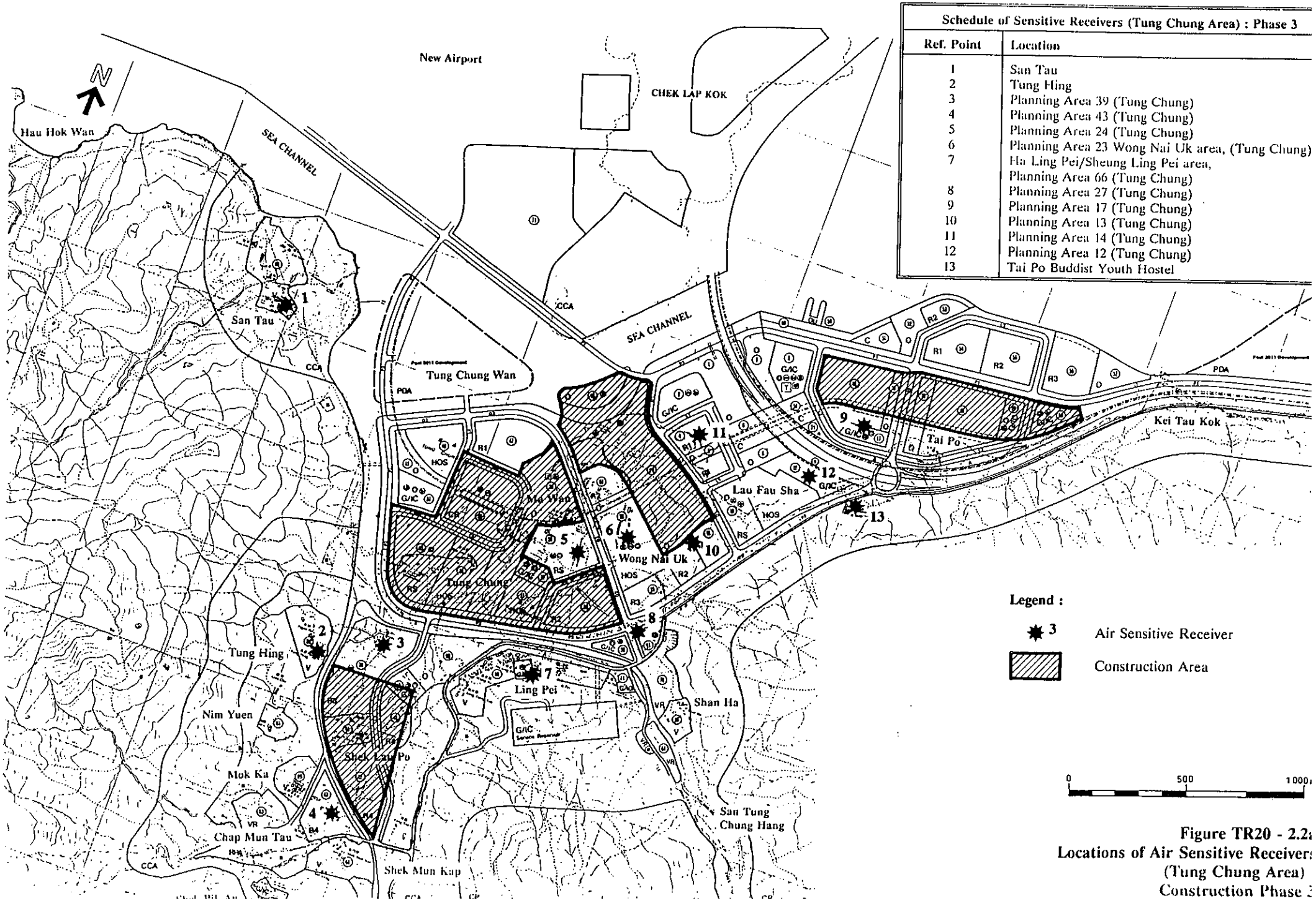
Schedule of Air Sensitive Receivers (Tai Ho Wan Area) : Phase 2	
Ref. Point	**Location**
14	Pak Mong Village boundary, Tai Ho Wan Planning Area 32
15	Tai Ho Wan (Temple)
16	Tin Liu, Tai Ho Wan Planning Area 33

Legend :

✸ 2 Air Sensitive Receiver

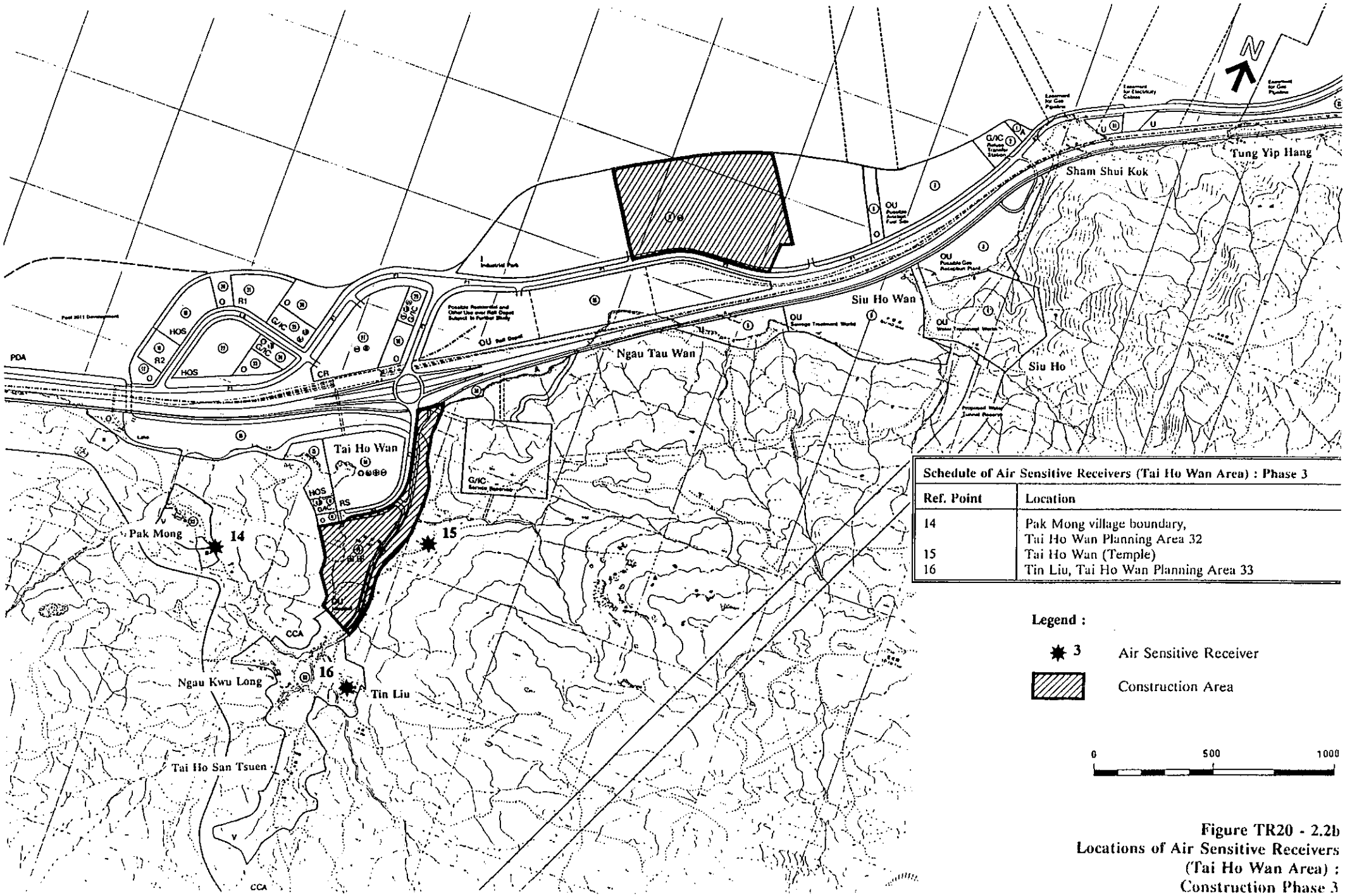
Construction Area

Figure TR20 - 2.
Locations of Air Sensitive Receive
(Tai Ho Wan Area)
Construction Phase



Schedule of Sensitive Receivers (Tung Chung Area) : Phase 3	
Ref. Point	Location
1	San Tau
2	Tung Hing
3	Planning Area 39 (Tung Chung)
4	Planning Area 43 (Tung Chung)
5	Planning Area 24 (Tung Chung)
6	Planning Area 23 Wong Nai Uk area, (Tung Chung)
7	Ha Ling Pei/Sheung Ling Pei area, Planning Area 66 (Tung Chung)
8	Planning Area 27 (Tung Chung)
9	Planning Area 17 (Tung Chung)
10	Planning Area 13 (Tung Chung)
11	Planning Area 14 (Tung Chung)
12	Planning Area 12 (Tung Chung)
13	Tai Po Buddist Youth Hostel

Figure TR20 - 2.2
Locations of Air Sensitive Receivers (Tung Chung Area) Construction Phase 3



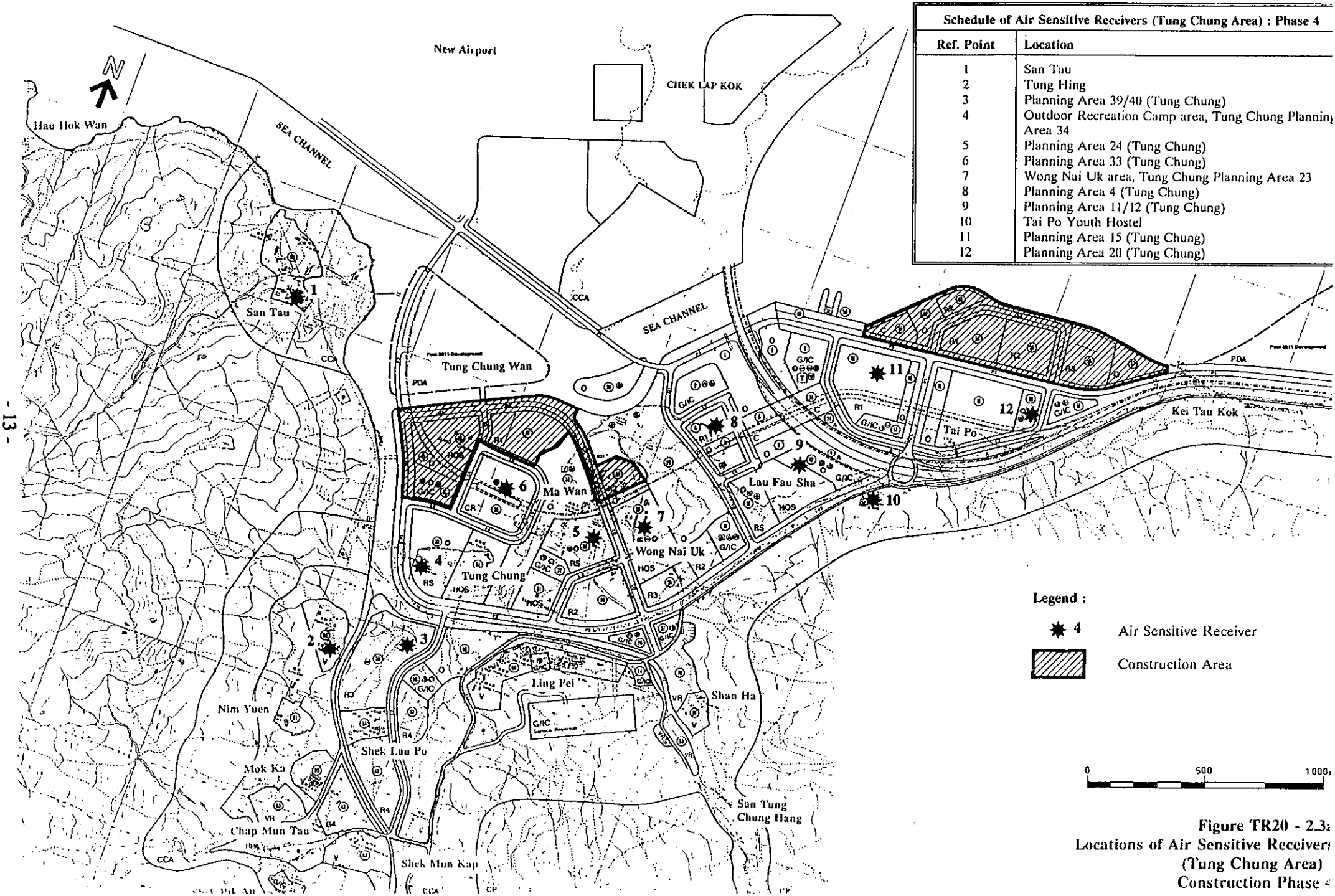
Schedule of Air Sensitive Receivers (Tai Ho Wan Area) : Phase 3	
Ref. Point	**Location**
14	Pak Mong village boundary, Tai Ho Wan Planning Area 32
15	Tai Ho Wan (Temple)
16	Tin Liu, Tai Ho Wan Planning Area 33

Legend :

3 Air Sensitive Receiver

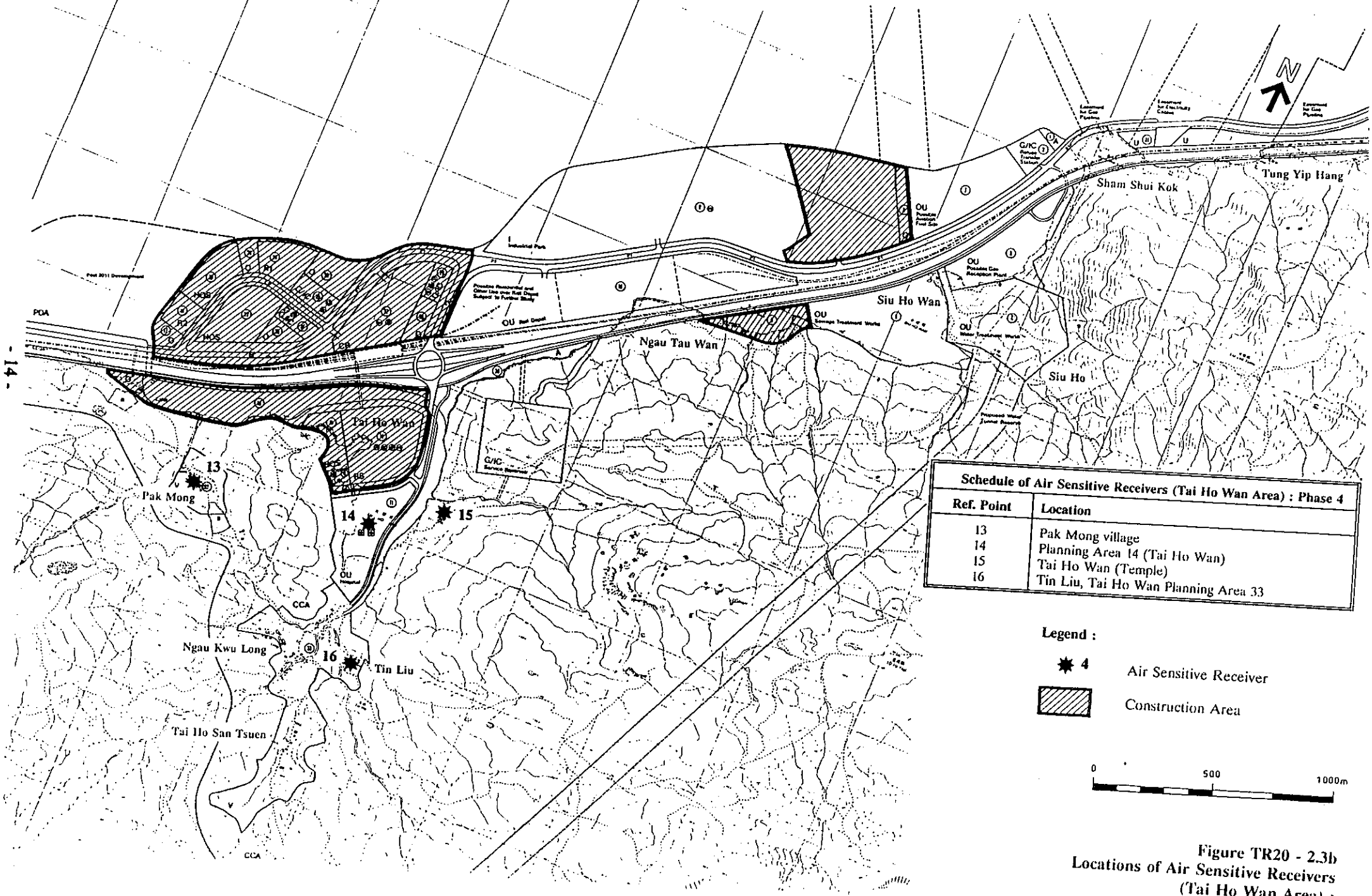
Construction Area

Figure TR20 - 2.2b
Locations of Air Sensitive Receivers (Tai Ho Wan Area) : Construction Phase 3



Schedule of Air Sensitive Receivers (Tung Chung Area) : Phase 4	
Ref. Point	**Location**
1	San Tau
2	Tung Hing
3	Planning Area 39/40 (Tung Chung)
4	Outdoor Recreation Camp area, Tung Chung Planning Area 34
5	Planning Area 24 (Tung Chung)
6	Planning Area 33 (Tung Chung)
7	Wong Nai Uk area, Tung Chung Planning Area 23
8	Planning Area 4 (Tung Chung)
9	Planning Area 11/12 (Tung Chung)
10	Tai Po Youth Hostel
11	Planning Area 15 (Tung Chung)
12	Planning Area 20 (Tung Chung)

Figure TR20 - 2.3
Locations of Air Sensitive Receivers (Tung Chung Area) Construction Phase



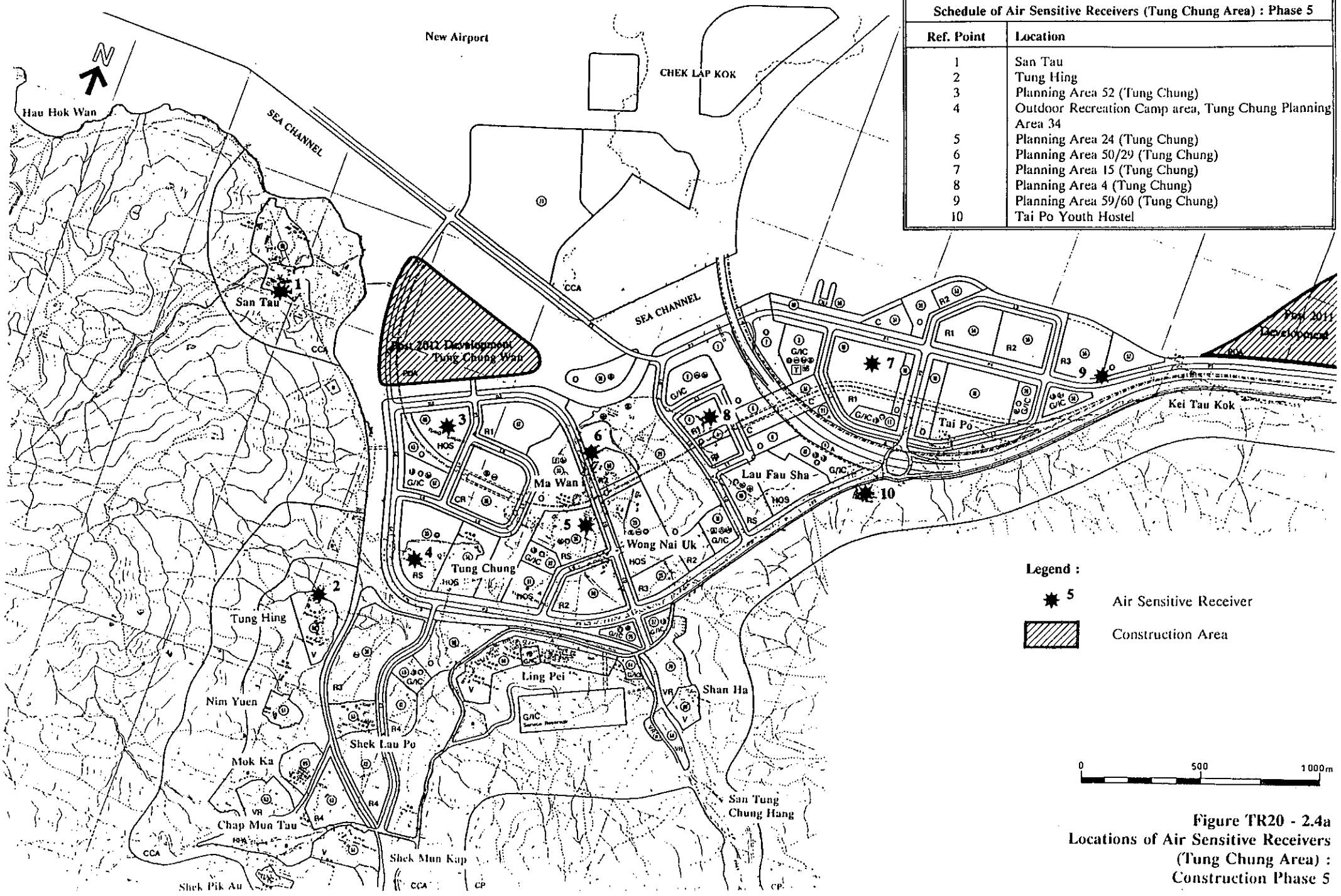
Schedule of Air Sensitive Receivers (Tai Ho Wan Area) : Phase 4	
Ref. Point	**Location**
13	Pak Mong village
14	Planning Area 14 (Tai Ho Wan)
15	Tai Ho Wan (Temple)
16	Tin Liu, Tai Ho Wan Planning Area 33

Legend :

4 — Air Sensitive Receiver

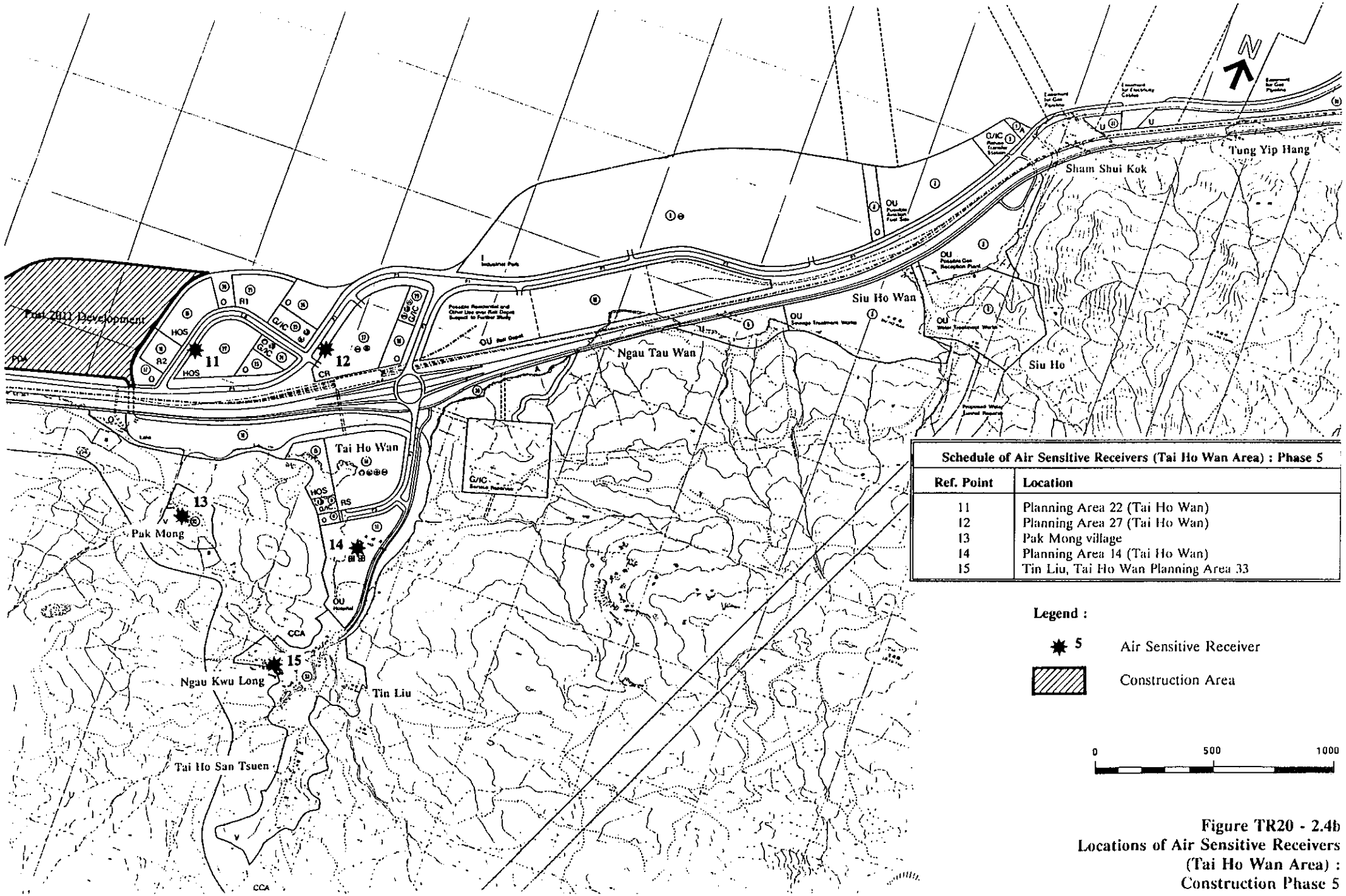
Construction Area

Figure TR20 - 2.3b
Locations of Air Sensitive Receivers (Tai Ho Wan Area) : Construction Phase 4



Schedule of Air Sensitive Receivers (Tung Chung Area) : Phase 5	
Ref. Point	**Location**
1	San Tau
2	Tung Hing
3	Planning Area 52 (Tung Chung)
4	Outdoor Recreation Camp area, Tung Chung Planning Area 34
5	Planning Area 24 (Tung Chung)
6	Planning Area 50/29 (Tung Chung)
7	Planning Area 15 (Tung Chung)
8	Planning Area 4 (Tung Chung)
9	Planning Area 59/60 (Tung Chung)
10	Tai Po Youth Hostel

Figure TR20 - 2.4a
Locations of Air Sensitive Receivers (Tung Chung Area) : Construction Phase 5



Schedule of Air Sensitive Receivers (Tai Ho Wan Area) : Phase 5	
Ref. Point	**Location**
11	Planning Area 22 (Tai Ho Wan)
12	Planning Area 27 (Tai Ho Wan)
13	Pak Mong village
14	Planning Area 14 (Tai Ho Wan)
15	Tin Liu, Tai Ho Wan Planning Area 33

Legend :

5 Air Sensitive Receiver

Construction Area

Figure TR20 - 2.4b
Locations of Air Sensitive Receivers (Tai Ho Wan Area) : Construction Phase 5

The construction activities considered in this report are those required for reclamation, land formation and the construction of drainage and basic infrastructure. Building construction will also generate some dust but this was assessed in in TR18 for the First Phase and it was concluded that the impact would be small. This has therefore not been included in the present air quality assessment.

Emission Factors

Dusts are subdivided into two categories with nominal aerodynamic diameter 0-10μm and 10-30μm. The dust particles of larger than 30μm tend to settle relatively close to the source. The dusts with diameter 0-10μm are termed as respirable suspended particulates (RSP). The term Total Suspended Particulates (TSP) refers to the total of the two categories.

The main construction dust sources are considered to arise from materials handling, both during loading and unloading and from the wheels of vehicles in-transit. There will be no requirement for rock crushing during Phases 2-5. The contribution from concrete batching has been assumed to be very minor compared to loading, unloading and hauling and has thus been disregarded in this assessment. Emission factors calculated have been based on USEPA-AP42 4th Edition 1985.

The impact on air quality at the indicative ASRs has been assessed using the criteria in HKPSG and the Hong Kong Air Quality Objectives (AQOs). The AQOs for TSP and RSP are based on 24 hour or longer averaging times but the EPD recommended the TSP level for construction is based on a 1 hour average. Pollution levels have therefore been calculated over both 1 hour and 24 hours for TSP, and over 24 hours for RSP.

Location of Sources

The indicative locations of the activities are assumed according to the works proposed during each of the development phases. Each source has been placed at the centre of the respective activity site.

Meteorological Conditions

The most important meteorological parameters governing dust dispersion are:-

- o wind speed;
- o wind direction;
- o stability class; and
- o mixing height.

For modelling purposes a combination of wind speed of $2ms^{-1}$ and a stability class D have been chosen. This is because at lower wind speeds the dust dispersion will be lower and the pollutants will concentrate relatively near to the source. At higher wind speeds dispersion will be higher and the consequent pollutant levels at ASRs will be lower. Stability Class D is the most stable day-time weather condition. These parameters together are considered to represent the worst-case meteorological criteria for air quality assessment in the development area.

Evaluation Techniques

Thirty-six wind angles have been tested to evaluate the likely impacts. This large number of wind angles was needed because of the scattered receptors and the extent of the Study Area. The results generated for the 36 wind directions have been compared and the highest values have been chosen for each receptor to estimate the worst 1 hour averaging time concentrations.

This method of assessment allows for the variability of local winds since it is most unlikely that winds will blow from a constant direction over short distances in areas of complex topography such as North Lantau, particularly at the low wind speeds used for the assessment. The 24 hour dust levels have been calculated by summing up the dust levels at each of the 36 wind directions multiplied by the percentage frequency of that wind direction based on annual wind data provided by the Royal Observatory (as measured at Chek Lap Kok in 1989). It is possible that the use of annual statistics may slightly underestimate the extreme worst case 24 hour concentrations but it is considered that this method of assessment gives more representative 24 hour values. The annual figures used have taken account of the prevailing winds and these were given a relatively high weighting in the multiplication. Also the project will last for many years, and hence the annual figure is the best practicable means available for the construction assessment.

The extent of air quality changes has then been compared the appropriate with AQOs and the EPD recommended 1 hour TSP level which are shown in Table 2.1.

Table 2.1 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	

Source : Consultants Estimates

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) Respirable suspended particulates means suspended particles in air with nominal aerodynamic diameter of 10 micrometres and smaller.
(vi) Photochemical oxidants are determined by measurement of ozone only.
(vii) Suggested short term averaging level for 1 hour is 500 $\mu g/m^3$.

Background Level

Background levels of air pollution in the Study Area have previously been estimated in TR10. The maximum background concentrations are summarized in Table 2.2.

Table 2.2 Maximum Yearly Averaged Background Air Pollutant Concentrations in the NLD Area (Averaging time : 1 hour)

Pollutant	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 particulates > 10 μm	< 1	< 1
Respirable suspended particulates < 10 μm	15	20
Total suspended particulates	15	20

Source : Consultants Estimates

2.2.4 Results

Presentation of Results

The results of the dust modelling are shown in Appendix A on Figures A1 to A12. The results have been presented in the form of histogram charts showing the impacts from the movements of construction vehicles which is the most important source of dust, while loading and unloading is concluded to have contributed insignificant amounts to all the modelled ASRs. The results show the maximum predicted dust levels each phase for 24 hour and 1 hour TSP and for 24 hour RSP with and without different forms of mitigation compared with the background levels.

The results indicate clearly the extent of dust reduction which could be achieved with different mitigation measures applied. Two types of mitigation measures have been tested as follows:-

- Mitigation 1 - watering of haul roads (50% suppression)
- Mitigation 2 - watering of haul roads and traffic speed reduced from 20 km/hr to 8 km/hr as EPD recommended speed limit on unpaved road (70% suppression).

The following sections discuss the results of the modelling.

Phase 2

(a) 1 Hour TSP

A level of 500$\mu g/m^3$ is recommended by EPD for construction activities. The level is not statutory and has not been included in Airport Core Projects, but has been used in this assessment to give an indication of the worst-case short-term impacts. Appendix A, Figure A1 indicates that the 500$\mu g/m^3$ level will be exceeded at all modelled ASRs in Tung Chung area, without mitigation, whenever construction is proceeding at nearby works sites. With mitigation measures 1 or 2, the modelled ASRs near the construction sites will still receive high TSP levels. ASRs in the Tai Ho area, will receive dust levels below the hourly AQO, without any mitigation requirement.

(b) 24 Hour TSP and RSP

The 24 hour AQO limits for TSP and RSP are 260$\mu g/m^3$ and 180$\mu g/m^3$ respectively. Without mitigation the modelled ASRs (2, 7, 8 and 9) near to the construction sites will be exposed to levels exceeding the AQOs, as indicated in Appendix A on both Figures A2 and A3. With mitigation 1 employed, the levels received will fall below the AQO limit. ASR 7, however, will have levels marginally below the 24 hour TSP AQO.

Phase 3

(a) 1 Hour TSP

The dust level received will be generally lower than in Phase 2, as indicated in Appendix A on Figure A4. The 1-hour dust level will be greatly reduced to 500$\mu g/m^3$ level at all modelled ASRs, with mitigation measures 2 applied, however this can only be achieved with the vehicle speed limited to 8km/hr on all haul roads.

(b) 24 Hour TSP and RSP

Dust levels predicted are well within the AQO limits even without dust mitigation measures employed, as indicated in Appendix A on Figures A5 and A6.

Phase 4

(a) 1 Hour TSP

Figure A7 in Appendix A indicates that without mitigation the 500$\mu g/m^3$ level will be exceeded at all ASRs modelled, especially those in the vicinity of Tai Ho Wan, whenever construction is proceeding at nearby work sites. With mitigation measure 1 modelled ASRs near the construction sites will still receive high TSP levels especially at Tai Ho Wan. With mitigation measure 2 TSP levels will be reduced to below the EPD recommended level at modelled ASRs in Tung Chung although there will still be exceedances in the vicinity of Tai Ho Wan.

(b) 24 Hour TSP and RSP

Without mitigation the modelled ASRs (11, 12, 13, 14 and 15) near to construction sites in the vicinity of Tai Ho Wan will be exposed to levels exceeding the AQOs, as indicated in Appendix A Figure A8 and A9. With mitigation 1 employed, the levels received will fall below the AQO limit with the exception of sites 13 and 14 where there will be exceedance of the 24 hour TSP AQO. With mitigation 2 employed such exceedances will be eliminated.

Phase 5

(a) 1 Hour TSP

The 1 hour dust level received will be lowest of any construction phase as indicated in Appendix A Figure A10. With mitigation 1 employed all exceedances are eliminated with the exception of site 11, although this exceedance could be eliminated by a 8km/hr limit on vehicles on all haul roads (mitigation 2).

(b) 24 Hour TSP and RSP

24 hour dust levels predicted are lower that at any other construction phase and are very much below the AQO, as indicated in Appendix A on Figures A11 and A12.

2.2.5 Mitigation Methods

Mitigation of dust, particularly from vehicle movements on unpaved haul roads, will be needed to reduce the impact on the ASRs.

Two methods of mitigation should be considered. These are:-

- o those relating to design and methods of construction; and (as indicated in 2.2.4 above)
- o those relating to suppression of dust during construction.

The assessment tested two methods of mitigation for the suppression of dust during construction and concludes that neither of these will, on their own, be capable of reducing dust to acceptable levels. It is important that this is achieved so that the high quality environment of the New Town is maintained and the New Town is attractive to new residents. The second method of mitigation tested also included dust suppression by limiting the speeds of vehicles on haul roads although this is difficult to enforce.

It is recommended that mitigation of dust, by suppression during construction, should be included in all construction contracts but that this alone should not be relied upon to reduce dust to acceptable levels.

Mitigation of dust therefore needs to be taken into account in the design of land formation and reclamation with the object of reducing the need for movements of vehicles. This can be achieved by one or more of the following:-

- o by use of marine fill, rather than land based fill, for all stages of reclamations;
- o by programming construction contracts so that there is time for contractors to use smaller numbers of plant items at any one time, thereby reducing dust levels;
- o by avoiding the need for stockpiles and surcharges; and/or
- o by phasing projects so that any haul road movements are over short distance.

An assessment of the dust impact of each contract should be carried out and modifications to the design made as necessary. In addition dust standards should be included in each contract; the action levels should be the AQOs plus a standard of 500 $\mu g/m^3$ for 1 hour TSP.

The precise methods of achievement of dust standards should be left to the contractor as methods of working will be his responsibility but the contract should include clauses specifying that strict dust control should be employed. The Site Engineer should be empowered to direct the contractor to take appropriate measures if dust levels become excessive.

The present assessment is based on the best available information currently available from the NLD design team. Detail subsequent refinements during the course of the designs for subsequent phases could affect the findings presented here.

2.3 Operational Phase Guidelines

2.3.1 Potential Operational Air Pollution Sources

Following the construction of each phase of the NLD some components may have the capability to adversely affect air quality. Proposed operational guidelines for such facilities are given in the following paragraphs.

Industrial Park

The first stage of the industrial park at Siu Ho Wan will be developed during Phase 2 and its completion will be during Phase 4 of the New Town development. The guidelines listed below should be followed in planning and operating the industrial park:-

(a) only clean industry or industries which do not have off-site air quality impacts should be allowed to locate in the industrial park;

(b) the use of solid fuel (coal) should be prevented and the use of distillate oil and fuel oil should be restricted below limits specified in Topic Report TR10 (Revised). These limits would comprise a ceiling on usage of approximately 2170 TJ per year of distillate oil (60,000m^3 per year) if the only industrial fuel source used at Siu Ho Wan industrial park was distillate oil and no coal or fuel oil was used. However, this assumes that the total SO_2 emissions do not exceed the 279 tonnes poer year SO_2 emission modelled in TR10 (Revised) at the Chek Lap Kok South industrial developments. Additionally, the use of LPG and/or town gas should be stipulated;

(c) process emissions from the industrial park should be strictly limited and industries likely to cause significant air pollution such as chemical processing industries should be discouraged;

(d) industrial/residential setbacks in accordance with HKPSG guidelines should be retained when the precise/nature of industrial developments are established;

(e) environmental assessment, monitoring and audit of the industrial park will be required during the detailed planning phase and should include an investigation into the maintenance of off-site air impacts to below AQO guidelines.

Refuse Transfer Station (RTS)

The RTS will be constructed during Phase 1 of the NLD and will be operational by 1997. The following controls will be necessary to restrict off-site air quality impacts:

(a) dust control devices and air extraction will be required and should form part of the integrated ventilation system for the transfer building;

(b) the air extraction system should include both natural and powered roof extraction to remove vehicle exhaust fumes and odour; and

(c) environmental assessment, monitoring and audit of the RTS will be required to minimise off-site air quality impacts (dust and odour) to below AQC

Refer to EIA STP

Sewage Treatment Works (STW) and Sewage Pumping Stations

The first stage of the STW will be completed during Phase 1 and stage 3 will be completed in Phase 3. The STW has the potential to cause odour nuisance but sensitive receivers are located some distance away and impacts are not likely to be significant. This needs to be confirmed and an environmental impact assessment of the Sewage Treatment Works should be carried out. Recommendations for monitoring and audit should be developed following such an EIA. Odour control devices could be included if an off-site problem was predicted. The Sewage Pumping Station in Tung Chung could cause an off-site odour nuisance and this should be environmentally assessed and subsequently monitored at the detailed design stage. Mitigation measures should be adopted in the design if off-site odour was predicted to cause odour nuisance.

NLE, Primary and Local Roads

The air quality impact of all roads should be monitored during the build up of road traffic, population and associated air sensitive receivers to validate the air setback results predicted in the environmental assessment. This would comprise part of the routine environmental auditing and monitoring programme of the NLD.

Hospitals

A hospital is scheduled for completion in Phase 4 development at Tai Ho Wan. This should be subject to environmental assessment, monitoring and audit to ensure that this facility has no off-site air quality impacts associated with its boilers. Fuel restrictions could be used if emissions were predicted to be significant.

2.3.2 Operational Air Sensitive Receiver Guidelines

Residential Population

The new residential population on North Lantau will increase from 20,000 persons in 1997 to 200,000 by 2011 will an ultimate post 2011 population of 260,000. Air quality considerations have been taken into account throughout the New Town design and residential population has been located with adequate air quality buffers from all potential operational pollution sources. This assessment includes existing villages and village resite areas. Nevertheless, environmental monitoring and audit will be necessary to ensure that air quality is within the AQOs and this is detailed in Chapter 5.

Other Air Sensitive Receivers

Nurseries, homes for the aged, hospitals and clinics, schools and active recreational activity areas have also been located with adequate air quality buffers from all potential pollution sources. Nevertheless, air quality monitoring and audit will be required during the operational phase to ensure air quality is within the AQOs.

2.4 Air Quality at Sensitive Receivers

2.4.1 Phase 1

The RODP has been reviewed to identify any residual impacts in Phase I and these are discussed below.

This review of residual impacts has been based on the final detailed layout plans for the First Phase presented in TR17 (Revised).

2.4.2 Residential Sensitive Uses

The air quality assessment has concluded that AQOs should be achieved at all residential receivers so long as they are set back by 40-45m from the NLE. This has been achieved throughout the New Town and thus air quality at all sensitive residential sites should be below the AQOs.

2.4.3 Non-Residential Sensitive Sites

Area 12 (Tung Chung) : Site 1, Secondary School

The site boundary is setback a minimum of 58m from the NLE which is more than the required setback of 40-45m.

Area 12 (Tung Chung) : Site 2, Secondary School

The site boundary is setback a minimum of 57m from NLE which is more than the required setback of 40-45m.

Area 12 (Tung Chung) : Site 3, Primary School

The site is setback a minimum of 110m from the NLE which is more than the required 40-45m setback.

Indoor Recreation Centre : Type A, Tung Chung - Area 6

The air intakes should preferably be located on the facade located furthest from the NLE (ie the west side of this building), although the building is located in excess of the required 40-45m setback.

Area 5 (Tung Chung) District Open Space

The HKPSG specifies that open space should be set back at least 5m from adjacent local distributor roads. The actual site is setback more than this and thus will be suitable for the proposed passive recreational use.

Sitting Out Area between Tung Chung Areas 1 and 6

The site is setback a minimum of 60m from NLE and therefore should be suitable for its intended purpose.

Area 8 (Tung Chung) Landscaped Sitting Out Area

The site meets the 5m set back requirement from the adjacent local distributor road. The site is setback from NLE by approximately 110m and will thus be suitable for proposed passive recreational use.

Tai Po Buddish Youth Hostel, Basketball Court

The HKPSG specifies a setback of more than 20m from a primary distributor road for active recreation and this has been achieved in the detailed layout plan.

Tai Ho Wan Proposed Artificial Lake (Open Space) Tai Ho Wan Area 16

The lake is setback a minimum of 34m from the centreline of the NLE. The Expressway EIA indicated that a 40-45m setback would be required for sensitive uses to avoid exceedance of the AQO for NO_2. HKPSG criteria require a minimum 20m air quality setback for active recreational uses from trunk roads. Some AQO exceedance could be experienced on the north western "perimeter" of the lake under certain wind conditions.

Tai Ho Wan Area 6 : Undetermined Use

The final use should take account of the requirement for a 40-45m setback from the NLE to any air quality sensitive uses (eg residential, schools, nurseries, homes for the aged, hospitals and clinics and active recreational uses).

2.4.4 Phases 2 to 5

The assessment of residual impacts from Phases 2 to 5 has been based from the RODP as detailed layout plans are not available. The assessment has concluded that there should be no residual impacts subject to the following:-

- the application of the development controls proposed above for the industrial park;
- the maintenance of a minimum setback of 45m from the NLE for all residential uses;
- the maintenance of setbacks specified in the HKPSG for all open space; and
- the application and maintenance of air quality controls to pollution sources external to the NLD, notably the existing and proposed power station at Castle Peak and the New Airport.

The last of these is outside the scope of this Study but these sources could have a major impact on air quality in the New Town. It is recommended that a permanent air quality station should be installed on North Lantau so that the background conditions can be monitored over a period of years. This could be installed on the roof of one of the GI/C buildings to be constructed during Phase 1 and should be operational at least one year before the opening of the New Airport. This is discussed further in Chapter 5 of this report.

3. WATER QUALITY

3.1 Introduction

3.1.1 Background

For background information and baseline conditions pertinent to this assessment, reference should be made to the following:

Working Paper WP8 (Revised) 'Suggested Siting for Sewage Treatment Works and Outfall';

Design Memorandum DM1 'Sewage Treatment and Disposal Facilities Outline Design';

Working Paper WP6 (Revised) 'Drainage Options for Tung Chung and Proposals for the Tai Ho Section of the North Lantau Expressway';

Topic Report TR8 'Preferred Concept Plan and Land Requirements for the First Phase';

Topic Report TR10 (Revised) 'Environmental Assessment';

Working Paper WP11 (Revised) 'Final Land Drainage Proposals'; and

Topic Report TR18 (Revised) 'Environmental Impacts from Construction of the First Phase'.

3.1.2 Sensitive Receivers

Sensitive receivers for water quality in and around the Study Area which will exist after completion of Phase 1 are indicated on Figure TR20-3.1 and include:

(a) the following water bodies :-

- o the coastal waters along the North Lantau shoreline between Pak Mong and Ta Pang Po;
- o East Tung Chung Bay. This is the water body between Chek Lap Kok and a line drawn approximately between Pak Mong and the north east tip of Chek Lap Kok;
- o the Sea Channel between the New Airport and the New Town in Tung Chung;
- o Tung Chung Wan;
- o Tai Ho Wan; and
- o existing water courses and new drainage channels.

(b) seawater intakes, generally required for cooling and flushing water. Not all of these are identifiable at the present time;

(c) the proposed SSSI where sea grass (Zostera nana) is found near San Tau.

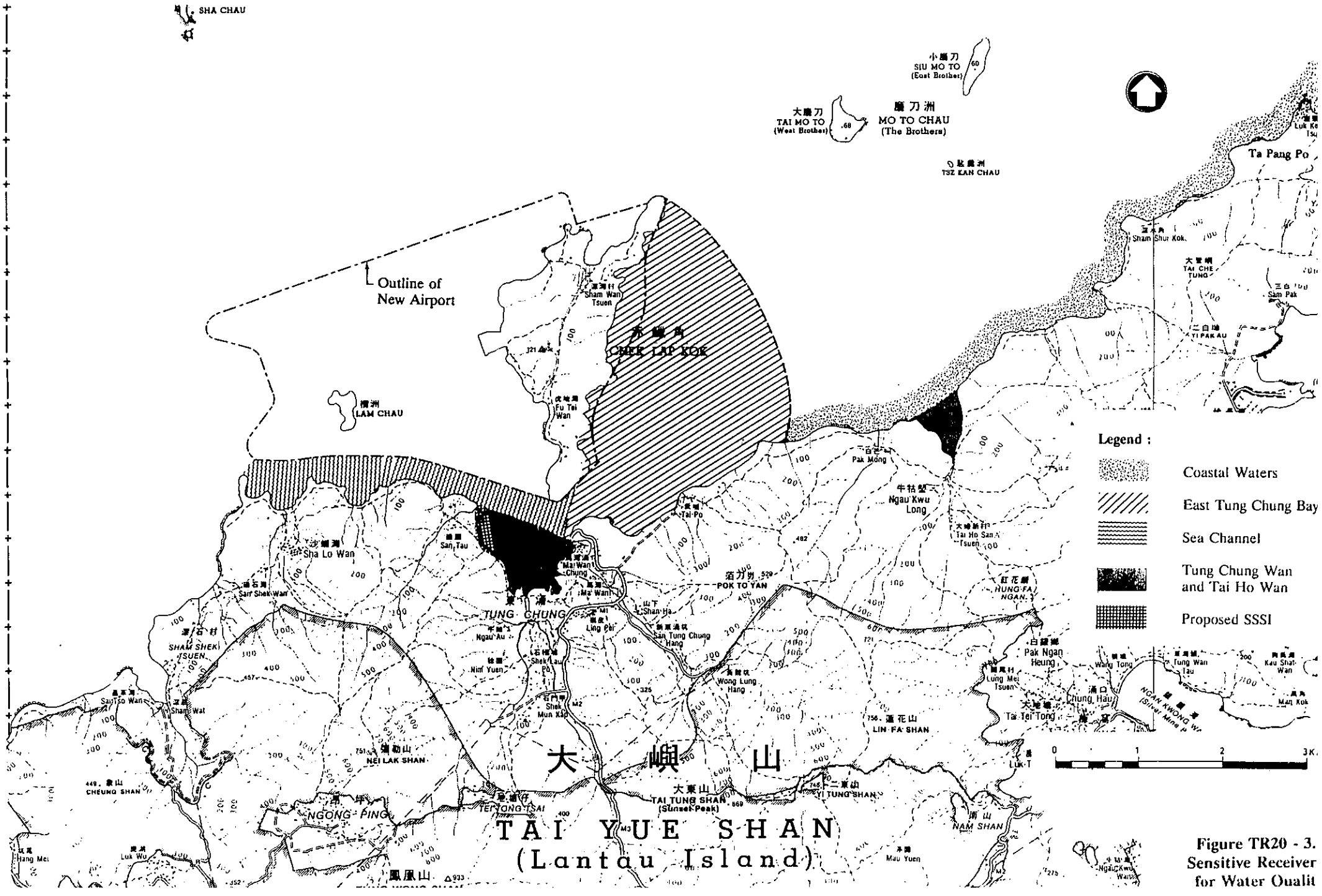


Figure TR20 - 3. Sensitive Receiver for Water Qualit

3.1.3 Assessment Methodology and Criteria

Impacts on sensitive receivers may arise from:-

- o the creation of semi-enclosed embayments which may reduce water circulation and retention time of pollutants, creating locally poor water quality. This could be a temporary situation, for example until the next phase is built, or more long term;
- o dredging or filling works for land formation or for navigation channels;
- o release of heavy metals, organic or nitrogenous material from bottom sediments;
- o disposal of dredging spoil creating locally turbid conditions;
- o discharges or spillages from activities on developed land; and
- o discharges or spillages to drainage channels from construction activities.

Impacts on water quality may be due to construction activities or a combination of both construction and operation activities following initial development.

Assessments have been made on the basis of available information and consider water movements, water quality, drainage and sewerage, sediment quality and disposal, and sensitive receivers potentially affected during each development phase.

The impacts have been assessed using the criteria in the HKPSG and :

(a) Water Quality Objectives (WQOs) promulgated under the Sewage Strategy Study for the North Western Water Control Zone, (scheduled to be gazetted at the end of 1991 but the provisions will not come into force until two years later);

(b) the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (Water Pollution Control Ordinance, Cap. 358, S.21) referred to as the Technical Memorandum; and

(c) Standards for Hong Kong Sediments from the Contaminated Spoil Management Study, 1991.

As noted earlier in this report one of the primary design aims of the NLDS has been to provide a high quality environment as far as possible in harmony with the existing environment of the North Lantau coast. Some of the impacts on water quality in one phase may be remedied by the next. The Study Area is divided into the Tai Ho Section and the Tung Chung Section. Developments in Tung Chung Wan or inner East Tung Chung Bay with the potential to affect flow rates or water quality in the sea channel are highlighted as this feature is germane to the overall development concept.

This Chapter considers water quality impacts in two parts. Firstly those overall impacts which are not specific to any phase of construction or operation are described. Secondly those impacts which will only occur during specific phases are considered. Broad details of mitigation are listed for each and proposals for environmental monitoring and audit are given in Chapter 5 of this report.

The description of impacts, and particularly construction impacts, must be read taking account of the limited information that is available on the design, the likely methods of construction or the construction programme for each phase. The approximate quantities of fill required are known and these have been detailed in Chapter 1. It has been assumed that similar methods of construction and similar placing rates of fill to those used for the Phase 1 construction will be applicable. This is likely to be conservative since future phases will be designed with fully drained reclamations wherever possible.

3.2 Impacts Common to all Phases

3.2.1 Construction Stages

Water quality impacts may arise from dredging and reclamation and the construction of infrastructure on the reclamation.

Dredging and Reclamation

Impacts on receiving water quality depend, to a large extent, on the actual working methods adopted. The preferred method of reclamation is to place fill directly on the marine mud, possibly surcharging in some areas, and inserting vertical wick drains to enhance consolidation rates. This method will minimise the amount of marine mud to be dredged and disposed.

It is probable that marine sand will be used for most of the reclamation, with the sand being placed hydraulically. The amount of suspended sediment in tailings from the reclamation will depend on the quality of marine fill used. Levels of suspended sediments will be less with better quality fill which has a low proportion of fines or if some of the fines are washed out at the borrow area. Impacts from placing fill could include increased turbidity and possibly an increased oxygen demand in the water column. These effects are expected to be only local to the reclamation site and impacts further field are not likely. The water bodies in the North Lantau area are not sensitive to levels of suspended sediments and data collected by EPD shows that natural levels of suspended solids vary widely. Local impacts from dredging and reclamation will vary phase by phase and these are discussed in more detail with the discussions below on impacts from each phase.

There will, nevertheless, be parts of the reclamation where marine mud will have to be dredged and sediment samples have been collected to identify any contaminated deposits that would need special treatment.

One sample exceeded the action level proposed in the Contaminated Spoil Management Study for cadmium. This was in the area of the First Phase reclamation and additional sampling and testing has been recommended. One other sample in the NLD Study Area showed cadmium concentrations above trigger levels. This was in the Siu Ho Wan area and it is recommended that further sampling and testing of sediments be carried out in this area during detail design for future reclamations and for the submarine outfall.

The Contractor will require a disposal licence, issued by the Environmental Protection Department, before disposing of surplus material. It may be necessary to use spoil disposal grounds some distance away from the works and fly tipping may become a problem. It is recommended that contract conditions include monitoring to ensure disposal is taking place at the allocated site and any necessary measures to minimise the impact on receiving water quality.

No specific mitigation measures are considered necessary for far field impacts from suspended sediments or from dredging and disposal of spoil. Mitigation measures appropriate for different phases of the project are discussed in more detail separately below. The following general mitigation should be included throughout the development:

(a) all reclamations should be designed to minimise dredging;

(b) contract conditions should included suspended sediment standards;

(c) baseline and impact monitoring should be carried out throughout all dredging and reclamation contract; and

(c) licences for the use of dumping grounds (issued by EPD) should included conditions designed to minimise fly dumping.

Prevention of fly dumping is very difficult unless inspectors are employed on every barge or dredger carrying spoil and this is very labour intensive and expensive. Penalty clauses can be included in contract conditions and spot checks carried out but these are unlikely to be wholly effective. There is probably no way that minor spills and leakages can be avoided but major infringments by contractors can be monitored by the installation of load cells on barges and dredgers connected to positioning systems such as the global positioning system (GPS). These will track the vessels and the location that spoil is dumped and the records can be submitted to the Site Engineer for inspection.

Monitoring at the dumping grounds will be necessary but procedures for this will depend on whether the dumping ground is allocated to the contractor for sole use or whether it is a gazetted dumping ground, such as Cheung Chau, which is being used by several contractors. In the former case it is appropriate for the contractor to survey the bathymetry of the dumping ground before dumping starts and on completion. Interim surveys, say at three month intervals, will be appropriate for the larger contracts. Monitoring for joint use dumping grounds will still be necessary but the responsibility for the monitoring is less clear. It may be more appropriate to let a separate monitoring contract but this needs to be reviewed on a case by case basis.

Water Quality Impacts from Work Sites

It has been assumed that work sites will be established at each development area. Possible water quality impacts include release of sediments or oil to water courses, streams or marine waters, accidental spillages to water courses and streams and disposal of domestic and construction wastes.

Sewage treatment and disposal facilities should be mandatory at each site. Contractors' should be required to connect on-site sewage disposal facilities to the foul sewers for treatment and final disposal at Siu Ho Wan unless they are prepared to treat sewage to an acceptable level on site. Effluent should meet the standards in the Technical Memorandum to be acceptable. Pretreatment of the effluent may be required in any case to comply with the effluent standards in the Technical Memorandum.

Solid wastes should be collected at a central refuse collection point on each development site for onward transfer to the Refuse Transfer Station at Siu Ho Wan. An alternative disposal method is burial in the reclamation.

Work sites associated with the industrial park could adversely affect water quality if pollutants are spilled or discharges made to the east of the site. Sensitive receivers include seawater or cooling water intakes which may be installed at the railway depot. If suspended solids levels in the adjacent water column exceed operating limits at the intake points, ameliatory action may be required.

To the west of this site sensitive receivers include the water body in Tai Ho Wan. At present ambient current velocities in this area are slow and any pollutants released into the embayment may take a long time before being dispersed. This area will be overlooked by passengers arriving at the New Airport as well as the high quality residential and commercial properties in the New Town and the visual impact of any pollution could be significant.

Mitigation measures proposed for work sites are:

(a) enforcement of the Technical Memorandum for all works sites;
(b) collection of domestic solid waste at a recognised central point for onward disposal at the RTS;
(c) use of stoplogs in drainage channels or streams to contain and then collect spillages or discharges;
(d) separation of surface water runoff using oil and grit separators; and
(e) inclusion of pollution control clauses in the contract conditions.

3.2.2 Operation Stage

The Sea Channel

The Sea Channel has been designed to maintain water quality in East Tung Chung Bay and to provide a buffer between the New Airport and Tung Chung. The design has included a hydraulic and water quality assessment which has concluded that the channel should meet its stated objectives. However this needs to be confirmed by monitoring of water quality in the channel and attention to detail in the designs of the channel walls as these are progressed during subsequent stages of the development. The characteristics of the channel will change as reclamation is formed in Tung Chung Wan. It is recommended that water quality in the channel is monitored on a regular basis and that the velocities over a cross section of each end of the channel are monitored on completion of each phase of reclamation. The first monitoring should be immediately following completion of the New Airport and Tung Chung Phase 1 reclamations. The results of this monitoring should be taken into account in subsequent designs with the objective of maintaining the existing flow into East Tung Chung Bay.

Water Quality Impacts from Effluents from Completed Development

All units at the industrial park will be connected to the foul sewer providing an opportunity to monitor and control the waste water processes within. Land leases should include conditions related to the specified processes and define any pretreatment of effluent, which may be necessary, prior to discharge to the foul sewer. Standards required should be in accordance with the Technical Memorandum. Review of the leases will be required should any operational changes occur. As with all such conditions they are only useful if followed up by subsequent monitoring. This is discussed in Chapter 5.

One of the basic assumptions made, in keeping with the recommendations of the Sewage Strategy Study, when determining the level of sewage treatment required for the NLD was that metals in industrial effluents would be removed at source. It has been noted that in the New Airport Master Plan Study Working Paper No. 34 'small but significant amounts of heavy metals will be discharged to the foul sewer from maintenance workshops'. This will need to be given further consideration in the context of treatment levels and enforcement of metal removal at industrial units.

The Technical Memorandum will be used to control discharges to the foul sewer for each individual industry. The level of sewage treatment required for the NLD was necessarily developed by making certain assumptions and using best estimates for processes. As flows and loads build up, consideration may need to be given to control of effluent from the industrial park. Alternatively the programme of upgrading works for the Sewage Treatment Works should be kept in review, and if necessary treatment levels upgraded.

Mitigation measures proposed for impacts from effluents are:

(a) enforcement of the Technical Memorandum for users of the industrial parks in the NLD and New Airport;
(b) issue of licences or leases on condition that any necessary pretreatment measures are taken prior to discharge and that effluents are monitored; and
(c) regular visual inspection of the drainage channels to determine when maintenance cleaning is required; and
(d) impact monitoring and auditing of water quality in Tai Ho and Tung Chung Wan.

Drainage

Stormwater drainage channels will be designed to carry runoff from the steep upland basins and from reclamation and development areas. The larger stream courses in Tung Chung, Tai Ho Wan and Siu Ho Wan are left as open channels while most channels in reclaimed areas will be culverted.

Boulder traps sand traps and silt traps will be included to minimise siltation. Dry weather channels will be included to aid flushing during periods of low flow thereby minimising the impact on receiving water quality. Silt, sand and boulder traps will require regular cleaning.

3.3 Phase 2

3.3.1 Water Movements

Reclamation comprises all site formation for the first stage of the industrial park in area 9 and is scheduled (subject to the findings of the SARA Study) to commence in 1996 and is scheduled to be completed in 1998. This could affect local water movements and it is expected that exchange of water between the large embayment formed to the east and mainstream flows will be slow. Within central Tung Chung the land formation will be on land which will have no impact on water movements with the exception of diversions of stream courses and construction of new drainage channels in Tung Chung. In east Tung Chung land formation of Planning Areas 15 and 19 will commence in 1993 and will be on reclamation. These works will reclaim the embayed area formed by the Phase 1 development although this reclamation is unlikely to affect water movements either during or after construction. Reclamation methods should aim to limit the water quality impact on the adjacent water column.

Mitigation measures proposed to minimise water movement impacts should include:

(a) those common to all phases discussed above; and

(b) attention to detail of the seawall alignment of the first stage of the industrial park at Tai Ho and of the Phase 2 reclamation in east Tung Chung.

3.3.2 Water Quality

Construction of the first stage of the industrial estate by means of reclamation could create water quality impacts. These will lead to an increase in suspended solids, increased turbidity and an increased oxygen demand in the water column adjacent to the reclaimed area. However, such impacts could be reduced by limiting the extent of dredging prior to land formation and adoption of reclamation methods to limit the impact on the adjacent water column detailed above. Of particular importance should be the maintenance of existing quality in the embayment between the east of the Phase 2 reclamation and the Phase 1 reclamation in the vicinity of the Refuse Transfer Station site. This is considered to be a sensitive water body as it is predicted that water exchange between the embayment and the mainstream flows will be low. Discharge into this embayment should wherever possible be avoided. Any necessary inputs into this sensitive embayment would build up as their dilution or dispersal would be slow so any discharges should be strictly controlled by the enforcement of the Technical Memorandum on Effluent Standards.

Additionally, site formation and work sites could also affect water quality in drainge channels and streams.

Mitigation measures to minimise water quality impacts should include:

(a) those common to all phases discussed above;

(b) attention of detail of newly formed temporary or permanent seawalls;

(c) impact monitoring in the embayed area east of the Phase 2 reclamation comprising the second stage of the industrial park and continuation of impact monitoring in East Tung Bay while marine based construction work is undertaken; and

(d) control of drainage channels where construction works are undertaken via silt traps and stoplogs when necessary to prevent polluted, silty discharge waters, especially into Tung Chung Wan.

3.3.3 Drainage

Water quality impacts arising from the limited Phase 2 extension of the drainage system in Tung Chung via existing stream diversions and diversions to existing drainage channels. These activities will generate silty downstream waters.

Mitigation of drainage associated water quality problems could be via the use of silt traps and stoplogs where monitoring indicated significant deleterious impacts or when spillages occur.

3.4 Phase 3

3.4.1 Water Movements

Reclamation for the second stage of the industrial park could affect local water movements and it is expected that exchange of water between the bay formed to the east and mainstream flows will be slow.

Part of the existing intertidal mudflat in Tai Ho Wan will be reclaimed for development of Planning Area 11. Water movements within the bay are likely to be affected both during and after construction.

Extensive reclamation in this phase has the potential to adversely affect flows in Tung Chung Wan and in the sea channel.

Planning Areas 30, 31, 32, 41, 42 and 65 will all be developed on existing land. Consequently impacts will be restricted to diversion of stream courses and the building of new drainage channels. Planning Area 29, designated as open space, will require a small area of reclamation alongside the sea channel. It is unlikely this area will affect flow rates either during or after construction. Planning Areas 33, 34, 35 and 36 in Tung Chung Wan will be, at least in part on reclamation. All these areas require diversion of the existing drainage channels but alterations to the flow regime will only be local. The method of reclamation and the alignment of the temporary seawalls will determine the extent to which flows out of Tung Chung Wan are affected. Small embayments will be formed both east and west of Area 36. Alterations to flow in this area combined with diversions created by the small island in the sea channel may have an impact, albeit temporary, on water quality.

In the east of the Sea Channel an artificial island (3.3 hectares) is proposed to form part of the town park (Planning Area 28). Hydraulic design of the channel to the south of the island will require particular attention given to maintaining flow through the secondary channel. One of the hinterland drainage culverts will discharge into this channel and this will improve flushing during the wet season.

Formation of land in Planning Areas 15, 16, 18, 19, 20, 58 behind the breakwater constructed in Phase 1 will have little impact on water movements either during or following construction.

Mitigation measures to minimise water movement impacts should include:

(a) those common to all phases discussed above;

(b) attention to detail of seawall alignment particularly at the industrial park in Tai Ho and at Tai Po; and

(c) alignment of the seawall of the channel island to maintain flow both in the secondary channel and in the sea channel.

3.4.2 Water Quality

Construction of the second stage of the industrial estate could create water quality impacts similar to those identified for Phase 2. The embayment to the east will be partly filled and it is likely that flushing of any pollutants from this area will be extremely slow.

Land within Tai Ho Wan will be formed by drained reclamation techniques. The drainage channel to the east should be maintained and care will be required to ensure this channel does not become polluted.

Site formation and works sites could affect water quality in drainage channels and streams, while reclamation may create high turbidity levels in Tung Chung Wan. Reclamation in Tung Chung Wan could affect the viability of the sea grass at San Tau and cause sedimentation in the sea channel. The sea grass is presently thriving in a marine environment in which suspended solids levels vary seasonably it is considered this species is probably highly tolerant of fluctuating water quality. However, impact monitoring is recommended whenever marine based activities are undertaken in Tung Chung Wan. If the suspended solids levels rise more than 30 per cent above ambient levels, mitigation measures may be required to protect this species.

The exchange of water between Tung Chung Wan and the Sea Channel and ultimately the main stream marine environment will be slow. Pollutants could be retained within these waters for a long period of time before being dispersed or diluted. Visual intrusion will be an important factor by this stage. Unless controlled, floating refuse could litter the coastline, particularly in the Sea Channel. Similarly construction of the residential developments adjacent to Tai Po could have an impact on water quality, especially in terms of aesthetics. Ambient current velocities in this area are probably only of the order of 0.1 - 0.2 m/s. Consequently dispersion and dilution of pollutants will be limited and it is more likely that deposition will occur close to the site.

Mitigation measures proposed to minimise water quality impacts should include:

(a) those common to all phases discussed above;

(b) attention to detail of the seawall alignment in Tung Chung;

(c) impact monitoring in the Sea Channel, San Tau, Tung Chung Wan, Tai Ho Wan and adjacent to any seawater intakes; and

(d) control of drainage channels where construction works are undertaken to prevent the discharge of drainage waters containing silt and other pollutants particularly to Tung Chung Wan. Use of temporary silt traps or stoplogs when necessary.

3.4.3 Drainage

Impacts on water quality from extension of the drainage system in both Tai Ho and Tung Chung during Phase 3 will be from diversion of existing streams and drainage channels and discharge of waters polluted with silt.

Mitigation measures similar to those proposed for Phase 2 should apply.

3.5 Phase 4

3.5.1 Water Movements

The seawall at Tai Ho has been designed to create visual interest. However two partial embayments will be formed and these should be considered in more detail during detail design with the objective of sustaining, and if possible, enhancing flow of water in this area to maintain water quality.

Developments in Tai Ho Wan are expected to exert impacts similar to those discussed in Phase 3. The artificial lake at Pak Mong will be designed and constructed during Phase 4. Flow and pollution loads monitoring of the streams entering the lake and sea water outside the lake will be needed so that an environmental design may be carried out. Any drainage control structures should be designed to maximise flushing of the lake and no pollution loads from adjacent development should be allowed into the lake. The lake should also be designed to maintain the wetlands at Pak Mong. Otherwise land formed in Tai Ho Wan (Planning Areas 12, 13, 14 and 15), designated for residential and recreational purposes, is unlikely to have other than a minor impact on water movements.

Reclamation of land seaward of the NLE and west of the railway depot will be undertaken during this phase (Planning Areas 17 to 29 inclusive). Formation of the land has the potential to alter water movements out of the lake at Pak Mong. The design of the seawall in this area will require careful attention to detail to maximise flushing of the bay formed due west of the site and the artificial lake.

Reclamation of Planning Areas 37, 45, 46 and 47 in Tung Chung Wan will complete the drainage design for Tung Chung Wan and flow of water into the sea channel should improve.

The residential, commercial and open space in Planning Areas 51 to 57 due east of the ferry terminal would affect local water movements and water exchanges with the sea channel. This will depend upon the final shape of the sea wall and the seaward extent of the reclamation. Both aspects require further detailing at a later stage.

Mitigation measures to minimise water movement impacts should include:

(a) those common to all phases discussed above; and

(b) attention to detailing the final alignments of seawalls throughout but particularly in Tung Chung Wan, inner East Tung Chung Bay and in the Pak Mong area.

3.5.2 Water Quality

Phase 4 will see the completion of most of the reclamation and land formation presently proposed for the New Town and the partial embayments at Tai Ho Wan and Tung Chung Wan will be filled with the exception of the Phase 5 area in Tung Chung. This will remove most of the areas where water exchange could be poor and water quality along the sea frontage of the New Town will generally improve so long as the sea walls are designed to maximise flow as recommended above.

Construction of reclamation in Tung Chung Wan could impact on water quality due to sedimentation in the sea channel and the proposed SSSI. Impact monitoring is recommended during these works in the sea channel and adjacent to the site of the proposed SSSI.

Mitigation measures similar to those proposed for Phase 2 and 3 should apply.

3.5.3 Drainage

Drainage systems will be substantially completed during this fourth phase. If the water feature has not been created as part of the Phase 2 developments it will be built during this phase. It is proposed that this will include a control structure such as a rubber dam which will have the additional function of being a pollution control mechanism once operational.

Mitigation measures similar to those recommended for Phase 2 should apply.

3.6 Phase 5 Residual Impacts

3.6.1 Water Movements and Sedimentation

Phase 5 will be the completion of the development as it is presently envisaged. There are no fundamental residual water movement impacts as it is considered that the design of the development has resolved all the main issues. Residual impacts therefore relate mainly to uncertainties surrounding sedimentation rates due to the modification in the tidal regime following formation of the New Airport platform and NLD reclamations.

Sedimentation rates within East Tung Chung Bay and the Sea Channel should be monitored on an annual basis and an audit of the efficiency for the sea channel, to flush both itself and the adjacent water bodies, should be carried out. Maintenance dredging of the Sea Channel and the navigation channel to the ferry terminal at Tai Po will probably be required but the frequency and quantities involved remain uncertain.

3.6.2 Water Quality

The main pollution loads from the New Town will enter the water body via the sewage outfall. Preliminary assessments of sewage flows and loads were based on the residential and employment forecasts given in LDPC Paper 20/90. The accuracy and reliability of such forecasts requires professional judgement to be applied when determining levels of sewage treatment. Although recourse was made to some of the WAHMO models, these are also based on many assumptions. Monitoring of flows and loads and receiving waters is thus recommended so that the programme for upgrading of sewage treatment works may be reviewed. Monitoring of water quality in East Tung Chung Bay will allow an audit of the efficiency of the Sea Channel.

The water features at Tai Ho Wan and Tung Chung Wan should enhance the environmental quality of the development. However, it is not certain whether the Pak Mong wetlands, which comprise the main ecological feature in this area, will be able to sustain life in the mainly freshwater habitat or indeed whether there will be sufficient ingress of seawater to maintain the brackish conditions in which mangrove communities thrive. This needs to be taken into account in the detail design of the lake.

3.6.3 Drainage

There should be no residual drainage impacts or impacts from Phase 5 construction.

3.7 Construction Phase Action Plan

3.7.1 General

Some components of the developments have the potential to adversely affect water movement and water quality during construction. Proposals for mitigation measures are made in the following paragraphs for each major component of the development for mitigation measures with the aim of minimising impacts. These proposals are not intended to form an exhaustive list, rather to highlight areas requiring specific attention. Furthermore they do not preclude the need for environmental assessments and impact monitoring which are further discussed in Chapter 5.

3.7.2 Work Sites

The main impact on water quality from work sites will be from effluent discharges and spillages. Inclusion of clauses covering the following mitigation measures is recommended in all contracts:

(a) ensure liquid and solid wastes arising on-site are properly disposed of;

(b) ensure liquid domestic wastes are treated to comply with the Technical Memorandum on Effluent Standards;

(c) dispose of any chemical wastes at the Chemical Waste Treatment Facility planned for Tsing Yi;

(d) dispose of solid waste at a central refuse collection point or in parts of the reclamation;

(e) provide adequate and appropriate pollution control equipment to deal with accidental spillages both on and off-site;

(f) monitor water quality, during marine based activities, to ensure his operations are not creating adverse impacts on water quality in the Sea Channel, Tung Chung Wan or East Tung Chung Bay;

(g) undertake impact monitoring in Tung Chung Wan, the Sea Channel and East Tung Chung Bay as appropriate;

(h) arrange that oily or bituminous wastes are cleaned and re-used or sent to either a landfill site or the Chemical Waste Treatment Facility on Tsing Yi Island for disposal;

(i) minimise the risk of marine pollution by floating refuse possibly by installation of refuse booms;

(j) prepare a spill action plan to handle potentially polluting spillages including any made to drainage channels;

(k) provide basic pollution control equipment to clean up spillages; and

(l) provide access to a cleaning team in the event of spillages or clean up of floating refuse.

3.7.3 Phase 2

Industrial Park

The following should be taken into account:

(a) adoption of reclamation methods to limit the impact on the adjacent water column;

(b) limiting the extent of dredging prior to land formation;

(c) maintaining flows out of Tai Ho Wan and minimising potential ingress of pollutants via control drains;

(d) all clauses relating to work sites;

(e) undertaking impact monitoring adjacent to the work site and in Tai Ho Wan when required;

(f) impact monitoring in front of any seawater intake points, eg at the railway depot, for the duration of marine based construction activities;

(g) if suspended solids levels in the water column adjacent to the aforementioned intake points rise above levels, agreed before commencement of the works, then consideration may need to be given to either altering working methods causing the problem or installation of temporary silt curtains for the duration of the works;

(h) provide personnel trained in the use of basic pollution control equipment kept on-site; and

(i) compliance of any off-site discharges with the Technical Memorandum. Discharges should not be made to either bays east or west of the site.

Tung Chung

In Tung Chung Wan Phase 2 works are land based activities. Action required to limit water quality impacts relate to:

(a) clauses a, b, c, d, e and h given above for work sites;

(b) general site cleanliness; and

(c) separation of silt and grease from surface water runoff to comply with standards given in the Technical Memorandum.

Tai Po

For the development in Tai Po behind the breakwater, Planning Areas 9, 14, 17, 21 and part of 18 and 19, the following actions are proposed:

(a) adoption of all clauses relating to work sites;

(b) particular attention given to floating refuse, installation of refuse nets and the routine collection of water borne litter to prevent it spilling into inner East Tung Chung Bay; and

(c) impact monitoring in inner East Tung Chung Bay while marine based construction work is undertaken.

3.7.4 Phase 3

Extension of the industrial park:

The conditions proposed in Phase 2 will apply.

Tai Ho Wan (Planning Area No. 11)

Within Tai Ho Wan consideration will need to be given to the following:

(a) all clauses relating to work sites;

(b) adoption of drained reclamation technique; and

(c) use of stoplogs in the existing drainage channel in the event of spillages;

Artificial Island for Town Park

During the creation of the artificial island, Planning Area No. 28, particular attention will need to be given to:

(a) all clauses relating to work sites;

(b) adoption of reclamation techniques to minimise the impact on water quality within the Sea Channel;

(c) impact monitoring in the sea channel, inner East Tung Chung Bay and adjacent to the site of the sea grass at San Tau, when marine works are undertaken; and

(d) should the ambient suspended solids concentrations in the water column increase by more than 30% then consideration may have to be given to installation of silt curtains.

Other Areas in Tung Chung

In Tung Chung Wan construction of Planning Areas 33, 34, 35 and 36 require attention to be given to:

(a) all clauses relating to work sites apply;

(b) reclamation methods adopted should minimise the impact on water quality;

(c) impact monitoring should be undertaken for the duration of all marine based activities in Tung Chung Wan, the sea channel and particularly at San Wau; and

(d) mitigation measures should be adopted if the level of suspended solids rises more than 30% above ambient.

Upper Tung Chung Valley

Development of Planning Areas 41, 42 and 65 will require attention to be given to:

(a) clauses a, b, c, d, e and h for work sites;

(b) use of temporary silt traps or stoplogs to prevent pollutants being conveyed by drainage channels; and

(c) compliance with the standards set in the Technical Memorandum for any discharges made to the existing stream course.

Tung Chung East

Construction of Planning Areas 15, 16, 18, 19, 20 and 58 in East Tung Chung Bay will require attention given to the following:

(a) all clauses relating to work sites;

(b) impact monitoring undertaken in East Tung Chung Bay as well as the sea channel when marine based activities are being undertaken; and

(c) supply of personnel trained in the use of basic pollution control equipment and the routine collection of refuse and floating debris.

3.7.5 Phase 4

Siu Ho Wan

Final formation of land in Siu Ho Wan and for the industrial park will require similar conditions to those given for phase 2.

Tai Ho Wan

In Tai Ho Wan development of Planning Areas 12, 13, 14 and 15 will require special attention given to:

(a) all clauses relating to work sites;

(b) adoption of drained reclamation techniques;

(c) minimising the potential impact on water quality in the lake during development;

(d) impact monitoring of water quality in the lake for the duration of the water based construction phase; and

(e) use of a pollution control mechanism if any pollutants are accidentally released into drainage channels.

Planning Areas 17 to 29

Land formation for the development of Planning Areas 17 to 29 inclusive, will require particular attention to be given to:

(a) all clauses relating to work sites;

(b) adoption of reclamation methods which will have minimum impact on receiving water quality;

(c) maintenance of flows within the area, especially from the artificial lake;

(d) rapid response to spillages especially those from the west of the site;

(e) impact monitoring adjacent to the site and especially close to the inlet of the pak Mong artificial lake; and

(f) impact monitoring in front of any seawater or cooling water intakes which may be located within a 2 kilometre radius of the work site.

Planning Areas 51 to 57

For the construction of Planning Areas 51 to 57 inclusive, east of the Tai Po ferry pier, account will need to be given to:

(a) all clauses relating to work sites;

(b) adoption of reclamation methods to minimise the impact on water quality and local flows;

(c) impact monitoring in East Tung Chung Bay and the sea channel; and

(d) consideration given to altering work methods if local water quality is affected.

3.8 Operational Guidelines

Following the construction or development of each of the phases for the NLD some new components may adversely affect water quality. Proposed operational guidelines are given in the following paragraphs:

Industrial Park

- lease conditions will include any requirement for pretreatment of effluent prior to discharge to the foul sewer;
- leases will be granted for specific activities and any changes in process design or effluent produced;
- metals will be removed from waste waters at source and not discharged to the foul sewer;
- access will be provided for monitoring effluent flow rates and quality.

Railway Depot

- discharges or accidental spillages will be controlled by enforcement of the Technical Memorandum;
- surface water collectors and oil traps to be provided in maintenance areas; and
- bunding may be required around fuel storage areas.

Water Features

- maintenance of the control structure at the Pak Mong lake; and
- prevention of accidental spillages entering water features or other drainage channels using stoplogs or temporary traps.

Refuse Transfer Station

- collection of vehicle washdown waters and leachates from tipping hall and compaction units to be collected and directed to sewage treatment works;
- monitoring of leachate quality and quantity prior to discharge to foul sewer; and

- surface water collectors in vehicle maintenance areas with separation of the effluent before the aqueous fraction is discharged to the foul sewer for treatment and the oil fraction is re-used or drummed and disposed of at the Chemical Waste Treatment Facility on Tsing Yi.

Sewage Treatment Works

- monitoring of influent and effluent;
- audit of the diffuser performance; and
- monitoring of receiving water quality to determine whether any alterations in the programme for upgrading the treatment levels is required.

3.9 Key Issues and Conclusions

3.9.1 Key Issues

Key issues identified during the foregoing assessment include:

(a) the final alignment of seawalls will be critical for the maintenance of flow between the Sea Channel island and the mainland;

(b) similarly alignment of seawalls is important at the industrial park, the area seaward of Pak Mong lake and east of the Tai Po ferry pier;

(c) during construction most of the potential water quality impacts relate to land formation and operation of work sites;

(d) impact monitoring is especially recommended when marine based construction activities are undertaken.

3.9.2 Conclusions

(a) Short term impacts on water movements and water quality will mostly be resolved by successive developments.

(b) Residual impacts on the flow regime consequent to development of the four phases, relate principally to alterations in sedimentation rates. Areas most likely to be affected include the Sea Channel, and the secondary channel as well as East Tung Chung Bay.

(c) Residual water quality concerns relate to the future assimilative capacity of the marine water body.

(d) Monitoring of effluent from development on North Lantau especially at the industrial park is recommended.

(e) Water quality monitoring during and following construction and development in each phase will be necessary to maintain standards in the North Western Waters in general, and in the Sea Channel, Tung Chung Wan, East Tung Chung Bay and Tai Ho Wan in particular.

4. NOISE

4.1 Introduction

4.1.1 Purpose

This Chapter presents an assessment of the likely noise impacts of the development at stages during the construction and operation phases and presents mitigation measures for inclusion into the construction contracts and engineering designs where the noise impacts are considered to be unacceptable. In particular, it reviews any residual noise conflicts between the detailed layout plans for Phase 1 (set out in TR17 Revised) and the proposed noise setbacks.

4.1.2 Background

Topic Report TR10 (Revised) "Environment Assessment" presented an assessment of the likely noise impacts of the Preferred Concept Plan. The findings have formed the basis for the development of the Recommended Outline Development Plan (RODP) reported in Topic Report TR11 and the associated addendum. Construction noise impact during the first phase have been included in Topic Report TR18 (Revised) "Environmental Impacts from Construction of the First Phase". The NLE Consultant has presented an assessment of the noise impact from the NLE on land use developments. Advance information on road traffic noise and train noise impacts has been incorporated in the assessment of the noise impacts for the whole of the NLD.

New Airport noise has been the subject of the Airport Master Plan Study (AMPS). All phases of the NLD are outside the NEF 25 contour (the HKPSG guideline for airport noise) and therefore will not be constrained by aircraft noise.

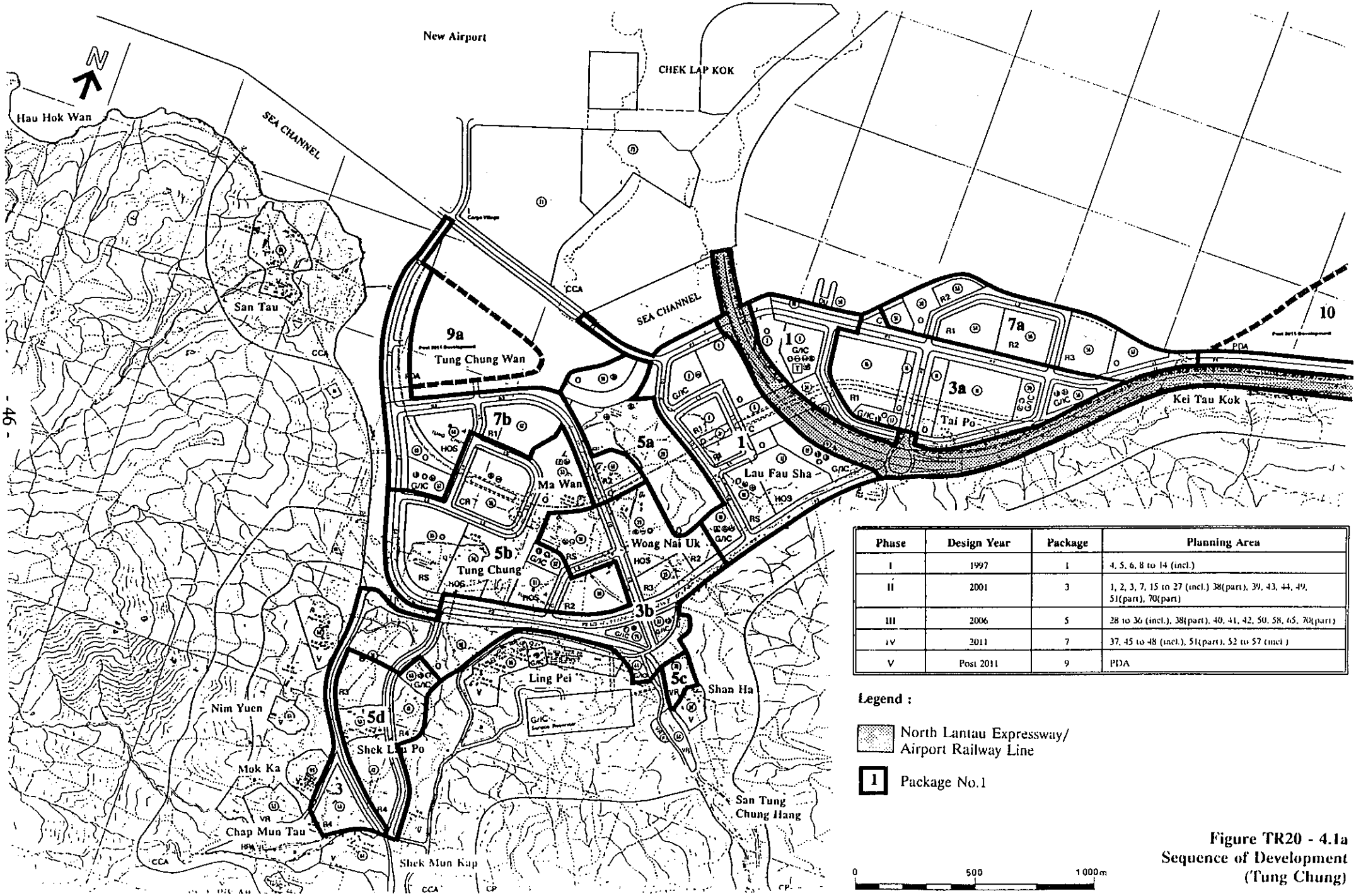
TR10 (Revised) reported that Industrial Park noise, Refuse Transfer Station noise and Railway Depot noise impacts could not be assessed as no details of the types of industry, level of activity or types of buildings were available. It is a requirement of the HKPSG that all fixed noise sources should be located and designed so that when assessed in accordance with the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM), the level of the intruding noise at the facade of the nearest sensitive use should be at least 5dB(A) below the Acceptable Noise Level (ANL) detailed in the TM. It has been assumed that these conditions will be applied to this project and there should therefore be no significant off-site noise impacts on the sensitive land uses at the interface with the proposed Industrial Park, Refuse Transfer Station or Railway Depot.

4.2 Construction Phase Assessment

4.2.1 Key Issues

Construction noise could produce an adverse impact on the existing village settlements and the new residential development. Tung Chung and Tai Ho will be developed in five phases with construction commencing in 1992 and extending beyond 2011. Figures TR20-4.1a and b show the phasing and location of the work sites.

Topic Report TR18 (Revised) assessed the construction noise impact from the first phase development using eleven noise neighbourhoods in North Lantau. Following the first phase development, there will be a need to address the impact on NSRs in the first phase development. Meanwhile, many of the existing village settlements in North Lantau which fall within the development areas will have been cleared or resited. For example, Tai Po will be



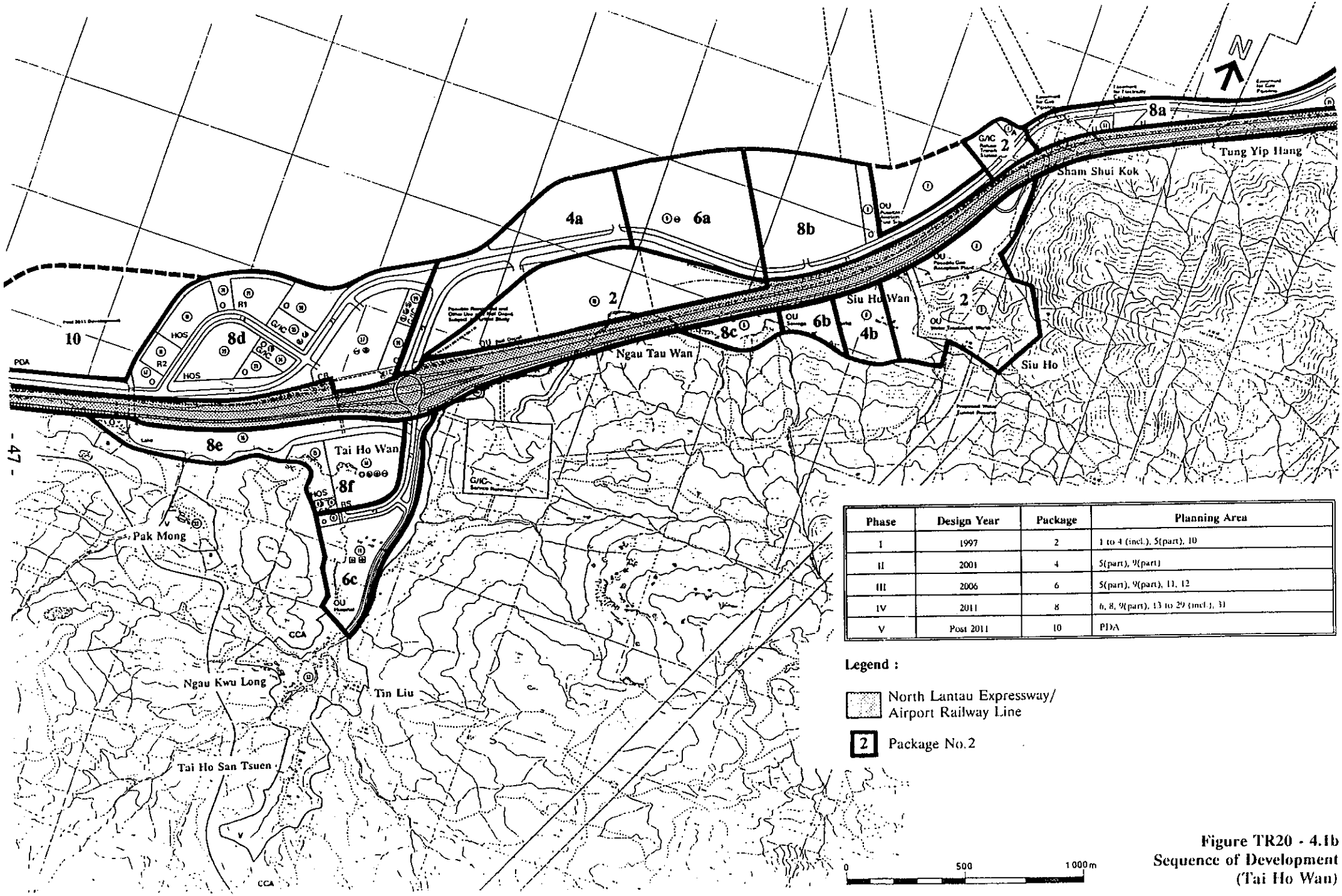
Phase	Design Year	Package	Planning Area
I	1997	1	4, 5, 6, 8 to 14 (incl.)
II	2001	3	1, 2, 3, 7, 15 to 27 (incl.) 38(part), 39, 43, 44, 49, 51(part), 70(part)
III	2006	5	28 to 36 (incl.), 38(part), 40, 41, 42, 50, 58, 65, 70(part)
IV	2011	7	37, 45 to 48 (incl.), 51(part), 52 to 57 (incl.)
V	Post 2011	9	PDA

Legend :

North Lantau Expressway/ Airport Railway Line

1 Package No.1

Figure TR20 - 4.1a
Sequence of Development (Tung Chung)



Phase	Design Year	Package	Planning Area
I	1997	2	1 to 4 (incl.), 5(part), 10
II	2001	4	5(part), 9(part)
III	2006	6	5(part), 9(part), 11, 12
IV	2011	8	6, 8, 9(part), 13 to 29 (incl.), 31
V	Post 2011	10	PDA

Legend :

North Lantau Expressway/ Airport Railway Line

2 Package No.2

Figure TR20 - 4.1b
Sequence of Development
(Tai Ho Wan)

relocated during Phase 1, Ma Wan and Wong Nai Uk will be resited during the Phase 2 and Ma Wan Chung and Sha Tsui Tau will be resited during Phase 3. Due consideration has been given to the interaction of the development phasing in order to minimize any unnecessary impact.

4.2.2 Construction Assessment Methodology and Impact Criteria

Civil engineering works for each phase will comprise reclamation/dredging and cutting/excavation activities. The construction noise assessment has assumed that the subsequent phases of development will comprise similar activities to those in Phase 1 as discussed in NLDS TR18 (Revised).

Reclamation/dredging will include:

(a) dredging of marine mud underneath sea walls using grab dredgers;

(b) seawall construction by dumping from barges, followed by placing fill from derrick barges;

(c) reclamation by sand filling placed hydraulically over the marine mud;

(d) access road construction; and

(e) concrete placing for drainage channels and infrastructure construction.

Cutting/excavation will include soft excavation and rock excavation using excavators loading materials into dump trucks. Access road construction and concrete placing is likely to be required. Drilling for rock blasting is also included in order to present a worst case noise scenario.

On the basis of the construction methods for the first phase development, similar activities and sub-activities have been developed for Phase 2 and all the subsequent phases, together with a list of powered mechanical equipment. Table 4.1 summarizes the anticipated construction activities and the plant and equipment likely to be used for all the phases. Sound power levels are also included.

Reclamation and dredging will require 24-hour working under normal circumstances, while other activities will normally be carried out during the daytime (0700-1900 hours). However, contractors may need to extend the working hours in order to make up for any loss of time due to bad weather or unforeseeable delays. Under the latter situation, the contractors will have to apply for a construction noise permit and the Noise Control Ordinance will have to be fully complied with.

According to the Technical Memorandum on 'Noise from Construction Work Other Than Percussive Piling', the ANLs for the works excluding percussive piling are as detailed in Table 4.2.

Table 4.1 Anticipated Construction Activities for Phase 2 and All Subsequent Phases

Activity	Sub-activity	Plant and Equipment	Qty	SWL/ dB(A)
Reclamation/Dredging	Dredging	Dredger (grab)	3	112
	Seawall	Barge (grab)	6	112
	Reclamation	Bucket loader	10	118
		Truck	20	117
		Bulldozer	10	115
		Roller	3	108
		Grader	2	113
	Concrete Placing	Batching plant	1	108
		Mobile crane	1	112
		Truck mixer	4	109
	Road Paving/ Asphalt	Pneumatic compactor	2	105
	Infrastructure	Bitumen batching plant	1	108
		Concrete batching plant		
		Truck mixer	3	108
		Concrete pump		
		Mobile crane	12	109
		Tower crane	3	109
		Truck	2	112
			15	95
			10	117
Cutting/ Excavation	Rock Excavation	Bucket loader	7	118
		Truck	14	117
		Bulldozer	7	115
		Mobile pneumatic drill	10	128
		Backhoe excavator	4	112
	Soil Excavation	Bucket loader	3	118
		Truck	6	117
		Bulldozer	3	115
		Backhoe excavator	3	112
	Road Paving/ Asphalt	Pneumatic compactor	1	105
	Infra-structure	Bitumen batching plant	1	108
		Concrete batching plant		
		Truck mixer	3	108
		Concrete pump		
		Mobile crane	12	109
		Tower crane	3	109
		Truck	2	112
			15	95
			10	117

Table 4.2 Acceptable Noise Levels for Construction Works Other Than Percussive Piling

Period \ ASR	A	B	C
All days during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day-time and evening (0700 to 2300 hours)	60	65	70
All days during the night-time (2300-0700 hours)	45	50	55

Twelve village groups which cover all existing village noise sensitive receivers likely to be affected by the construction in the Study Area have been identified. They include all the existing village settlements in Tung Chung, Tai Ho Wan and Siu Ho Wan. Appendix C, Table C22 lists the affected villages within each village group. The locations of these village groups are shown in Figure TR20-4.1c. In addition new noise sensitive receivers have been referred to by Planning Areas which are indicated in TR20-1.2a and 1.2b.

As the development progresses, NSR in the developed areas will need to be included and the relocated villages will need to be excluded from the list of NSRs. Due consideration has been given to identifying all of the NSRs which are likely to be affected by each phase of the development.

Additionally, it should also be noted that from the end of Phase 1, the area will change from a rural area, Type "A" development, to a low density residential area consisting of low rise or isolated high-rise developments, Type "B" development. Thus the Area Sensitivity Rating for the construction noise assessment should be Type "B" development.

All phases of the New Town will designed to comply with the HKPSG requirements and therefore, according to the Technical Memorandum there will be no Influencing Factors.

The calculation methodology is similar to that described in Topic Report TR18 (Revised). The predicted noise levels, Leq(5-min.), at the facade of the worst-affected NSR have been compared with relevant noise criteria.

No details of the need to work in restricted periods are available at the present time so this assessment has assumed that reclamation and dredging could be working throughout the non-restricted period and the restricted periods but that other activities would work only until 2300 hours. This allows for the situation where contractors may wish to work beyond 1900 hours to catch up lost time. This is not likely to happen for all activities and will only happen for part of the construction. However the assessment is for the worst case. Noise levels of 50 dB(A) have therefore been used to test reclamation and dredging activities and 65 dB(A) has been used to test other activities at residential receivers.

Normal daytime activities are not commonly of major concern except at schools, hospitals and the like. The likely impacts on these receivers have been assessed by taking a daytime noise criterion of 75 dB(A) as measured at the facade of the receivers.

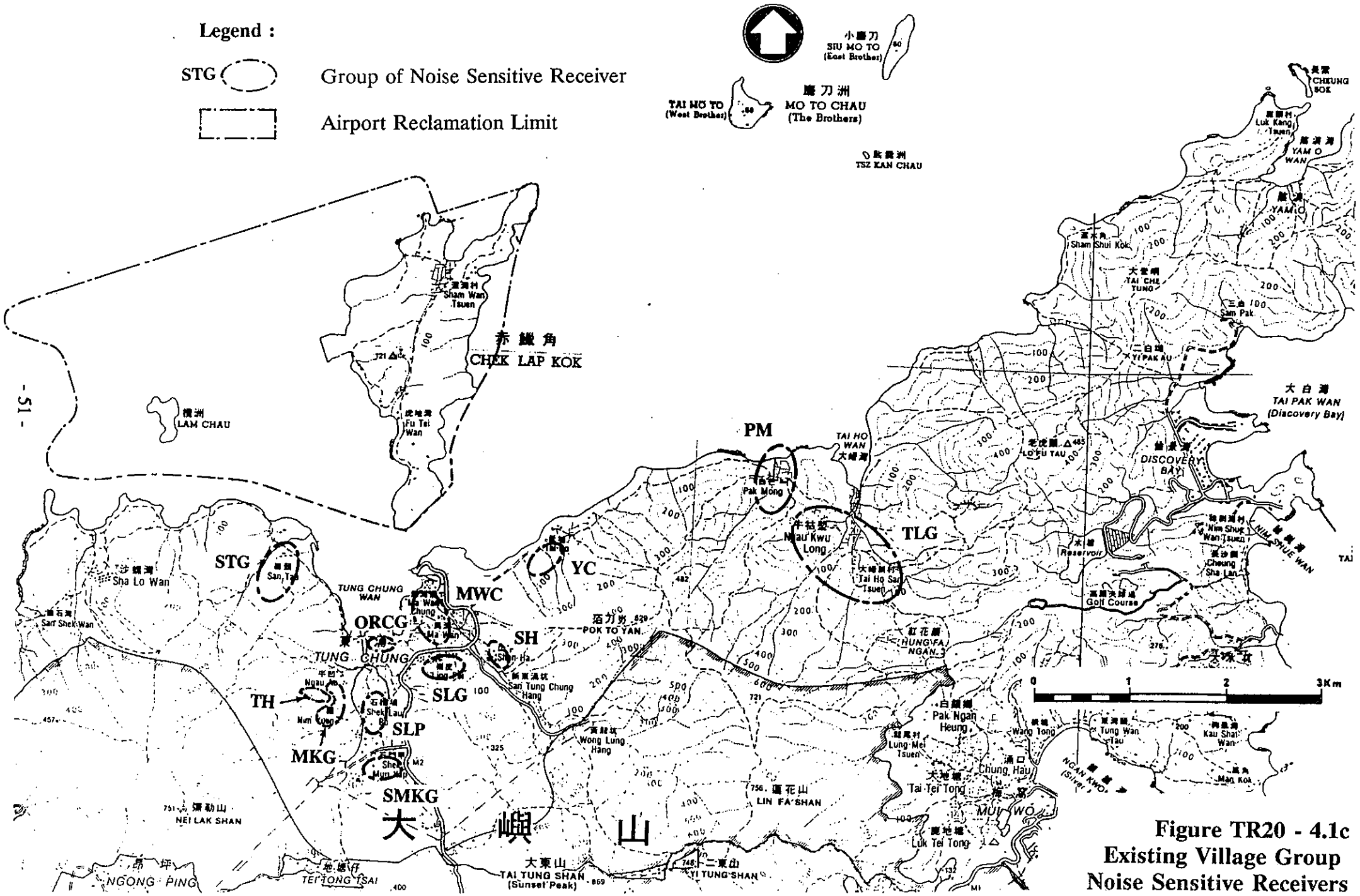


Figure TR20 - 4.1c
Existing Village Group
Noise Sensitive Receivers

4.2.3 Impact Assessment and Mitigation

Phase 2

Impacts

Phase 2 will consist of two work sites in Tung Chung and Tai Ho, numbers 3(a) and 3(b) and 4(a) and 4(b) respectively, as indicated on TR20-4.1a and 1b.

The predicted facade noise levels for all the worst-affected NSR by each of the work sites areas are given in Appendix C, (Tables C1 to C4) with the underlined figures in these tables indicating where the facade noise levels would exceed the noise criteria.

Tai Po village will be relocated during Phase 1 and the Ma Wan and Wong Nai Uk villages resited during Phase 2 and therefore all these have been excluded from the list of affected receivers under Phase 2.

Work on sites 3(a), 4(a) and 4(b) will be mainly reclamation/dredging which will occur on a 24 hour basis. Work on site 3(b) will be mainly cutting/excavation which under normal circumstances will only occur during daytime.

The following NSRs will receive noise from Phase 2 works in excess of the ANL:

- o most NSRs from work site 3(a) and 4(a) and 4(b) reclamation;
- o Youth Camp from all work site 3(a) activities except road paving;
- o Planning Areas 4, 10 and 11 from work site 3(a) dredging and also from both NSRs for 4(a) dredging;
- o Planning Areas 4, 10, 11 and 12 from work site 3(a) infrastructure works and also from both NSRs for 4(a) infrastructure;
- o all NSRs from work site 3(b) rock excavation;
- o all NSRs from work site 3(b) soil excavation and infrastructure works except Planning Areas 4, 11 and 12 and at San Tau, Tin Sam and Kau Liu village group; and
- o road paving from work site 3(b) lead to exceedances only at Ma Wan Chung village group, Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai and Lung Tseng Tau village group and Skek Mun Kap and San Keng village group.

Mitigation

Effective noise mitigation would be required for the reclamation work to be carried out over 24 hours during Phase 2. The Youth Camp will require noise insulation to protect this property during Phase 2.

Night-time working for Phase 2 work site 3(b) cutting/excavation and soil excavation and infrastructure works is not recommended unless there is very effective noise mitigation and control on site. Similarly, for work site 4(a) infrastructure works will usually only occur during daytime and will require very effective noise mitigation and control on site to allow night-time working.

Phase 3

Impacts

Phase 3 development will consist of four work sites in Tung Chung 5(a) to 5(d) and three at Tai Ho, 6(a) to 6(c), as indicated on TR20-4.1a and 1b. The predicted facade noise levels for all the worst-affected NSR by each of these work areas are given in Appendix C, Tables C5 to C11.

Ma Wan Chung and Sha Tsui Tau will be relocated during this phase and therefore both have been excluded from the list of affected receivers under this package.

Work sites 5(a), 6(a) and 6(b) will be mainly reclamation/dredging. Work sites 5(b) and 6(c) will consist of both reclamation/dredging and cutting/excavation. Work sites 5(c) and 5(d) will be mainly cutting/excavation.

The following NSRs will receive noise from Phase 3 works in excess of the ANL:

- all NSRs from work sites 5(a), 5(b), 6(a) and 6(b) reclamation;
- all NSRs from work sites 5(b), 5(c) and 5(d) rock excavation;
- all NSRs from work site 5(b) dredging, infrastructure works and soil excavation except planning areas 4 and 43;
- Planning Areas 23 and 24 from work site 5(b) seawall construction and concreting works;
- San Tau, Tin Sam and Kau Liu village group and Planning Areas 4, 23 and 24 from work site 5(a) dredging and infrastructure works;
- Planning Area 4 from work site 5(a) seawall construction;
- all NSRs from work site 5(c) infrastructure works and soil excavation except planning areas 23, 24 and 25;
- road paving from work site 5(d) lead to exceedances only at Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai and Lung Tseng Tau village group and Skek Mun Kap and Mok Ka, Nim Yuen, Tung Hing and Ngau Au village group;
- Tin Liu, Ngau Kwu and Tai Ho San Tsuen village group from all work site 6(c) activities except road paving; and
- Pak Mong village group from dredging, reclamation and rock excavation at work site 6(c).

Mitigation

Effective noise mitigation would be required for the reclamation work to be carried out over 24 hours during Phase 3 at all NSRs and for dredging works at some NSRs. Night-time working for Phase 3 infrastructure works, rock and soil excavation, seawall construction and road paving are not recommended unless very effective noise mitigation and control on site are instigated.

Phase 4

Impacts

Phase 4 development will consist work sites 7(a) and 7(b) at Tung Chung and a 8(a) to 8(f) at Tai Ho, as indicated on TR20-4.1a and 1b. The predicted facade noise levels for all the worst-affected NSR by each of these work areas are given in Appendix C, Tables C12 to C19.

Work sites 7(a), 7(b), 8(a), 8(b) and 8(d) will be mainly reclamation/dredging. Work on site 8(e) is for the man-made lake and therefore would be mainly dredging and seawall construction. Work on sites 8(c) and 8(f) would consist of both types of work. Mainly two existing noise neighbourhoods and a proposed hospital in Tai Ho would be affected by work on sites 8(a) to 8(f). Predicted noise levels are generally lower for Phase 4 than other Phases.

The following NSRs will receive noise from Phase 4 works in excess of the ANL:

- all NSRs from work sites 7(a), 7(b), 8(a), 8(b), 8(c), 8(d), 8(f) reclamation;
- all NSRs from work site 7(a) infrastructure works;
- all NSRs from work site 7(a) seawall construction except Planning Area 17;
- all NSRs from work site 8(f) rock excavation;
- Planning Area 58, 19 and 15 from work site 7(a) dredging;
- Planning Area 58 from work site 7(a) concreting works;
- all NSRs except Planning Area 4 from work site 7(b) dredging and infrastructure works;
- all NSRs except Planning Area 4 and Tung Hung village group from work site 7(b) seawall construction;
- Planning Areas 23, 24, 35 and 36 from work site 7(b) concreting works;
- Pak Mong village group from work site 8(e) dredging and seawall construction;
- Planning Area 11 from work site 8(e) dredging;
- Pak Mong village group from infrastructure works from work site 8(d);
- Planning Areas 24 from work site 7(b) road paving;

- Tin Liu, Ngau Kwu and Tai Ho San Tsuen village group and planning area 11 from work site 8(f) rock excavation and infrastructure works; and

- Planning Area 11 from work site 8(f) seawall construction and concreting works.

Mitigation

Effective noise mitigation would be required for the reclamation work to be carried out over 24 hours during Phase 4 at all NSRs and for dredging works at some NSRs. Night-time working for Phase 4 infrastructure works, rock and soil excavation, seawall construction and road paving are not recommended unless very effective noise mitigation and control on site are instigated.

Phase 5

Impacts

The fifth phase of development is the post 2011 development and this would be carried out under work site 9 for Tung Chung and work site 10 for Tai Ho, as indicated on TR20-4.1a and 1b. The predicted facade noise levels for all the worst-affected NSR under work site 9 and work site 10 are given in Appendix C, Tables C20 and C21.

Work on site 9 and 10 will consist of mainly reclamation/dredging type of work.

The following NSRs will receive noise from Phase 5 works in excess of the ANL:

- all NSRs from work sites 9 and 10 reclamation;

- San Tau, Tin Sam and Kau Liu village group and Planning Areas 46, 47, 48 and 4 from work site 9 dredging;

- all NSRs from work site 10 dredging except Planning Areas 22, 15, T55, T54, T58, T19 and T20;

- Planning Areas 18, 19 and 21 from work site 10 and Planning Areas 46 and 47 from work site 9 seawall construction;

- Planning Areas 18 and 19 from work site 10 and Planning Areas 46 and 47 from work site 9 concreting; and

- Pak Mong village group and Planning Areas 18, 19 and 21 from work site 10 and San Tau, Tin Sam and Kau Liu village group and Planning Areas 46, 47, 48 and 4 from work site 9 infrastructure works.

Mitigation

Effective noise mitigation would be required for the reclamation work to be carried out over 24 hours during Phase 5 at all NSRs and for dredging works at some NSRs. Night-time working for Phase 5 infrastructure works, rock and soil excavation, seawall construction and road paving are not recommended unless very effective noise mitigation and control on site are instigated.

4.2.4 Overall Construction Phase Recommendations

Rock excavation is potentially very noisy and therefore is not recommended for working beyond the normal working hours unless with effective noise mitigation and careful noise control on site.

The results of this assessment have shown that working in the periods restricted under the NCO will not be possible unless mitigation at source is applied. Some activities may not be possible even with mitigation. Some activities will also exceed the recommended maximum daytime noise level of 75 dB(A) unless mitigated.

There are a number of methods of noise mitigation available to contractors ranging from the use of silenced plant to noise screens. Details of construction activities are not sufficiently well developed at the present time to define specific methods of mitigation; these details will not become available until detail design for each contract has started.

Noise mitigation proposed therefore falls under two broad categories:-

- o the NCO should apply in its entirety to all construction contracts and no exemptions should be permitted. Construction contracts should also specify a maximum noise level of 75 dB(A) at any sensitive receiver during periods not controlled by the NCO; and

- o contracts should be designed, phased and planned to minimise noise.

The latter of these requires that noise considerations should be taken into account at an early stage in the design for each contract. The works should be designed to minimise noisy activities. Contract periods should additionally be designed to allow contractors sufficient time to programme their works so that noisy activities are not necessary at night and so that there is sufficient time to carry out these activities during the daytime with plant numbers reduced to avoid excessive noise.

It should be possible to plan the works so that activities such as rock drilling and site formation can be programmed to meet these objectives without any cost penalty. Dredging and reclamation are traditionally carried out over 24 hours to maximise the use of the capital intensive equipment and greater care will be needed in programming these activities to minimise noise. The objectives should be achievable if contractors are allowed sufficient time to carry out the works. This can lead to the use of smaller numbers of plant and if they are allowed sufficient flexibility to programme their works so that, for example, any activities needing 24 hour working can be located further away from sensitive receivers.

4.2.5 Construction Phase Conclusions

From Phase 2 onwards construction will be constrained by the presence of both the existing and new noise sensitive receivers. Effective noise mitigation and control on site will be required for the works to be carried out within the constraints of the Noise Control Ordinance.

Reclamation is likely to produce unacceptable noise levels at the facade of the adjacent NSR during 24-hour working and 24 hour working should not be permitted unless the noise levels in the NCO can be achieved.

The assessment has assumed the worst case where any activity could continue into the evening. Contractors will normally wish to complete all activities using daytime working to avoid the extra costs of working at night and therefore the worst case will only materialise on infrequent occasions.

4.3 Operation Phase Assessment

4.3.1 Road Traffic Noise

Road traffic noise has been one of the key issues in preparing the RODP because of the constraints it could impose on development of land uses sensitive to noise in the area. In order to accommodate sensitive land uses adjacent to NLE and primary distributors, the initial assessment of the RODP reported in TR10 showed that the HKPSG standards could only be met alongside the NLE if mitigation of noise was applied. The recommended mitigation measures were a combination of one or more of:-

(a) noise barriers consisting of a 6m high landscaped bund with a 3m high solid barrier were recommended wherever noise sensitive development was proposed alongside the NLE;

(b) setbacks to noise sensitive development. Depending on site functions, setbacks of 160m from the nearside edge of the road were recommended;

(c) a friction course should be applied to the road surface where traffic flows were high; and/or

(d) residential blocks should be aligned such that their windows had an angle of view of the road of 120° or less.

Some flexibility in these measures could be permitted in certain circumstances. For example developers might wish to plan their estate layouts with a larger setback and have a larger angle of view of the road. A smaller setback would be permissible if windows had a smaller angle of view or if non-sensitive uses were built facing the road.

Noise barriers (without landscaped bunds) were also considered for primary distributors. However, the improvement in setback with this treatment alone was not considered to be significant in terms of cost effectiveness as the noise conflicts were little reduced and thus this form of mitigation alone could not be recommended. An investigation into the efficacy of using a friction course adjacent to dwellings has indicated that the required setback could be significantly reduced for less busy primary roads using only a friction course. For busier primary roads including P2 a friction course plus the previously proposed (in TR10 Revised) 3m earthbund together with a 3m solid barrier would be required adjacent to sensitive receivers located close to these roads. No noise treatment was considered necessary for local roads because of the anticipated low traffic volumes.

These results were derived based on a set of preliminary traffic figures which have been subsequently updated following transport testing. The broad guidelines for noise mitigation presented previously have therefore been reviewed taking account of the most recent traffic figures (this data is shown in Appendix B, Tables B1 - B4), and the detailed layout plans for Phase 1, and recommendations for noise mitigation prepared.

4.3.2 Train Noise

Noise from trains will depend inter alia, on the type of rolling stock used, the design of the track and the train frequency. Details of these are not available and the NLE Consultants

have calculated the train noise based on the frequencies stated in the Airport Rail Feasibility Study Final Report and assuming a BREL type of train is used. BREL have supplied details of noise tests carried out on their rolling stock running at 150 kph and the results of these tests were used by the NLE Consultants in their assessment. Their results (reported in the NLE Environmental Impact Assessment Final Report) have formed the basis of the assessment of impacts in this report.

However, EPD have stated that there is a possibility that trains much noisier than the BREL train could be used and have thus suggested that a noise level of 92 dB(A) be tested. It has therefore been agreed that the train noise impacts should be assessed on the basis of an "83 dB(A) train" but that the sensitivity of the plan to a worst case "92 dB(A) train" should also be considered.

Two types of rolling stock have therefore been considered in this report. These are:

- o Rolling stock with an emission strength of 83 dB(A) at 25m from the track at grade when measured in accordance with ISO 3095 (83 dB(A) train); and

- o Rolling stock with an emission strength of 92 dB(A) at 25m from the track at grade when measured in accordance with ISO 3095 (92 dB(A) train).

4.3.3 Assessment Methodology and Impact Assessment For Road Traffic Noise

Road Traffic Conditions

Traffic figures used for the assessment are based on those presented in TR18 (Revised). These are summarised in Table 4.3 and shown in detail in Appendix Tables B1 - B4. Traffic links are also shown in Appendix B, Figures B1 - B4. The calculation methodology and the assessment criteria are identical to those given in Topic Report TR10 (Revised).

Table 4.3 Traffic Figures, Links, Speeds, Percentage Heavies and Noise Generation

Road Section	Worst-case traffic volume (Veh/hr)	Year	Speed (km/hr)	% of Heavy Vehicle	Facade noise level at distance of 25m dB(A)	
					30m above road level	80m above road level
NLE N(2)	2590	2011(OP)	67	29	75	73
NLE S(2)	3200		67	25		
NLE E(3)	3830	2011(PM)	56	31	76	74
NLE W(3)	3667		58	32		
P1(37)	1079	2011(PM)	48	39	69	66
P2 E(12)	1390	2011(AM)	39	35	72	69
P2 W(12)	1040		45	51		
P2(13)	1342	2011(AM)	42	42	70	67

The NLE is assumed to have a surface friction course which will reduce the generated noise by at least 3.5 dB(A). Other roads are assumed to have normal road surfaces. In addition, a 120° angle of view is assumed for all NSRs except schools. Local roads are excluded in the noise prediction. These assumptions have been used to determine the setback distances necessary from the edge of the nearside carriageway to satisfy the HKPSG requirements at a lower floor receiver in all noise sensitive land uses in years 2001 and 2011.

Road Mitigation Assumptions

Noise treatment, in the form of earth bunds/barriers, has been considered where the setback distances without mitigation exceed 160m for sensitive developments flanking the NLE and 50m for sensitive developments flanking primary roads or district roads.

The noise mitigation considered takes one of the following forms :

- Type I - 3m earth bund with 3m high noise barrier on top;
- Type II - 6m high earth bund with 3m high noise barrier on top; and
- Type III - 3m high noise barrier.

Detailed specifications of the mitigation measures are provided herein for Phase 1 for which detailed layout plans are available. Detailed layout plans for Phase 2 and subsequent phases are not available and schematic layouts of noise treatments have been provided.

Residual noise impacts could exist with the proposed additional earth bund/barrier mitigation treatment. The residual setback distances required to satisfy the HKPSG noise criteria with the proposed noise treatment have been determined.

The residual noise impacts in the first phase detailed layout plans with the proposed noise treatments, are shown by noise contours of L10(1-hr.) at 85m PD for 2011. These contours represent the facade noise levels for top floor receivers with a 120° angle of view of the road. These receivers will be least protected by the barriers.

4.3.4 Impact Assessment Methodology for Train Noise

Table 4.4 gives the setback distances required to satisfy the HKPSG and the NCO night-time criteria for the ARL, LAL and ARL+LAL without noise mitigation. The determining factor of setback distances is the NCO criteria for the operation between 2300 hours and 0700 hours.

Table 4.4 **Setback Distances in Metres Required to Satisfy the Prescribed Noise Standards for ARL, LAL and ARL + LAL (No Mitigation)**

Train Service	Ht. above Ground (m)	83dB(A) Train		92dB(A) Train	
		HKPSG	NCO	HKPSG	NCO
ARL	1.5	30	100	120	750
	80	-	50	80	750
LAL	1.5	30	200	120	> 1,000
	80	-	50	80	> 1,000
ARL + LAL	1.5	30	300	120	> 1,000
	80	-	280	80	> 1,000

Note : Symbol - indicates no setback requirement

In order to reduce the necessary setback distances, trackside barriers have been considered. The barrier considered consists of a 1.5m high inward curved trackside barrier as indicated on Figure TR20-4.2 have been calculated using the methodology in "Transportation Noise Reference Book" assuming that the barrier is of an absorptive type. For receiver locations at 80m above ground and closer than about 40m from the tracks, the predictive equation for barrier attenuation becomes invalid and a "no line of sight" approach was adopted.

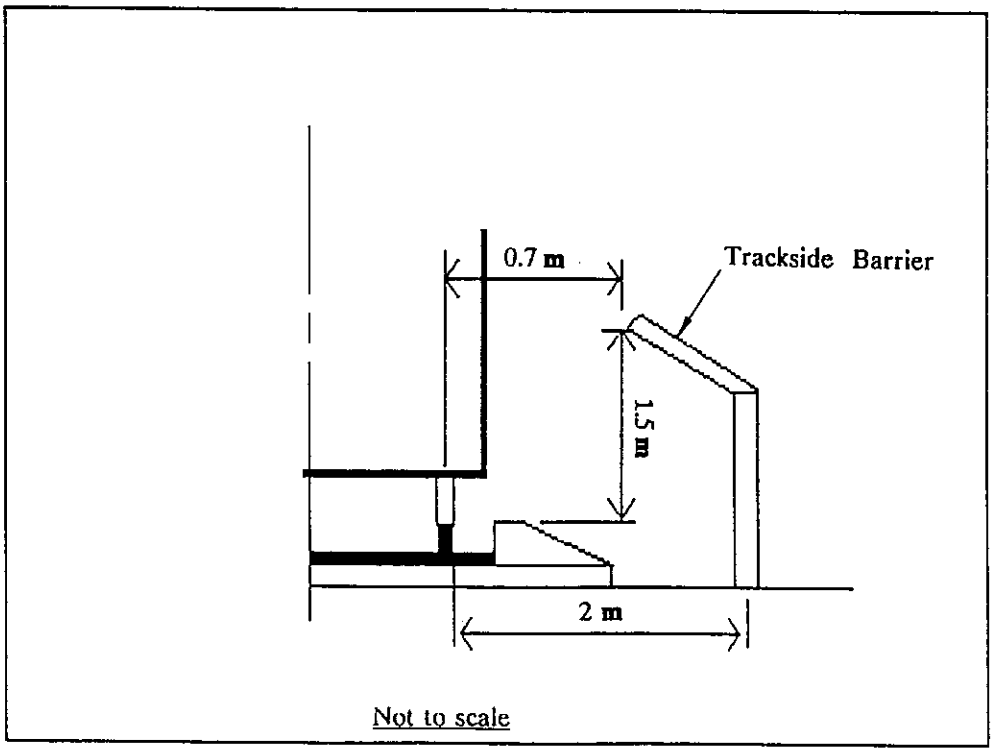


Figure TR20 - 4.2
Configuration of Trackside Railway Noise Barrier

The residual setback distances which are required to satisfy the noise standards assuming these barriers are used, are shown in Table 4.5.

Table 4.5 Setback Distances in Metres Required to Satisfy the Prescribed Noise Standards for ARL, LAL and ARL + LAL With Mitigation

Train Service	Ht. above Ground (m)	83 dB(A) Train		92 dB(A) Train	
		HKPSG	NCO	HKPSG	NCO
ARL	1.5	**	**	**	13
	80	-	16	37	70
LAL	1.5	**	**	**	23
	80	-	26	37	85
ARL + LAL	1.5	**	**	**	35
	80	-	37	37	100

Note : Symbol ** indicates less than 10m, Symbol - indicates no setback requirement

As can be seen, a 92 dB(A) train rolling stock requires about three to four times the setback distance required for an 83 dB(A) train rolling stock to achieve the NCO standard with the above trackside barrier.

4.3.5 Assessment of Noise Impacts from Road and Rail Traffic in Each Phase

General

All road setbacks in this section are given as the distance from the edge of the nearside carriageway of roads.

Phase 1 : Road Traffic Noise

Topic Report TR17 (Revised), "First Phase Development Layout Plans", describes the detailed planning layouts for the First Phase. According to Figure TR20-4.3 the first phase development includes the following noise sensitive land uses :

- o Planning Area 4 - Proposed residential development (R1);
- o Planning Area 10/11 - Proposed public housing estate (RS/HOS) including a primary school, a neighbourhood community centre and a health clinic; and
- o Planning Area 12 - Proposed educational use (E) including a primary school and 2 secondary schools.

With a friction course and a 120° angle of view but without earth bunds/barriers, the two secondary schools and the primary school would be exposed to road traffic noise in excess of the HKPSG guidelines. Also, NSRs in Planning Area 10/11 fronting the NLE are likely to be exposed to noise levels slightly higher than 70 dB(A) in 2001. Table 4.6 gives the setback distances from the edge of the nearside road carriageway required to satisfy the HKPSG criteria for all the above NSR in Tung Chung Phase 1 development without earth bunds/barriers for 2001 and 2011.

Table 4.6 Setback Distances Required to Satisfy the HKPSG Criteria for Tung Chung Phase 1 Development Without Mitigation

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
4	D1(8)	R1	25	27
10	D1(9)	RS	43	39
	NLE (2)		172	169
	P2 (12)		30	37
11	NLE (2)	HOS	172	169
	P2 (12)		30	37
12	NLE (2)	E	408	400
	P2 (12)		72	87

Both Planning Area 12 and Planning Area 10/11 will need noise treatment of the NLE to ensure compliance with HKPSG. The primary school in Planning Area 12 will further require noise treatment of Road P2. Table 4.7 summarizes the mitigation proposals for the above planning areas. The setback distances are considered to be acceptable following the noise treatment. For the primary school in Planning Area 12 facing Road P2, a Type III mitigation is considered sufficient to protect the school because the middle carriageway of P2 is depressed and the nearside and farside carriageways are at a similar level to the school.

Table 4.7 Noise Mitigation Proposals for Tung Chung Phase 1

Planning Area	Major Line Source (Link)	Land Use	Type of Mitigation	Approximate Barrier Length (m)	Residual Setback distance (m)
10	NLE(2)	RS	II *	280	46
11	NLE(2)	HOS	II *	280	46
12	NLE (2)	E	II *	280	51
	P2 (12)		III *	160	41

Note: * plus friction course

In addition, a Type I noise barrier will be necessary to protect the existing Youth Camp at Tai Po Interchange. The resulting noise contours at 85m PD with the proposed barriers are shown in Figure TR20-4.3. The 70 dB(A) contour line falls beyond the plot boundary of the residential sites and therefore will not constrain residential development. Figure TR20-4.4 shows the predicted facade noise levels at the three schools and the Youth Camps with the proposed earth bund/barrier noise treatment of the roads. No exceedance of the HKPSG noise criteria is predicted with the proposed school layouts and the proposed noise treatment of the roads.

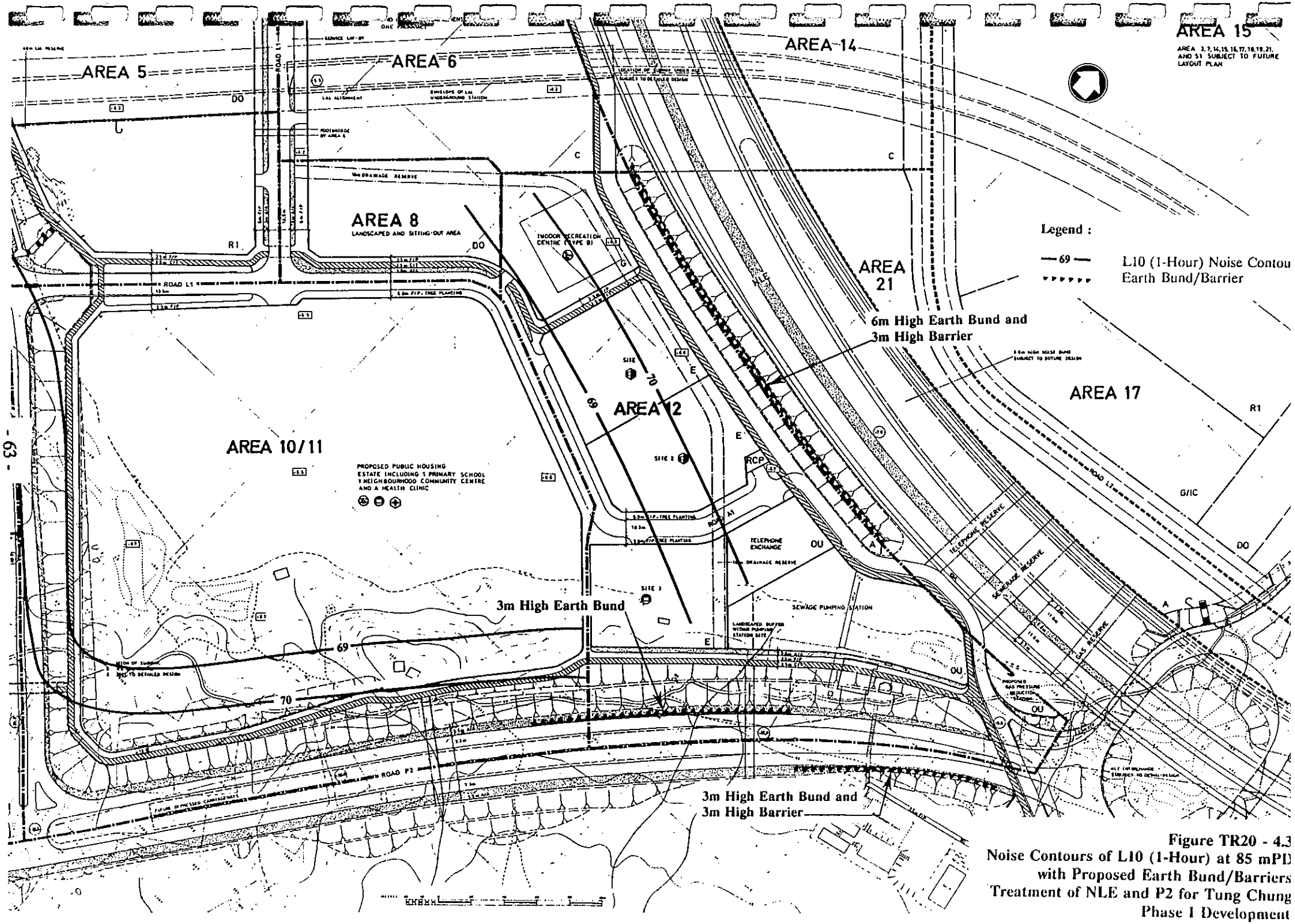


Figure TR20 - 4.3
Noise Contours of L10 (1-Hour) at 85 mPD with Proposed Earth Bund/Barriers Treatment of NLE and P2 for Tung Chung Phase I Development

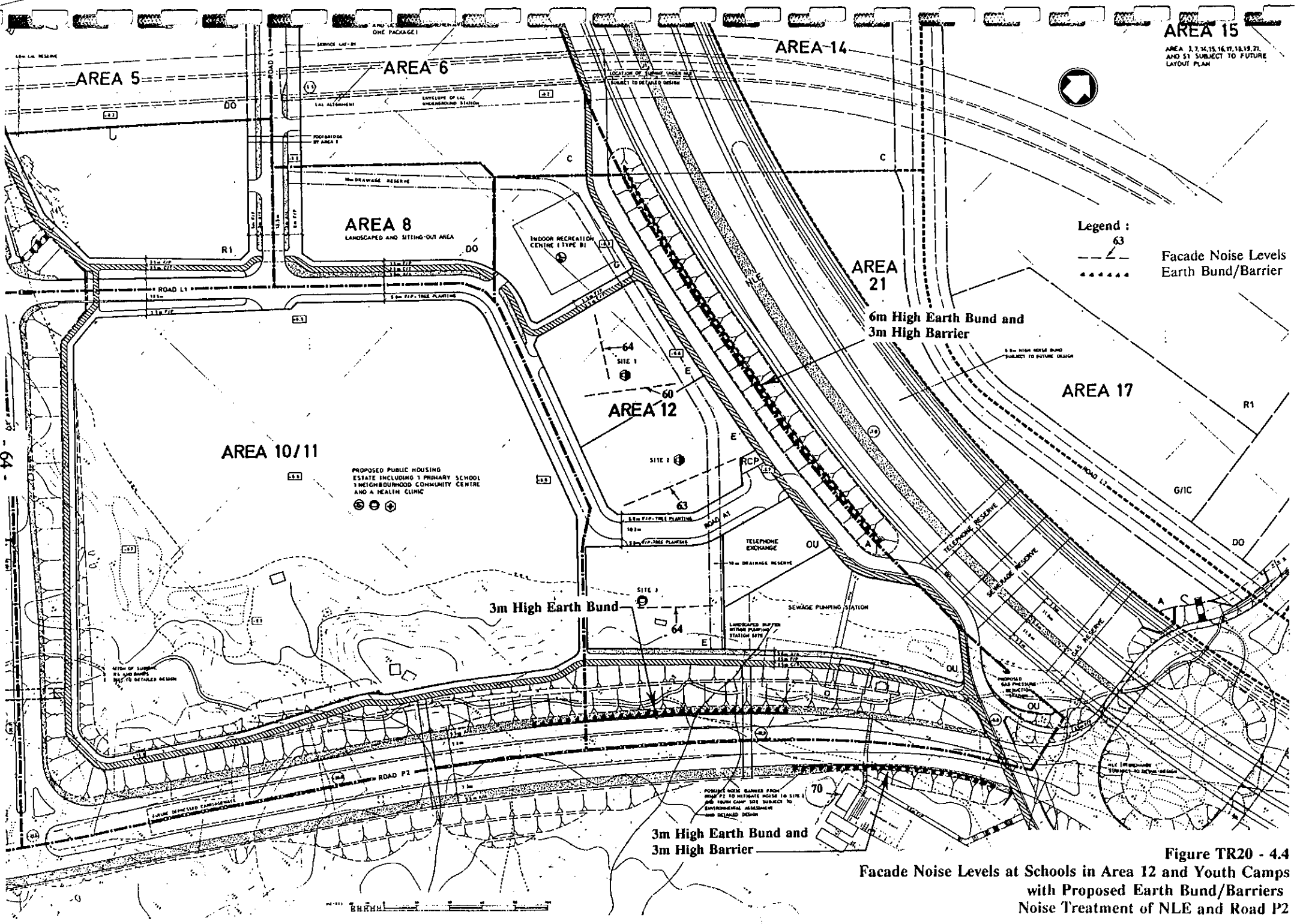


Figure TR20 - 4.4
Facade Noise Levels at Schools in Area 12 and Youth Camps with Proposed Earth Bund/Barriers Noise Treatment of NLE and Road P2

Phase 1 : Train Noise

Without mitigation as noted in Table 4.4 train noise will not constrain development in Phase 1. The LAL is proposed to run through Planning Areas 5 and 6. An underground Tung Chung Station is planned for Area 6 and the tracks continue underground through Area 5. Since the tracks are underground in these sections, no mitigation will be needed. Tracks running through Planning Area 14 are assumed to be integrated with the proposed podium development to the extent that train noise is contained by the building envelope. Thus no mitigation is considered necessary to protect Planning Area 12 from LAL.

Based on the results in Table 4.5, the setback without mitigation from the ARL or LAL will be 50m and thus neither the at grade ARL running along the southbound carriageway of the NLE or the LAL would have no impact on Phase 1 Planning Areas 10/11 and 12. However, residual setbacks for a 92 dB(A) train running at-grade, without mitigation would constrain the development unless mitigation was provided. For a 92 dB(A) train on the ARL trackside barriers will be required to protect Planning Areas 10/11 and 12 as indicated on Figure TR20-4.5.

Phase 2 : Road Traffic Noise

Sensitive land use development in Phase 2 is also confined to Tung Chung. Table 4.8 gives the road traffic setback distances required to satisfy HKPSG criteria without noise mitigation.

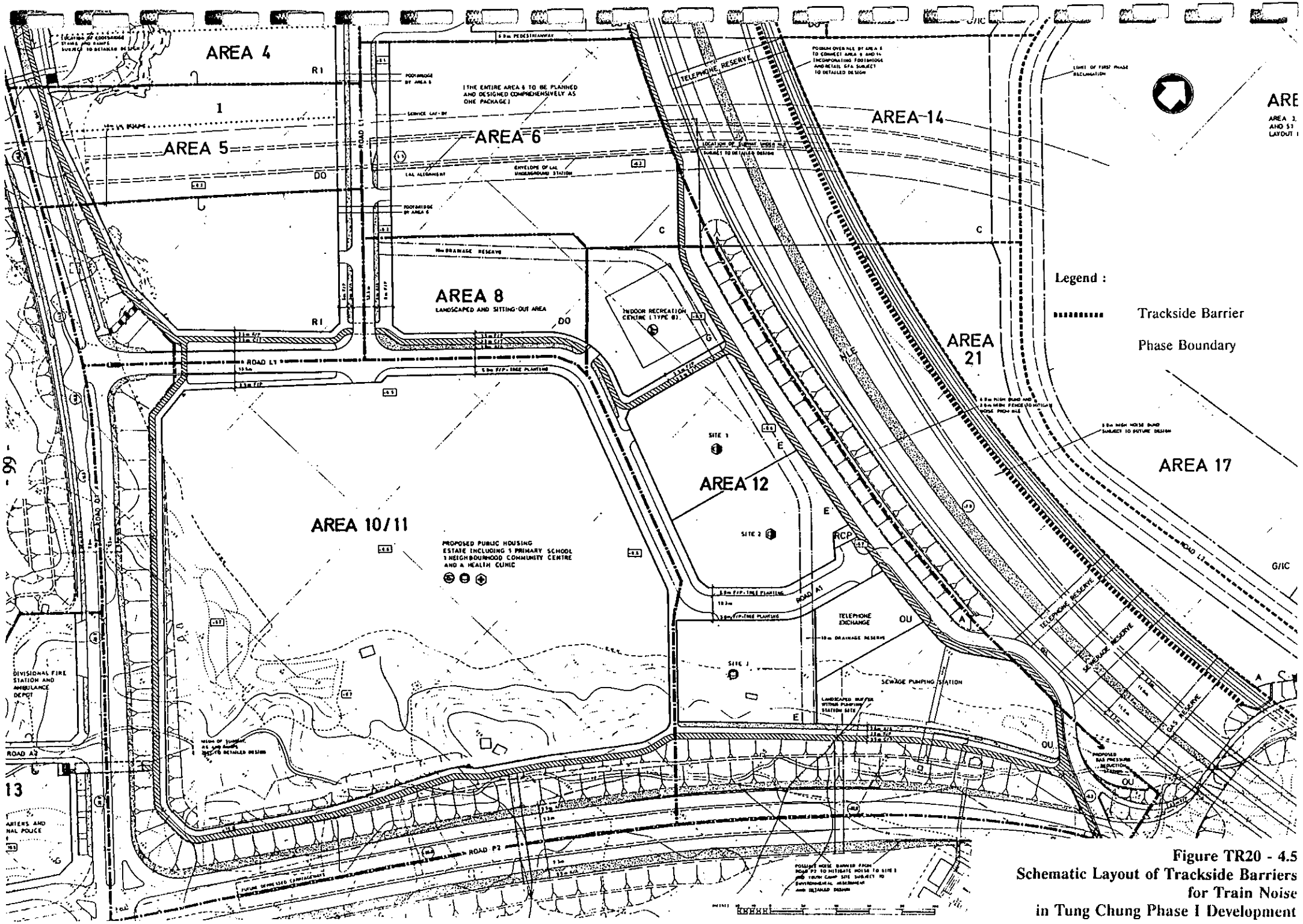


Figure TR20 - 4.5
Schematic Layout of Trackside Barriers for Train Noise in Tung Chung Phase I Development

Table 4.8 **Setback Distances Required to Satisfy the HKPSG Criteria for Tung Chung Phase 2 Development Without Mitigation**

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
15	NLE (2)	R1	172	169
	P1 (28)		--	15
17	NLE (2)	E	408	400
	P2 (20)		--	40
19	NLE (3)	R1	192	209
	P1 (27)		--	15
	P2 (20)		--	17
20	NLE (3)	E	455	496
	P1 (27)		--	36
58	P1 (37)	G/IC	--	77
	NLE (3)		455	496
22	P2 (13)	R2	25	40
23	D2 (17)	HOS	34	53
	D2 (30)		--	46
24	D2 (30)	RS	--	46
25	D2 (17)	R3	34	53
	P2 (13)		25	40
27	P2 (13)	E	58	96
38	P2 (22)	R3	--	28
43	--	R4	--	--
70	--	VR	--	--

The most affected Planning Areas are Areas 15, 17, 19, 20, 27 and 58 flanking the NLE where noise treatment of the roads is required. No noise treatment of Road D2 is considered necessary for Area 23 as the setback distance for this site does not exceed the 50m criterion. Table 4.9 gives the noise mitigation proposals required to ensure HKPSG compliance for Tung Chung Phase 2. Schematic layouts of the noise bunds/barriers are shown in Figure TR20-4.6a and b together with the residual setback lines. Mitigation proposals for Phase 1 are also shown.

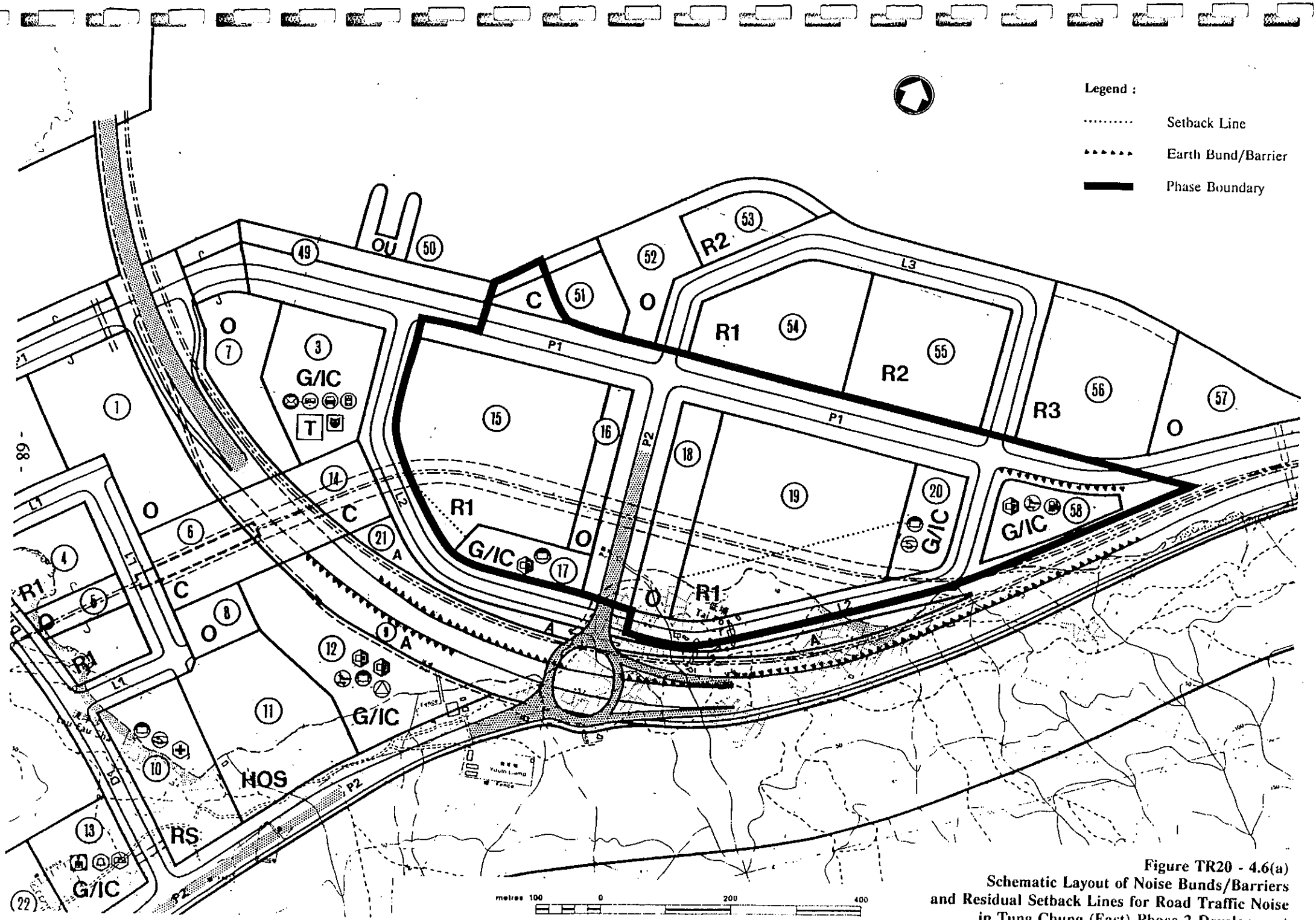


Figure TR20 - 4.6(a)
Schematic Layout of Noise Bunds/Barriers and Residual Setback Lines for Road Traffic Noise in Tung Chung (East) Phase 2 Development

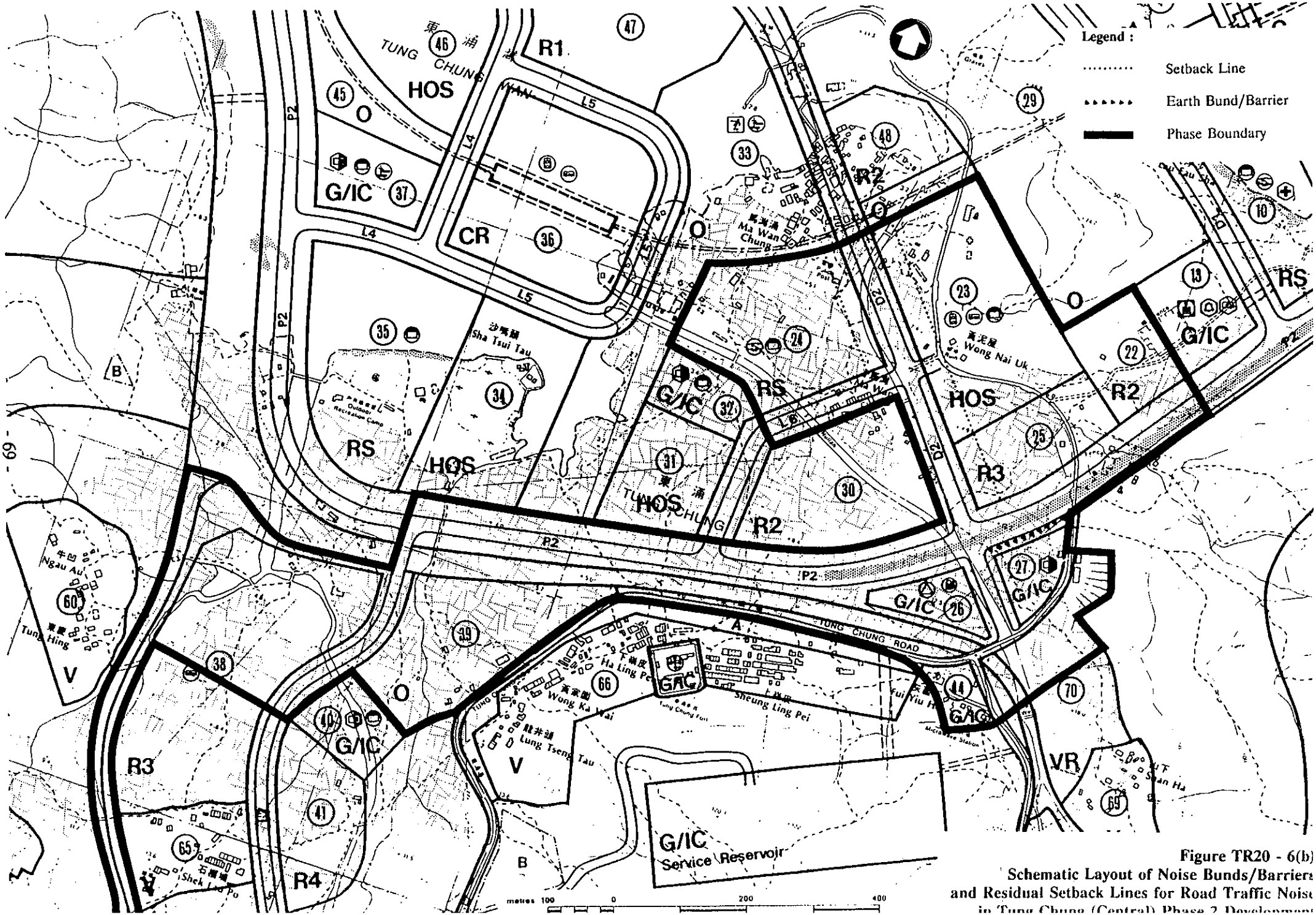


Figure TR20 - 6(b)
Schematic Layout of Noise Bunds/Barriers and Residual Setback Lines for Road Traffic Noise in Tung Chung (Central) Phase 2 Development

Planning Area 58 is planned for a secondary school and noise tolerant uses. It is possible that the noise tolerant facilities could be planned during the detailed layout stage to screen the school from the NLE and Road P1 so that noise treatment of the two roads may not be required.

Table 4.9 Road Noise Mitigation Proposals for Tung Chung Phase 2

Planning Area	Major Line Source (Link)	Land Use	Type of Mitigation	Approximate Barrier Length (m)	Residual Setback distance (m)
15	NLE (2)	R1	II *	350	136
17	NLE (2)	G/IC	II *	350	51
19	NLE (3)	R1	II *	600	176
20	NLE (3)	E	II *	600	51
27	P2 (13)	E	I *	150	31
58	P1 (37)	G/IC	I *	170	31
	NLE (3)		II *	250	51

Note : * plus friction course .

Phase 2 : Train Noise

In Phase 2, portions of Planning Areas 15 and 19 are sandwiched between the ARL and LAL alignments. However, it should be noted that the LAL is depressed in Planning Area 19 and is depressed to at-grade-depressed in the east of Planning Area 15 and underground in the west of Planning Area 15. With a 83 dB(A) train when the LAL is fully depressed or at-grade-depressed trackside barriers will not be necessary. However, with a 92 dB(A) train trackside barriers may be required north and south of the LAL subject to detailed vertical alignment of the LAL in this section to protect this section even though the section through Planning Areas 15 and 19 are depressed/at-grade-depressed.

With a 83 dB(A) ARL train no mitigation would be required to protect Planning Areas 10/11, 12, 15 or 19 but for the ARL with a 92 dB(A) train trackside barriers, as indicated for Phase 1, will be required to overcome noise constraints on Planning Areas 10/11 and 12. In addition with a 92 dB(A) train noise could also severely constrain development on Planning Area 10/11 and 12 without trackside barriers installed on the east of the ARL track at this time.

Where the LAL and ARL run together adjacent to Planning Area 58 trackside barriers will be required with either train type to protect the school site unless site layout can be designed so that the proposed noise tolerant uses protect the school from ARL/LAL train noise. With the 83 dB(A) train the provision of trackside barrriers on the ARL and LAL would elimate the noise constraint but with the 92 dB(A) plus trackside barriers on the ARL and LAL the whole of Planning Area 58 would be unsuitable for noise sensitive uses unless additional mitigation was provided, such as full rail enclosure.

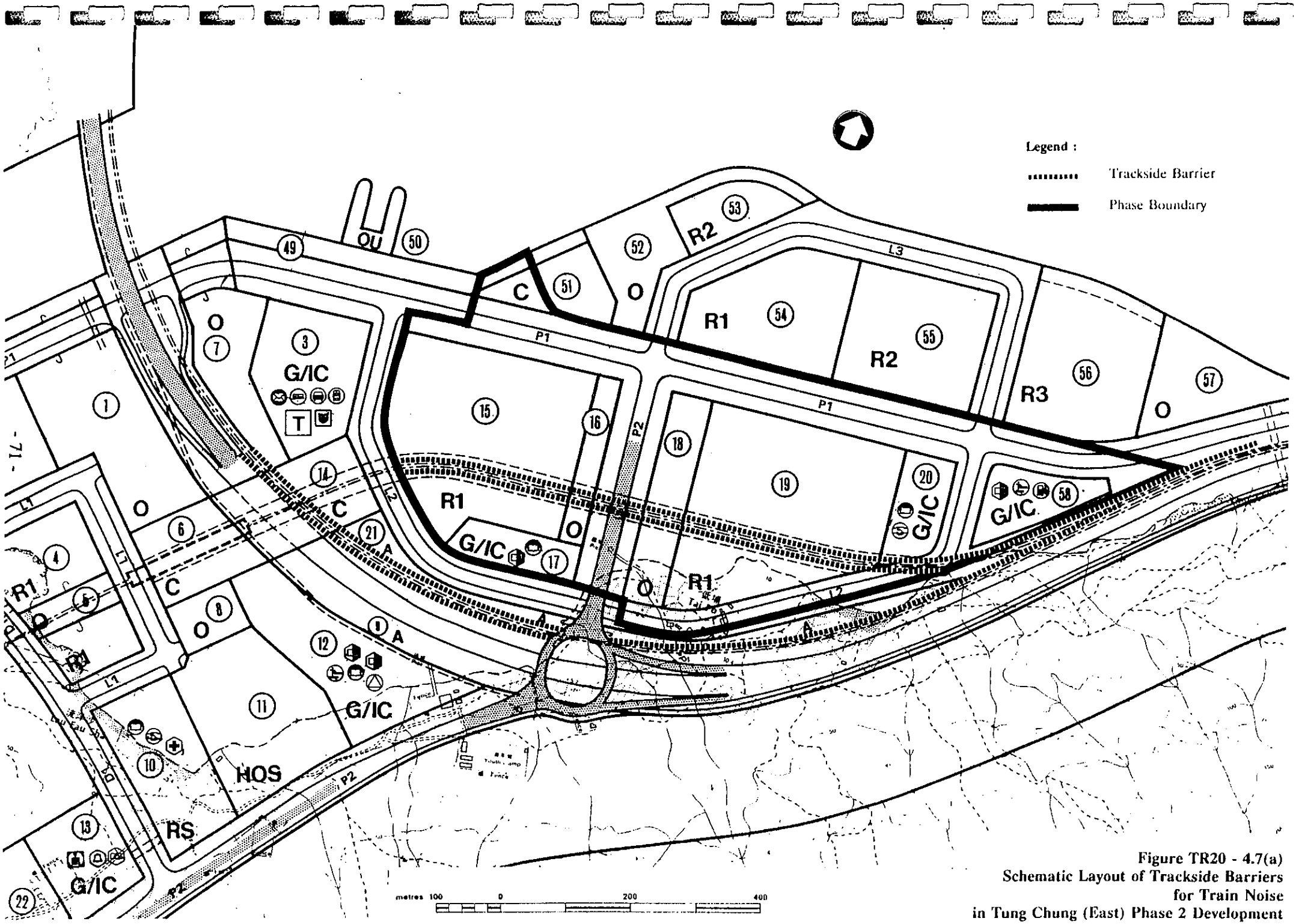


Figure TR20 - 4.7(a)
Schematic Layout of Trackside Barriers for Train Noise in Tung Chung (East) Phase 2 Development

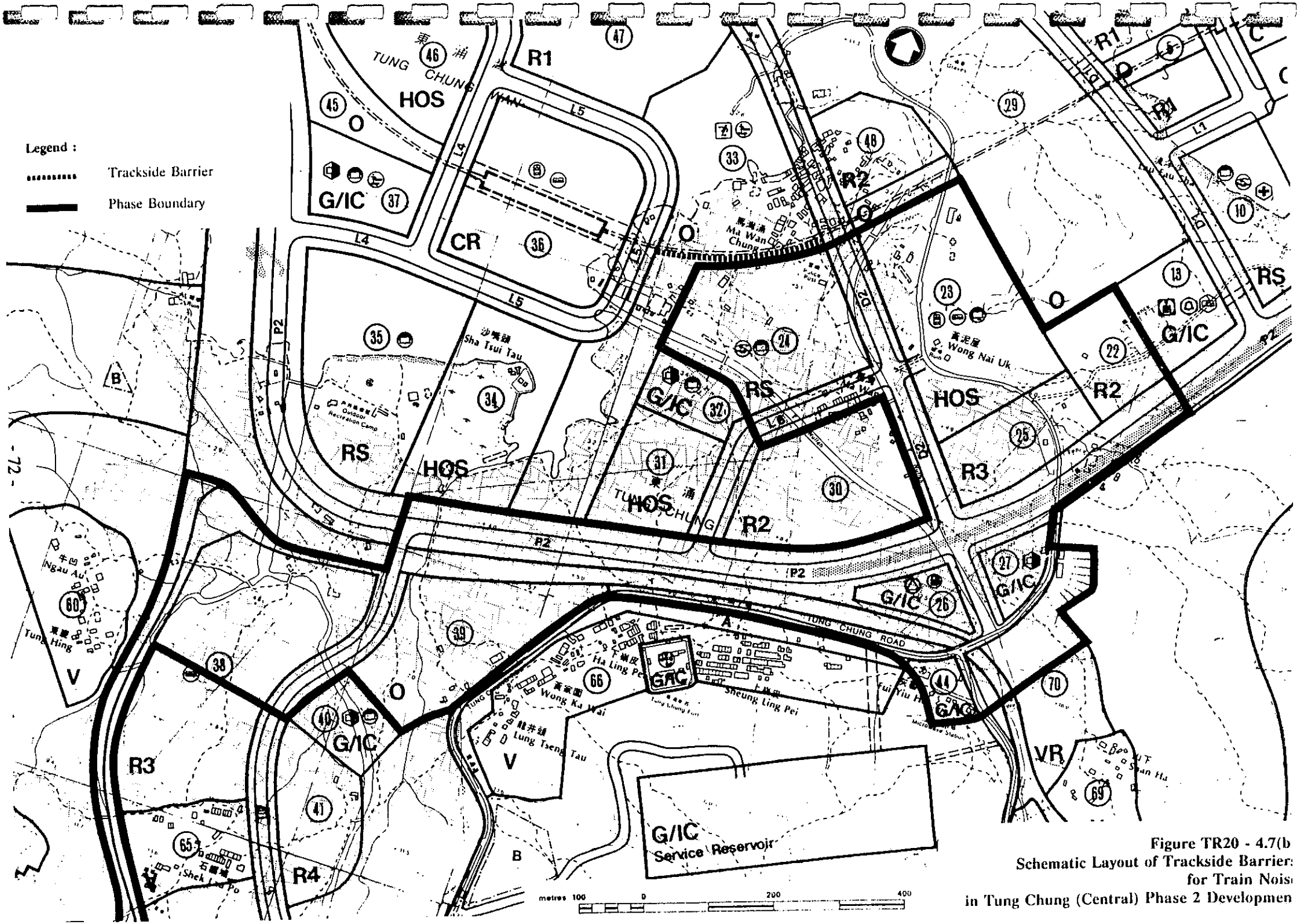


Figure TR20 - 4.7(b
Schematic Layout of Trackside Barrier
for Train Noise
in Tung Chung (Central) Phase 2 Developmen

The LAL between Road D1 and Road D2 will be depressed. As a result, no trackside barriers are considered necessary with an 83 dB(A) train to protect Planning Areas 22 and 23. However, with a 92 dB(A) trackside barriers may be required, even though this section is depressed to protect Planning Areas 22 and 23. The LAL is at-grade-depressed through Planning Area 24 and thus with an 83 dB(A) train no barriers would be necessary. With a 92 dB(A) trackside barriers may be necessary to protect Planning Area 24, although this requirement will be subject to the detailed vertical alignment of the LAL in this area. Figure TR20-4.7b shows the schematic layout of trackside barriers in Tung Chung (Central).

Phase 3 : Tung Chung - Road Traffic Noise

The third phase development in Tung Chung will be similarly constrained by road traffic noise without the erection of earth bunds/barriers adjacent to sensitive uses. The setback distances required to satisfy the road traffic noise requirement are shown in Table 4.10.

Table 4.10 Setback Distances Required to Satisfy the HKPSG Criteria for Tung Chung Phase 3 Development Without Mitigation

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
30	D2 (17)	R2	34	53
	P2 (14)		4	11
31	P2 (15)	HOS	4	36
32	--	E	--	--
34	P2 (15)	HOS	4	36
35	P2 (22)	RS	--	28
36	--	CR	--	--
38	P2 (22)	R3	--	28
40	--	E	--	--
41	--	R4	--	--
42	--	R4	--	--
65	--	V	--	--
70	--	VR	--	--

No noise mitigation of the roads is considered necessary for this phase other than that recommended previously for Phases 1 and 2. Planning Area 30 will not be constrained by road traffic noise and therefore no treatment of Road D2 will be necessary. Figure TR20-4.8 shows all the setback distances.

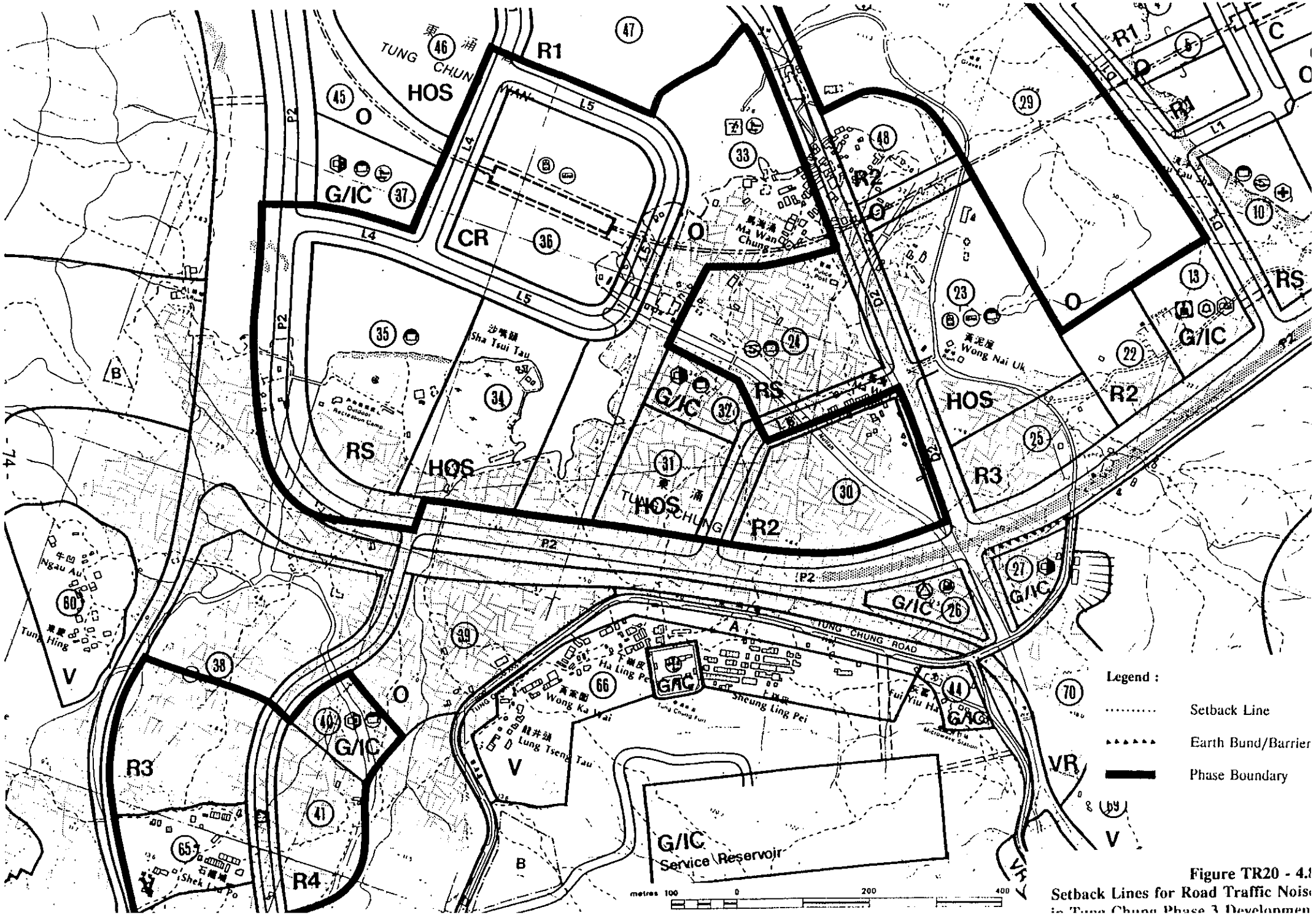


Figure TR20 - 4.
Setback Lines for Road Traffic Nois
in Tung Chung Phase 3 Developmen

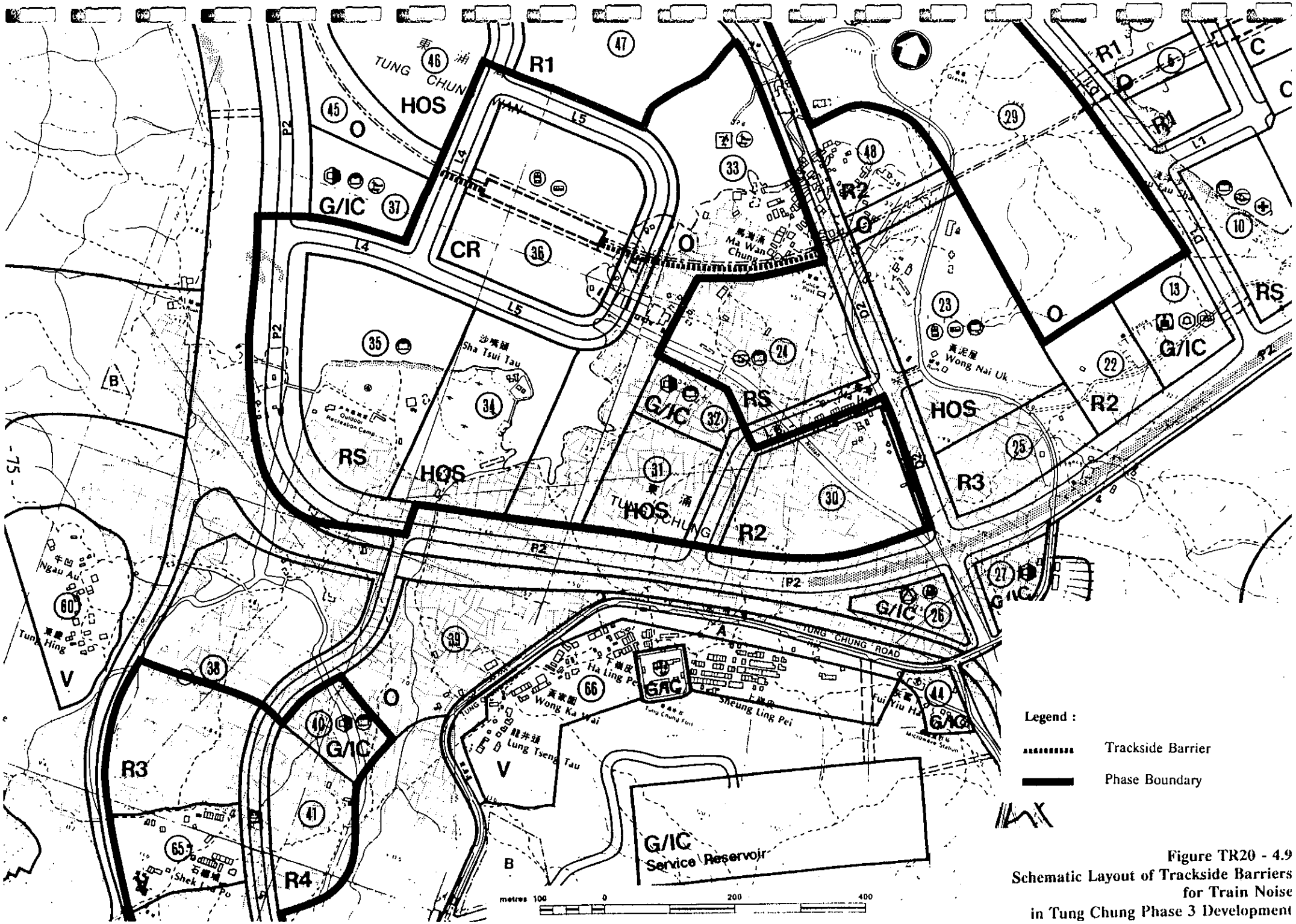


Figure TR20 - 4.9
Schematic Layout of Trackside Barriers for Train Noise in Tung Chung Phase 3 Development

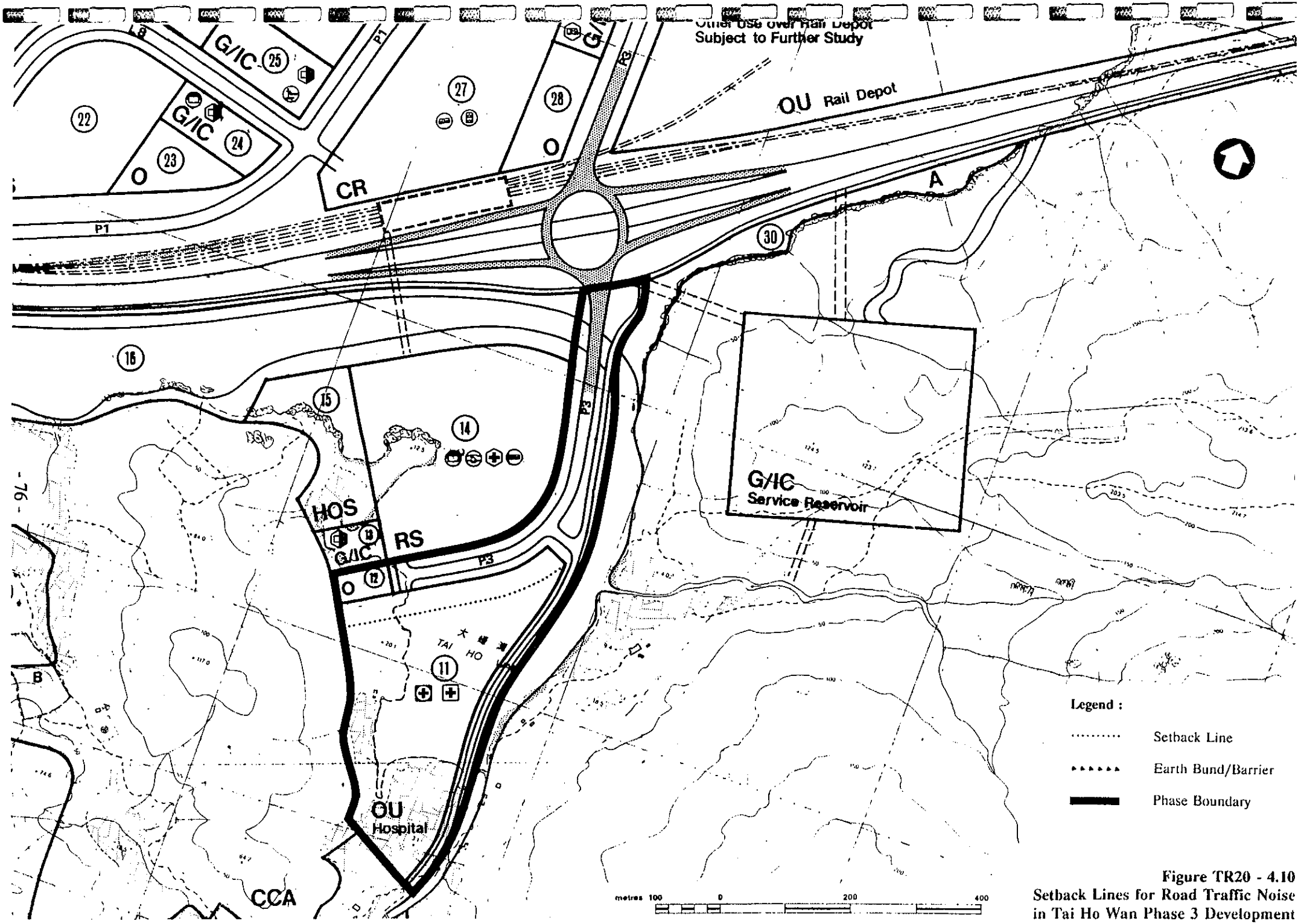


Figure TR20 - 4.10
Setback Lines for Road Traffic Noise in Tai Ho Wan Phase 3 Development

Phase 3 : Train Noise

Train noise impacts on Tung Chung Phase 3 are expected to be similar to those in the previous two phases. The LAL will run through Area 36 but will not impact on the CR development as it is envisaged that the second Tung Chung LAL station site will be designed with an integrated building - noise source design. Nevertheless trackside barriers alongside track running at-grade-depressed east and west of the station may be required for the 92 dB(A) train subject to detailed design of the vertical alignment of this section. Figure TR20-4.9 shows the schematic layout of the trackside barriers proposed for Phase 3.

Phase 3 : Tai Ho Wan - Road Traffic Noise

Table 4.11 gives the setback distances required to ensure compliance with HKPSG criteria without mitigation for Tai Ho Wan Phase 3. The only affected land use is Planning Area 11 which is planned for a District Hospital. No noise treatment of Road P3 is considered necessary. Figure TR20-4.10 shows the calculated road traffic setback line for the site.

Table 4.11 Setback Distances Required to Satisfy the HKPSG Criteria for Tai Ho Wan Phase 3 Development Without Mitigation

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
11	P3 (7)	Hospital	--	46

Train noise is will not constrain development in Tai Ho Wan Planning Area 11 for 83 dB(A) train rolling stock as the site boundary is over 500m from the tracks. However, trackside barriers would be required for 92 dB(A) train rolling stock.

Phase 4 : Tung Chung - Road Traffic Noise

The fourth phase of development in Tung Chung is unlikely to be constrained by road traffic noise with the provision of sufficient noise setbacks. Table 4.12 gives the road traffic setback distances required to ensure HKPSG compliance without mitigation. No noise mitigation of the roads is considered necessary for this phase other than that recommended for Phases 1, 2 and 3. Figure TR20-4.11 shows the setback lines for all noise sensitive land uses in this phase.

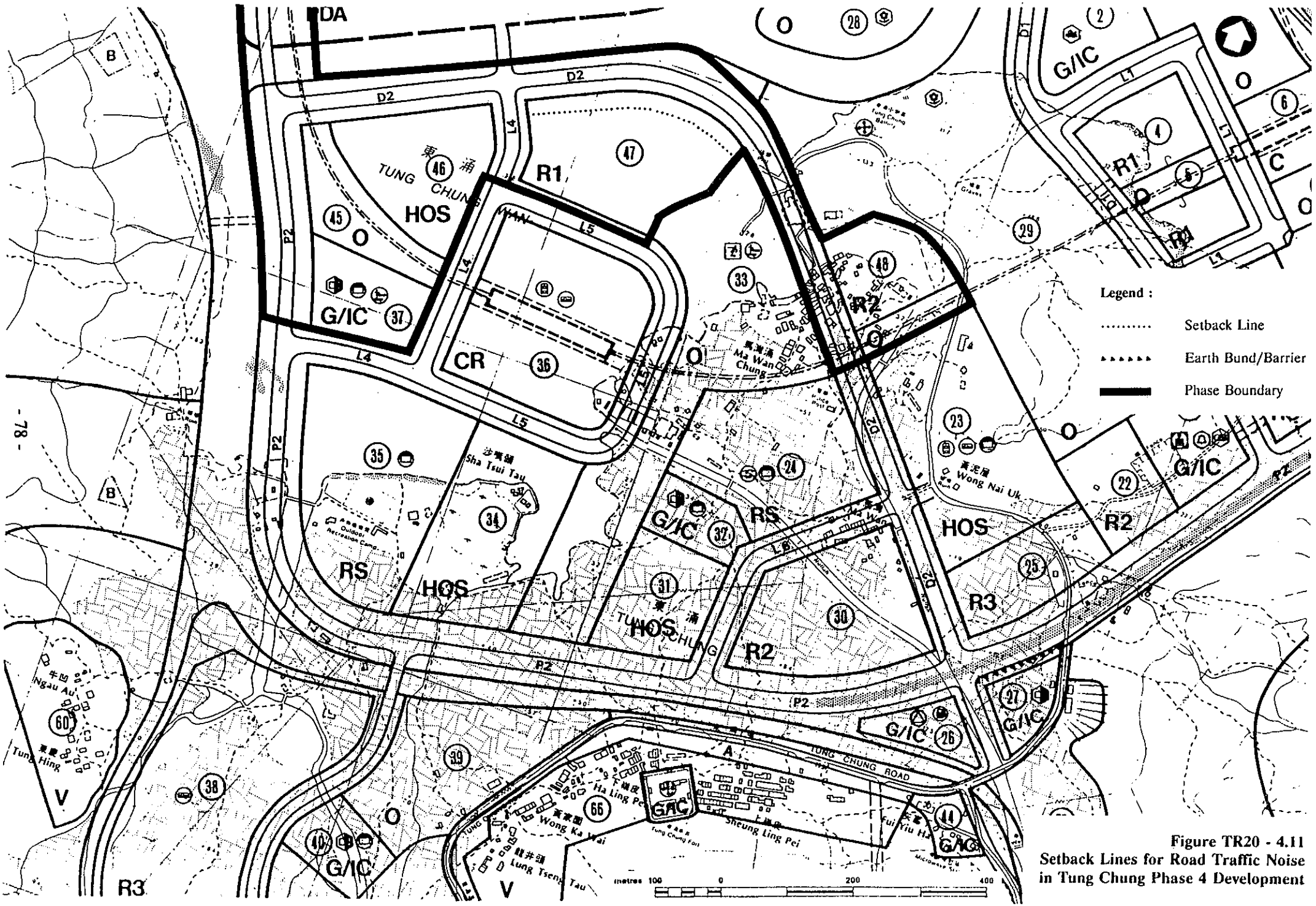


Figure TR20 - 4.11
Setback Lines for Road Traffic Noise in Tung Chung Phase 4 Development

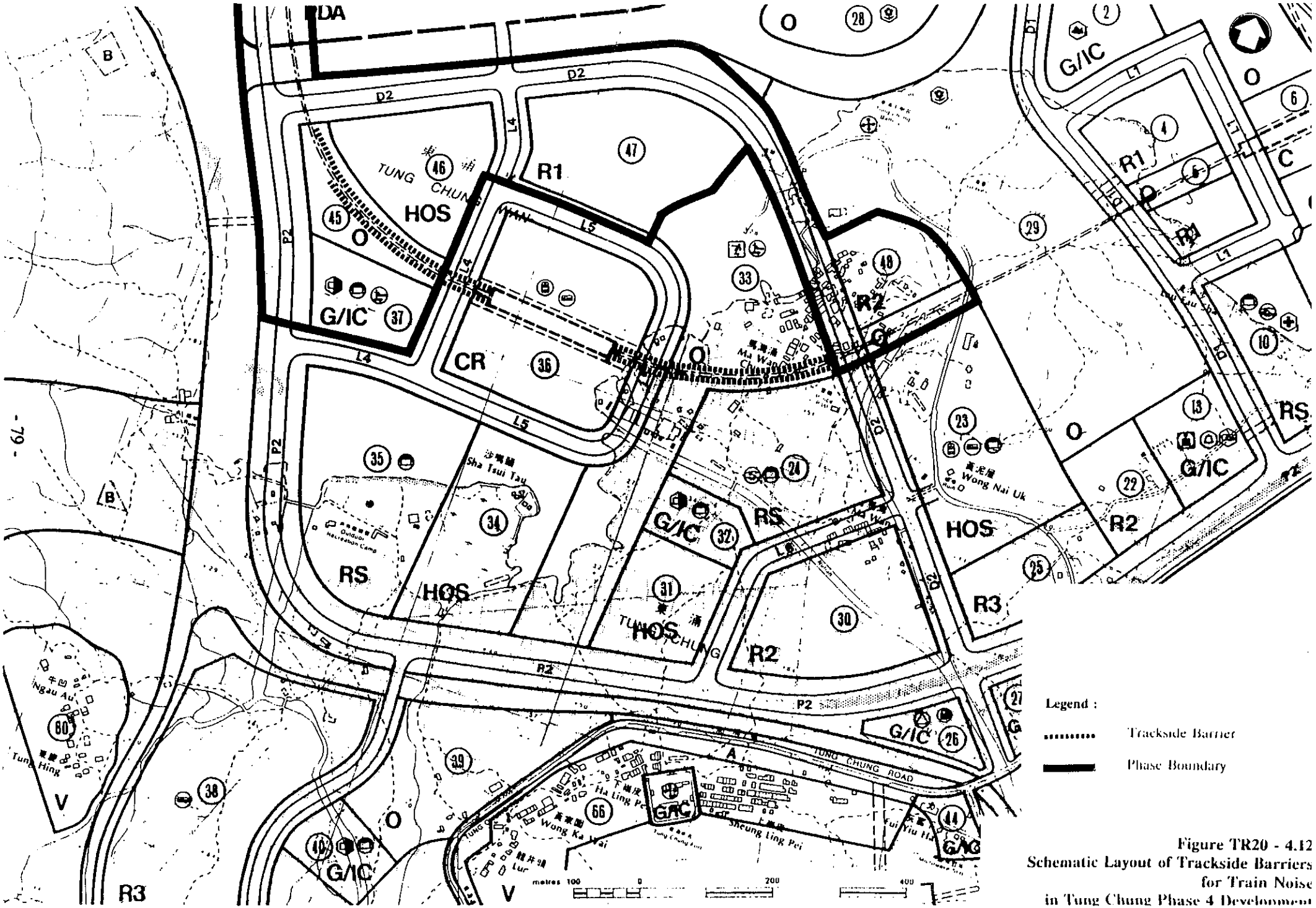


Figure TR20 - 4.12
Schematic Layout of Trackside Barriers for Train Noise in Tung Chung Phase 4 Development

Table 4.12 Setback Distances Required to Satisfy the HKPSG Criteria for Tung Chung Phase 4 Development Without Mitigation

Planning Area	Major Line Source	Land Use	Setback Distance (m)	
			2001	2011
37	P2 (31)	G/IC	--	25
46	D2 (32)	HOS	--	23
	P2 (31)		--	11
47	D2 (33)	R1	--	42
48	D2 (33)	R2	--	42
53	--	R2	--	--
54	P1 (27)	R1	--	15
55	P1 (27)	R2	--	15
56	P1 (37)	R3	--	32

Phase 4 : Tung Chung - Train Noise

Train noise will not constrain development in Tung Chung - Planning Areas 46, 47, 48 and 37 without mitigation as the track will be at-grade-depressed in the Planning Area 45. It is considered however, subject to detailed LAL design, that trackside barriers may be required with the 92dB(A) trains to remove site development constraints even though this section is at-grade-depressed. For the 92 dB(A) train the barriers considered in this report alone may be insufficient to remove the railway noise development constraint in noise Planning Area 46 and on the school sites in Planning Area 37. Thus additional forms of mitigation may be necessary, subject to the detailed vertical alignment of this section. Figure TR20-4.12 shows the schematic layout of the trackside barriers proposed for Phase 4.

Phase 4 : Tai Ho Wan - Road Traffic Noise

Phase 4 development in Tai Ho Wan could be constrained by road traffic noise from the NLE, as can be seen from Table 4.13 without the erection of new earth bunds and barriers. In particular, Tai Ho Wan Planning Areas 14, 15, 18, 22, 24, 25, 27 and 29 are likely to be adversely affected and large noise setbacks would be required. Table 4.14 gives the noise mitigation proposals for these areas for Phase 4 to ensure HKPSG compliance.

Table 4.13 Setback Distances Required to Satisfy the HKPSG Criteria for Tai Ho Wan Phase 4 Development Without Mitigation

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
13	--	E	--	--
14	P3 (6)	RS	--	21
	NLE (1)		192	208
15	NLE (1)	HOS	192	208
18	P1 (10)	R2	--	31
	NLE (1)		192	208
19	--	HOS	--	--
21	--	R1	--	--
22	P1 (10)	HOS	--	31
	NLE (1)		192	208
24	P1 (10)	E	--	74
	NLE (1)		455	493
25	P1 (11)	E	--	134
27	NLE (1)	CR	192	208
	P1 (11)		--	56
29	P1(12)	E	--	135
	P3 (5)		109	177

Table 4.14 Noise Mitigation Proposals for Tai Ho Wan Phase 4

Planning Area	Major Line Source	Land Use	Type of Mitigation	Approximate Barrier Length (m)	Residual Setback distance (m)
14	NLE (1)	RS	II *	600	176
15	NLE (1)	HOS	II *	600	176
18	NLE (1)	R2	II *	200	176
22	NLE (1)	HOS	II *	400	176
24	P1 (10)	E	I *	120	31
	NLE (1)		II *	220	51
25	P1 (11)	G/IC	I *	120	41
27	NLE (1)	CR	II *	250	176
29	P1 (12)	E	I *	200	41
	P3 (5)		I *	150	41

Note : * plus friction course

Planning Area 29 at Tai Ho Wan is planned for a secondary school, an ambulance depot and a fire service station. As the school is the only sensitive use on the site, noise barriers for Road P3 and Road P1 may not be required with full use of the non-sensitive facilities on the site to screen the sensitive one. Figure TR20-4.13 shows the schematic layout of earth bunds/barriers and the associated setback lines for all noise sensitive uses in Phase 4 development at Tai Ho Wan.

Phase 4 : Tai Ho Wan - Train Noise

Train noise will have impacts on the sensitive land uses (Planning Areas 18, 19, 22, 27 and 29) along the combined line (ARL + LAL) according to Tables 4.4 and 4.5. The extent of the impacts depending on the type of rolling stock to be used for the services. With a 83 dB(A) train the installation of a trackside barrier north of the railway line will elimate such constraints. However, noise constraints may remain even with barriers for the 92 dB(A) train in Planning Area 27 although the extent of constraint will depend on the detailed layout plans for this Planning Area including that of Tai Ho Wan station. Figure TR20-4.14 shows the schematic layout of the trackside barriers to protect the adjacent land uses.

No trackside barriers on the south of the ARL/LAL would required for 83 dB(A) train rolling stock as the nearest dwellings Planning Areas 14 and 15 are over 200m away. However, with the 92 dB(A) train trackside barriers south of the railway would be necessary to protect these sensitive uses.

Phase 5

As the land uses in this post 2011 development are undetermined at this stage, no assessment of noise impacts can be made.

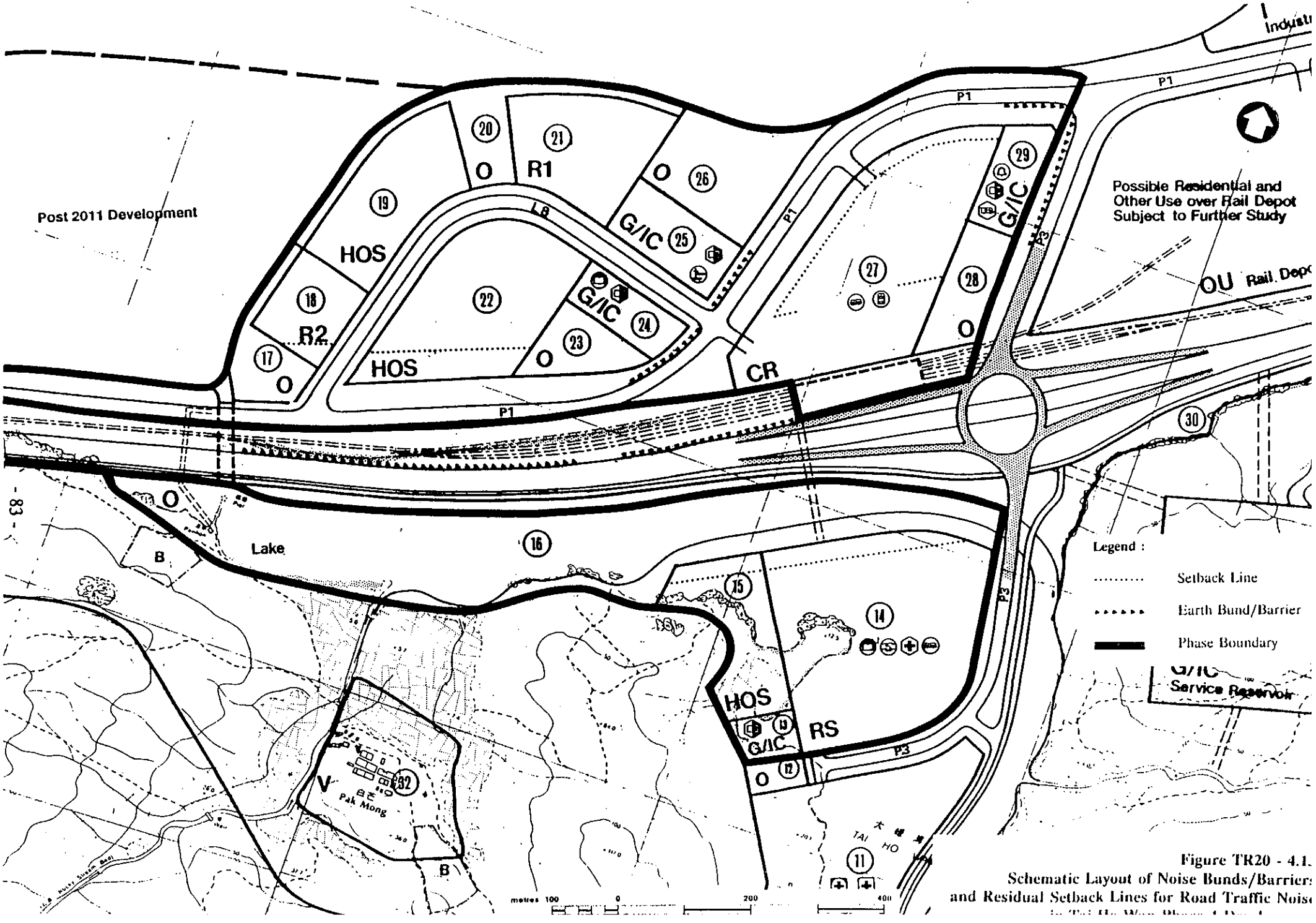


Figure TR20 - 4.1
Schematic Layout of Noise Bunds/Barriers and Residual Setback Lines for Road Traffic Noise

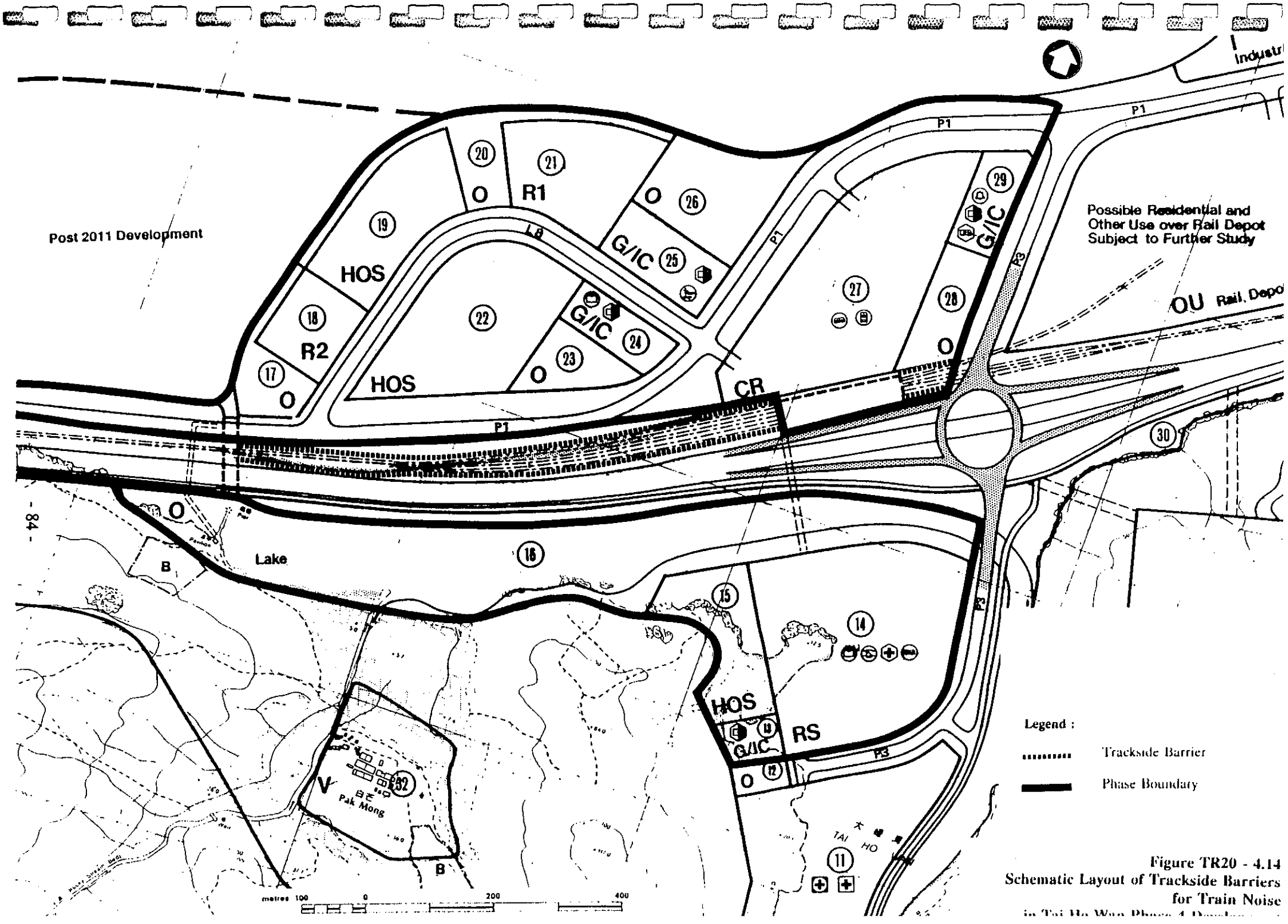


Figure TR20 - 4.14
Schematic Layout of Trackside Barriers for Train Noise

4.4 Recommendations

The following overall recommendations are made in connection with the foregoing analysis.

(a) An integrated noise "package" to the whole of the NLD should consist of a combination of:

- o Surfacing of the NLE and all primary roads with a layer of friction course;
- o Provision of appropriate noise setbacks for sensitive land uses flanking busy roads during detailed layout planning;
- o Restricting angle of view of the adjacent roads to less than 120° for dwellings; and
- o Noise barriers.

(b) The following noise barriers are recommended:

- o Additional earth bund/barrier noise treatment of the NLE is recommended if the setback distances at the noise sensitive land uses flanking the road exceed 160m without the use of bunds/barrier. The appropriate additional NLE treatment is a landscaped earth bund 6m high with a 3m high noise barrier on top;
- o Additional earth bund/barrier noise treatment of the primary roads is recommended if the setback distances at the noise sensitive land uses flanking the road exceed 50m without the use of bunds/barriers. The appropriate additional treatment is a landscaped earth bund 3m high with a 3m high noise barrier on top;
- o Additional noise treatment of the NLE (2), NLE (3) and P2 (27) would be required to protect the Tung Chung Phase 1 and Phase 2 development by 2001. Earlier implementation of the mitigation scheme may be necessary. Trigger levels should be established to indicate the need and urgency of the road treatment against road traffic noise; and
- o The timing for the erection of railway trackside barriers cannot be established in this study and need further consideration when details of the vertical alignment of the LAL and more details of rolling stock are available. Absorptive type railway trackside barriers of 1.5m high, as shown schematically in Fig TR20-4.2, have been shown to be sufficient to reduce noise to acceptable levels. However, with the 92 dB(A) type of train there are some locations where trackside barriers plus additional mitigation may be required (subject to detailed vertical railway alignments).

4.5 Operation Noise Guidelines

4.5.1 Potential Operational Noise Pollution Sources

Some components of the NLD may lead to noise pollution. Proposed operational guidelines are given in the following paragraphs.

Industrial Park

The first stage of the Industrial Park will be completed during Phase 2 and its completion be during Phase 4 of the new town development. The following development controls should be applied to minimise noise pollution impacts:

(a) only industries which do not have off-site noise pollution impacts in accordance with the HKPSG should be allowed to locate at the industrial park;

(b) industrial/residential setbacks should be retained when the precise nature of industrial developments are established; and

(c) environmental assessment, monitoring and audit of the industrial park will be required during the detailed planning phase.

Railway Depot

The railway depot will be completed during the Phase 1 and Phase 2 developments. The following development control will minimise off-site noise pollution impacts:

(a) enclosure of parts of the railway depot may be necessary to prevent noise pollution emanating from operations; and

(b) environmental assessment, monitoring and auditing of the railway depot will be required during its detail design.

Railway Track Maintenance Operations

Careful timing and management of track grinding operations and other maintenance measures will be required to minimise noise pollution impacts.

NLE, Primary and Local Roads

The noise impact of roads should be monitored during the build up of road traffic, population and associated noise sensitive receivers to validate the setback results predicted in the environmental assessment. This would comprise part of the routine environmental auditing and monitoring programme of the NLD to ensure HKPSG levels are not exceeded.

Residential Population

The new residential population will increase from 20,000 persons in 1997 to 200,000 by 2011 with an ultimate post 2011 population of 260,000. Noise pollution considerations have been taken into account throughout the New Town design and residential population has been located with adequate noise buffers from all potential pollution sources. This assessment includes existing villages and village re-site areas. Nevertheless, environmental monitoring and audit will be necessary to ensure that HKPSG noise levels are achieved.

Other Noise Sensitive Receivers

Nurseries, homes for the aged, hospitals and clinics, convalescent homes, places for public workship, libraries, courts of law, performing arts centres, auditoria, amphitheatres, country parks, and schools (kindergartens) will also have to be located with adequate noise setbacks/buffers from all potential noise pollution sources, detailed above. Nevertheless, noise monitoring and audit will be required during the operational phase to ensure HKPSG noise levels are achieved.

4.5.2 Operation Phase Conclusions

The following conclusions have been drawn in respect of the operation phase :

(a) Year 2011 represents the worst case noise scenario in terms of road traffic noise;

(b) Noise conflicts in Phase 1 Layout Plans can be resolved by the provision of an integrated noise package;

(c) Residual noise conflicts would still exist with the proposed earth bund/barrier noise treatment of the NLE and primary roads. Setback distances are required in some planning areas to reduce the noise conflicts;

(d) 92 dB(A) train rolling stock requires considerably larger setback distances than 83 dB(A) train rolling stock in order to satisfy the NCO requirements for the period 2300-0700 hours;

(e) Railway trackside barriers of the type shown in Figure TR20-2.2 reduce the setback distances to about 40m for 83 dB(A) train rolling stock at-grade; and

(f) With the 83 dB(A) train the recommended trackside barriers will elimate noise conflicts on noise sensitive uses in the RODP. However, if trains noisier than this are used there are some locations where noise sensitive uses are located close to the tracks where the proposed barriers will not remove all noise constraints. Thus additional mitigation could be required and the use of such stock should be discouraged.

5. ENVIRONMENTAL MONITORING AND AUDIT

5.1 Introduction

This Chapter details the environmental monitoring and auditing of air and water quality and noise levels required to ensure compliance with operational guidelines and environmental standards set in contracts. Baseline environmental monitoring will provide a reference against which subsequent environmental monitoring data can be compared to ensure environmental objectives are being adhered to and to indicate where it is necessary to take mitigatory action. One of the primary objectives of the Construction Phases will be to undertake works in such a way as to minimise the environmental impacts.

One of the primary planning objectives was to provide a high quality urban environment whilst minimising the impact on the natural environment. Operational phase environmental auditing, coupled with monitoring, will be required to ensure these objectives are achieved.

5.2 Air Quality

5.2.1 Monitoring and Audit of Air Quality during Construction

Impact monitoring of 1 hour and 24 hour TSP levels should be carried out at all air sensitive receivers and at the site boundary whenever works generating dust are being carried out. The monitoring schedule should be determined by the Engineer depending on the contractor's method of working but as a guide should be about 3 days per week at all sensitive receivers that are likely to be affected and at selected points around the site boundary. A 1 hour TSP and a 24 hour TSP sample should be collected on each day with the 1 hour sample being representative of high impacts (for example during blasting). 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 reported on daily record sheets recording:-

(a) sampling point;
(b) sampling time;
(c) monitored level;
(d) equipment used;
(e) weather conditions; and
(f) activities being carried out on site.

Monthly reports of all monitoring data should be prepared and copied to the Contractor and EPD.

5.2.2 Target, Trigger and Action Levels for Dust

Table 5.1 shows the target, trigger and action levels proposed for construction dust for inclusion in all construction contracts.

Table 5.1 Target, Trigger and Action Levels for Dust

	Target	Trigger	Action
24 Hour TSP Level in $\mu g/m^3$	Background Level plus 30%	Average of target and action level	260
1 Hour TSP Level in $\mu g/m^3$	Background Level plus 30%	Average of target and action level	500

Table 5.2 summarises action to be taken in the event that the target, trigger and action levels proposed in Table 5.1, are exceeded.

Table 5.2 Proposed Action Plan for Dust

Event	Action	
	Engineer	Contractor
Exceedance of target level for one sample	Repeat measurement as soon as possible	-
Exceedance of target level for more than one consecutive sample	Repeat measurements Notify contractor	-
Exceedance of trigger level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of trigger level for more than one consecutive sample	Increase frequency of monitoring to daily Notify contractor Require contractor to make proposals to reduce dust	Review plant and methods Submit proposals for reducing dust to Engineer Implement remedial actions
Exceedance of action level for one sample	Repeat measurement as soon as possible Notify contractor	-
Exceedance of action 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

5.2.3 Air Quality during Operation

Based on the existing and planned locations of EPDs fixed air quality monitoring stations it is recommended that a fixed ambient air quality monitoring station should be established in the vicinity of Tung Chung. The site should not be directly influenced by local emission sources, such as the New Airport, NLE or industrial areas. The recommended station should be located so as to obtain measurements for typical levels of pollutants to which the general population in the area are exposed. A location on the roof a building in the Phase 1 Development area should be investigated during detailed design and the station should be operational at least one year before the opening of the New Airport. Such a station would provide a valuable contribution to EPDs systematic established air quality monitoring site network. Action will need to be taken if AQOs are exceeded.

5.3 Monitoring and Audit of Water Quality

5.3.1 Baseline Conditions and General Requirements

Baseline water quality monitoring is currently being carried out to provide a reference against which subsequent monitoring data can be compared.

One of the primary objectives of the construction phase development will be to undertake the Works in such a manner as to minimise the impact on marine water quality. Water quality monitoring is recommended to determine whether this objective is being achieved and where necessary to take mitigatory action.

5.3.2 Monitoring Requirements

Water quality monitoring proposals for Phase 1 have been outlined in TR18 (Revised). For subsequent phases the time horizons and the lack of detailed outline development plans for each phase preclude specification of detailed monitoring requirements for each phase. It is apparent that a series of monitoring guidelines will be required along similar lines to those proposed for Phase 1.

As the North Lantau Development proceeds the need for impact monitoring will consequently increase. Visual impacts from floating refuse, observed by the expanding population and the ever increasing number of visitors, may be as significant as chemical and biological impacts on water quality.

Monitoring programmes should be further considered when more details relating to programmes and construction methods become available. As a guide, monitoring for baseline water quality conditions should be carried out during the two months immediately preceding any marine activities. This should consist of temperature, salinity, suspended solids, turbidity and dissolved oxygen on depth profiles three times per week. Impact monitoring should proceed until all marine activities in that contract have been completed and should consist of the same measurements weekly. Specific monitoring of the performance of the sewage treatment works and the sewage outfall are discussed in the following section and in Table 5.5.

Table 5.3 shows the target, trigger and action levels for water quality which would be reasonable based on the assessment carried out for this report. This does not take any account of impacts on water quality from the New Airport construction and should be reviewed continuously on site in the light of the impact monitoring results.

It is likely that monitoring of effluents from works sites will be necessary to ensure compliance with the Technical Memorandum. In this case weekly monitoring should be adequate.

Table 5.3 Target, Trigger and Action Levels Proposed for Water

Impact	Target	Trigger	Action
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 proposed action plan for monitoring water pollution is given in Table 5.4 and summarizes action to be taken in event of exceedance of target, trigger and action levels proposed in Table 5.3.

Table 5.4 Proposed Action Plan for Water

Event	Action	
	Engineer	Contractor
Exceedance of target levels	Notify Contractor	-
Exceedance of trigger levels	Notify Contractor Require Contractor to propose measures to reduce pollution Increase monitoring frequency to at least one measurement per day as appropriate	Submits mitigation proposals to the Engineer. Implements mitigation proposals
Exceedance of action level	Notify Contractor Notify EPD Required contractor to implement mitigation measures Increase monitoring frequency to twice daily	Implement mitigation measures Advise Engineer of measures applied

5.3.3 Operation Stage

Requirements

Environmental auditing of projects, especially on a scale such as the NLD, is required to ensure compliance with the operational guidelines and environmental standards set in the Contracts. Specific aspects of the NLD requiring post-construction auditing include:

- o discharges made to the foul sewer which are subsequently conveyed to the sewage treatment works for further processing;
- o the Sea Channel and East Tung Chung Bay;
- o discharges to urban and catchment drainage systems; and
- o discharge from the sewage outfall.

Discharges to the Foul Sewer

Discharge of effluent to publicly owned foul sewers is controlled by the Technical Memorandum on Effluent Standards. Application for discharge consents will be made to the EPD. Compliance monitoring of such discharges will be controlled by the same Department.

Facilities which will discharge to the foul sewer include the RTS, the hospital and clinics at Tai Ho Wan, and airport related operations. Details of the latter are given in the New Airport Master Plan Working Paper No. 35. Leaseholders of sites at the industrial park will also discharge to the foul sewer however the nature of these discharges is unknown at present.

Monitoring guidelines can be formulated when more details of flows and loads become available. Discharges to the foul sewer will be monitored by the operators and checked by the EPD.

The Sea Channel and East Tung Chung Bay

Monitoring of flows and velocities in the Sea Channel should be taken following the completion of each stage of reclamation in Tung Chung. Sedimentation in the channel should be monitored on an annual basis so that dredging programmes can be developed.

Monitoring of water quality in East Tung Chung bay will be needed on a regular basis. The best way of doing this is probably to add one position in the centre of the bay to EPD's regular monitoring programme.

Discharges to Urban and Catchment Drainage

The performance and design concepts behind the urban and catchment drainage may be compromised if pollutants are permitted to contaminate the stormwater conveyed by these channels. Visual inspections are recommended to identify the need for maintenance of silt traps and removal of litter and debris.

Discharge from the Sewage Outfall

Monitoring the performance of the Siu Ho Wan STW and Sewage Outfall is recommended to review trends in water and sediment quality and to determine, if possible, the impact of the discharge of effluent on the receiving waters. The hydraulic performance of the diffuser and the predictions of bacterial dispersion modelling may also be tested by monitoring.

In addition to the above, a major benefit is that by monitoring receiving water quality the programme for upgrading the treatment levels at the Works can be continuously reviewed. This was discussed in Chapter 3, where uncertainties concerning future marine water quality were highlighted. WAHMO assumes many improvements to receiving water quality due to major infrastructure projects. Should these be delayed then predicted assimilative capacity may be called into question.

It is recommended the STW and Sewage Outfall monitoring programme is divided into the following discrete elements:

- measurement of effluent flows and loads upon entry to the sewage treatment works. If the RTS, or indeed any other facilities, have dedicated inlets to the sewage treatment works the quality of influent can be tested;
- performance of the diffuser and the buoyant rise of the effluent plume. The latter would confirm the predictions made by the bacterial dispersion model which was a component in the decision regarding treatment levels and phasing of the Works;
- plume dispersion and E.Coli mortality;
- sediment quality adjacent to and in close proximity to the diffuser. This should be carried out to identify the changes in organic and metal content of the sediments; and
- receiving water quality.

This programme can be expressed in tabular form as follows:-

Table 5.5 Components of the Proposed STW and Sewage Outfall Monitoring Programme

Component	Monitoring Parameters	Frequency
Flows and Loads	BOD, suspended solids, DO, COD, all forms of N and P metals both individual and as TTM	Hourly for 24 hour periods twice monthly
Diffuser Performance	Flow, current velocity, salinity, temperature	One hour test in March, June, December
Dispersion Model	Effluent discharge, E.Coli load, tidal current, temperature and salinity profile	One observation
Sediment	Organic and heavy metal content	Annually until maximum flow build up, then bi-annually

As with all monitoring programmes the results should be kept under review to ensure the objectives of the programme are being complied with.

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water & noise.

5.4 Noise

5.4.1 Construction Phase

The purpose of the construction phase noise monitoring and auditing programme is mainly to establish compliance with the terms and conditions set out in the Construction Noise Permits and any daytime noise criteria contained in the contract documents. 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 determined by the Engineer depending on the contractor's method of working but noise should be measured in accordance with the Technical Memorandum on Noise from Construction Work other than Percussive Piling. Measurement should 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 at up to 3 days per week or more frequency if noise levels become high. The contractor should be instructed to take action to reduce noise levels whenever any level is measured in excess of those defined in the Contraction Noise Permit. Although in general Construction Noise Permits do not explicitly contain noise level limits, it is understood that the ANL in the NCO are statutory levels to the effect that the permits could be revoked by the Control Authority with or without further punitive terms if it can be established that the relevant ANL in the NCO are not observed by the contractors.

The procedure for noise monitoring should follow those contained in the Technical Memorandum on Noise from Construction Works Other Than Percussive Piling. It is recommended that the following target, triggering and action levels for construction noise should be incorporated in the contract document.

Table 5.6 Target, Trigger and Action Levels for Construction Noise (dB(A))

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

The frequency of noise measurements should be at least one per time period for each typical construction activity. The proposed action plan is set out in Table 5.7.

Table 5.7 Construction Noise Action Plan

Event	Action	
	Engineer	Contractor
Exceedance of 60dB(A) and 45 dB(A) target levels Exceedance of daytime target or trigger level	Notify Contractor	-
Exceedance of 65 dB(A) and 50 dB(A) trigger levels Exceedance of daytime action level	Notify Contractor Require Contractor to propose measures to reduce noise Increase monitoring frequency to at least two measurements per time period as appropriate	Submits noise mitigation proposals to the Engineer Implements noise mitigation proposals
Exceedance of 70 dB(A) and 55 dB(A) action level	Notify Contractor Notify EPD Require contractor to implement mitigation measures Increase monitoring frequency to hourly	Implement mitigation measures Advise Engineer of measures applied

5.4.2 Operational Phase

The noise monitoring and auditing programme for operational phase should be to establish the timing for implementation of any planned noise mitigation. For example, should the traffic levels in North Lantau build up faster than anticipated, noise treatment of certain sections of the roads would be required. This cannot be achieved without a well-defined noise monitoring and auditing programme.

Operational Noise Monitoring Requirements

Noise auditing will be required for the NLD to ensure compliance with the operational guidelines and environmental standards set in Contracts. Specific aspects of the NLD requiring post-construction noise auditing include:

(a) road traffic and railway noise;
(b) industrial noise;
(c) railway depot noise;
(d) refuse transfer station noise; and
(e) New Airport noise.

A regular noise monitoring and auditing programme could be interactively used in detailed planning of subsequent development phases and would be of use in the formulation of detailed precise mitigation requirements. The monitoring should be designed, inter alia, to confirm the assumptions and assessments made for this Study. It is recommeded that an annual survey of noise from the NLE and Airport Railway is carried out at selected sensitive receivers or more often if there are complaints. Monitoring of noise from the railway depot, industrial sites and refuse transfer station should be at the same frequency.

6. CONCLUSIONS

This report has presented an assessment of the environmental impacts of the NLD construction from Phase 2 onwards together with suitable mitigation measures. The report has concluded that the environmental impacts during construction will generally be within the current standards if the recommended mitigation measures are applied.

Control of noise from construction will be under the Noise Control Ordinance and this report has predicted worst-case noise levels operated by construction plant and proposed suitable mitigation methods.

The NLDS environmental study goal was to achieve a high quality urban environment and thus this report additionally presents operational guidelines for the NLD required to minimise any residual adverse environmental impacts of these major developments on environmental quality. This report also aims to give guidance to the environmental standards to be followed to reduce such negative impacts on all environmental sensitive receivers.

Finally, this report presents broad environmental monitoring and audit proposals required during and post construction to minimise any residual environmental impacts and maximise environmental quality of the New Town.

Appendix A

Air Quality

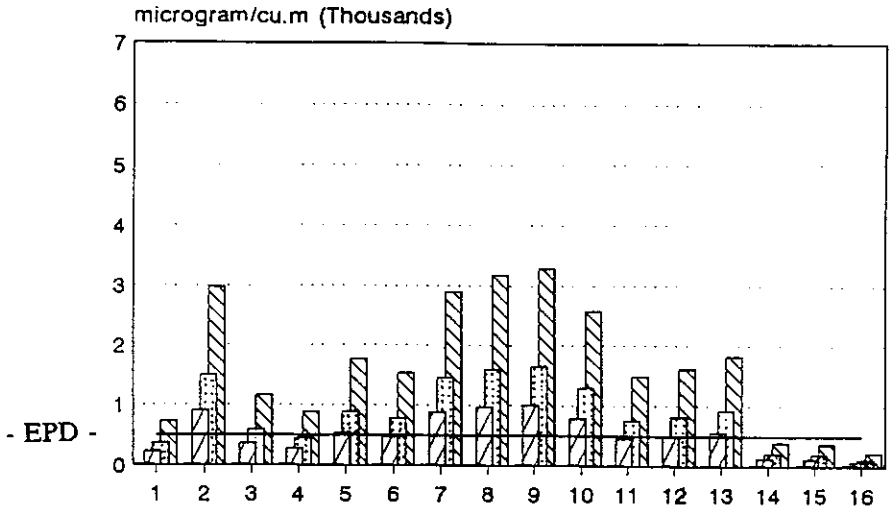

Figure A1
Phase 2
Maximum Predicted 1 Hour TSP

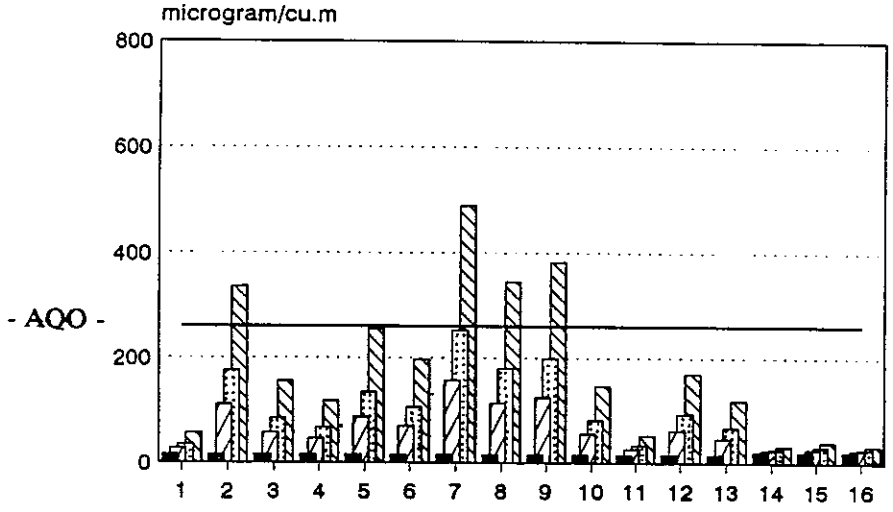

Figure A2
Phase 2
Maximum Predicted 24 Hour TSP

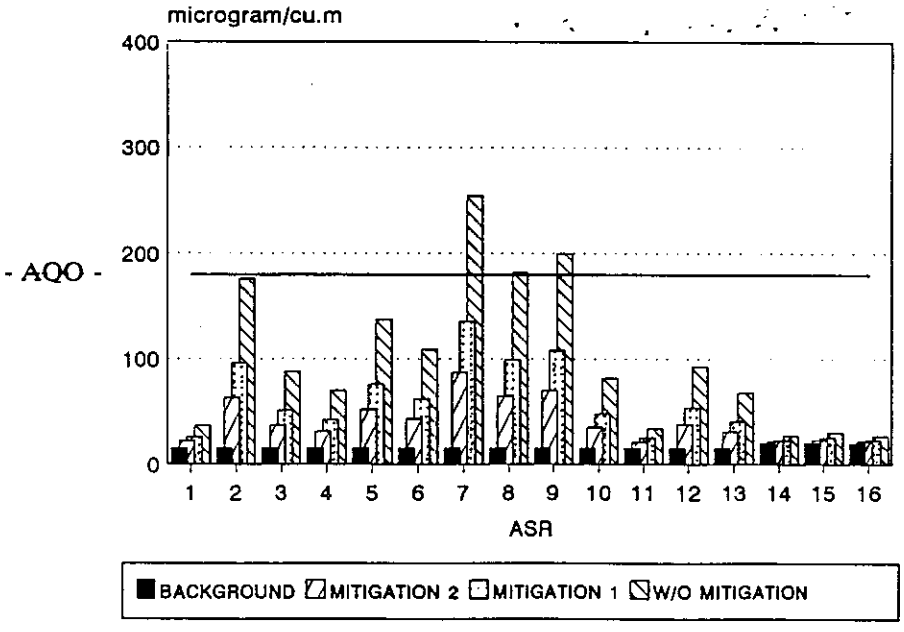

Figure A3
Phase 2
Maximum Predicted 24 Hour RSP

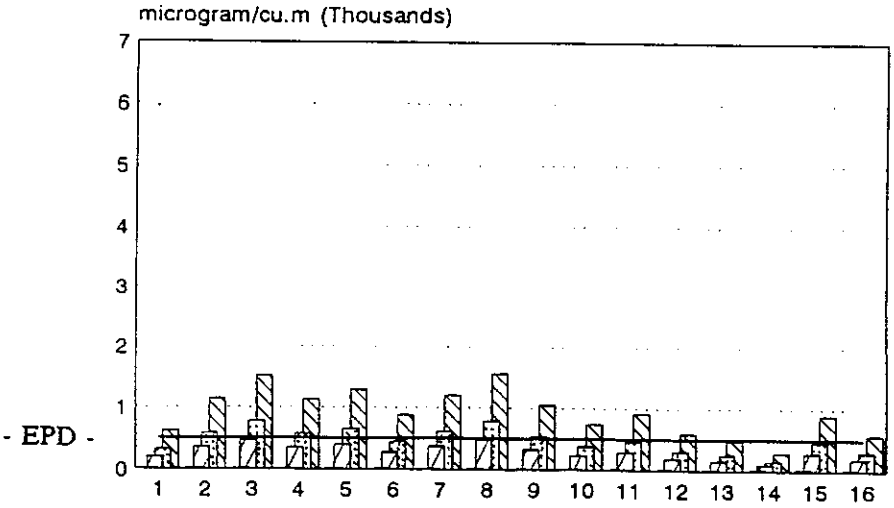

Figure A4
Phase 3
Maximum Predicted 1 Hour TSP

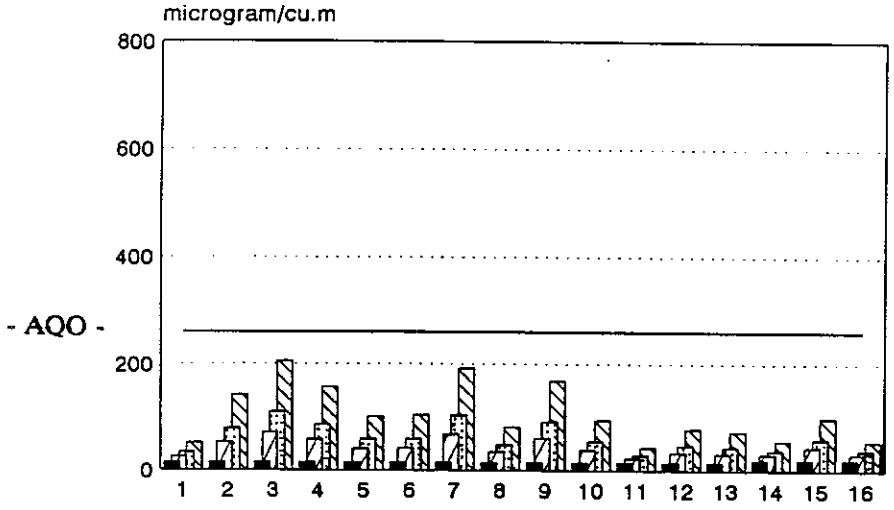

Figure A5
Phase 3
Maximum Predicted 24 Hour TSP

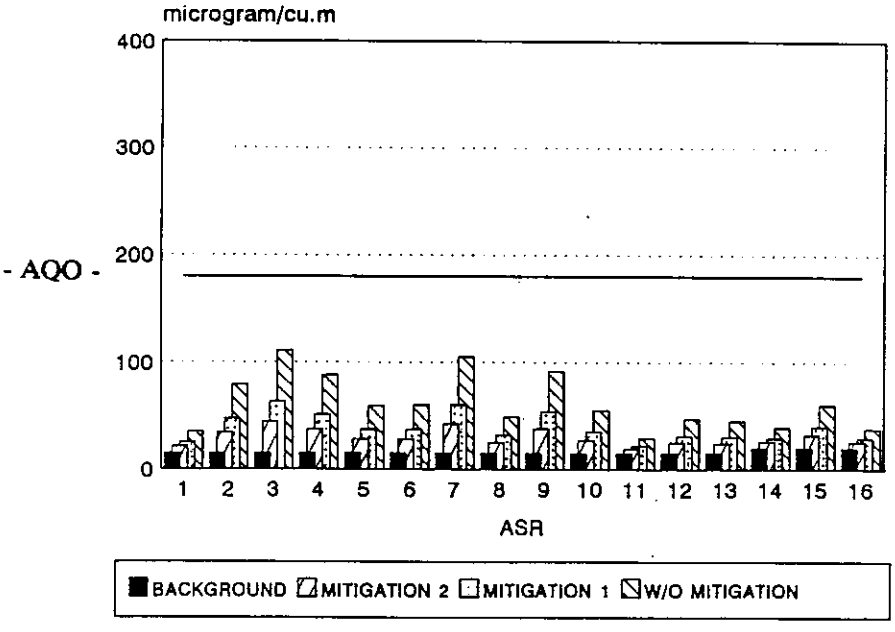

Figure A6
Phase 3
Maximum Predicted 24 Hour RSP

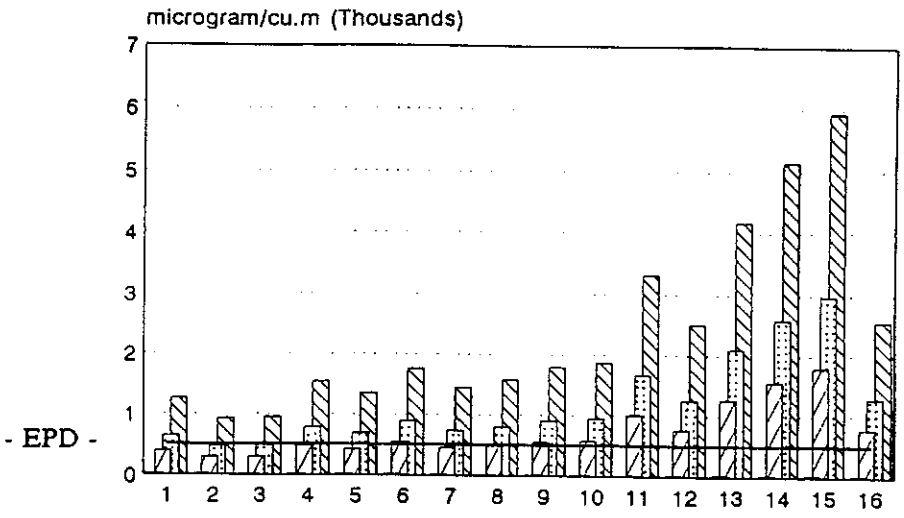

Figure A7
Phase 4
Maximum Predicted 1 Hour TSP

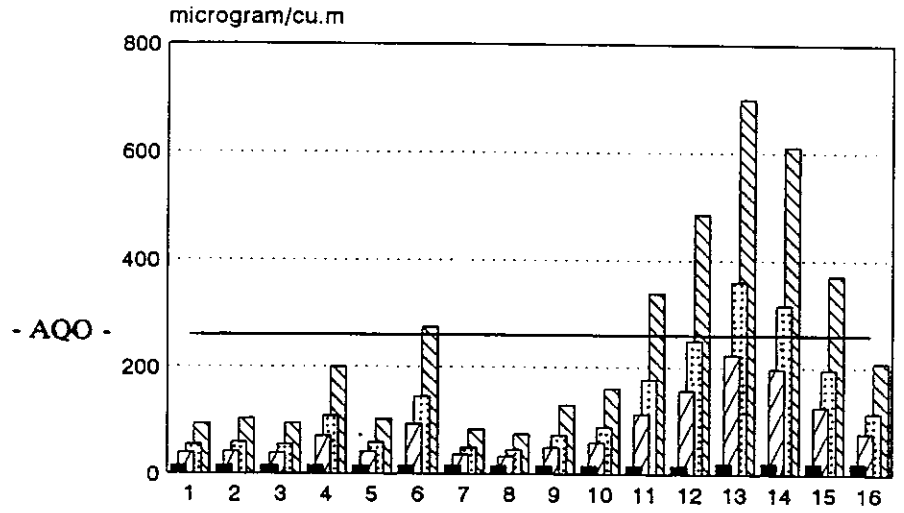

Figure A8
Phase 4
Maximum Predicted 24 Hour TSP

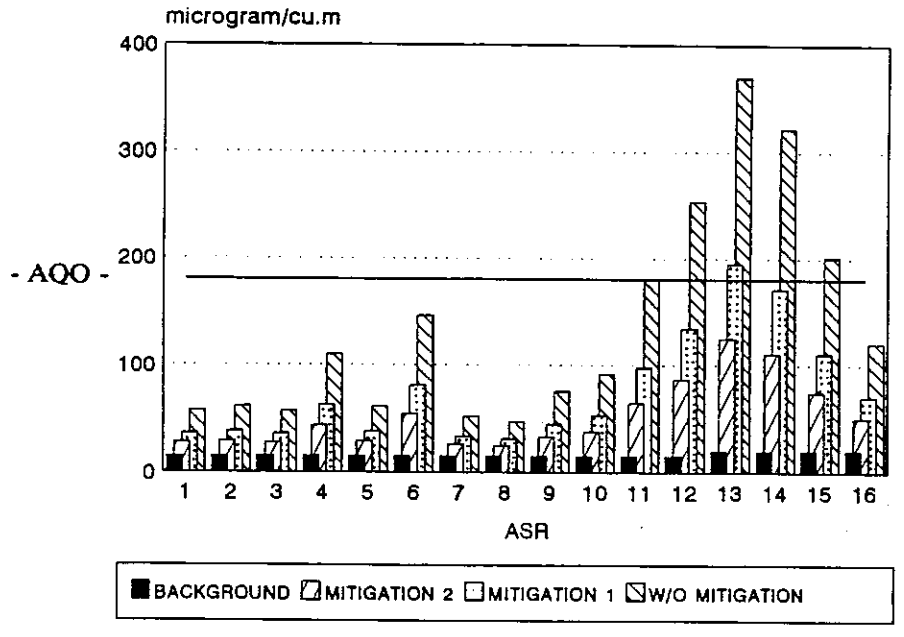

Figure A9
Phase 4
Maximum Predicted 24 Hour RSP

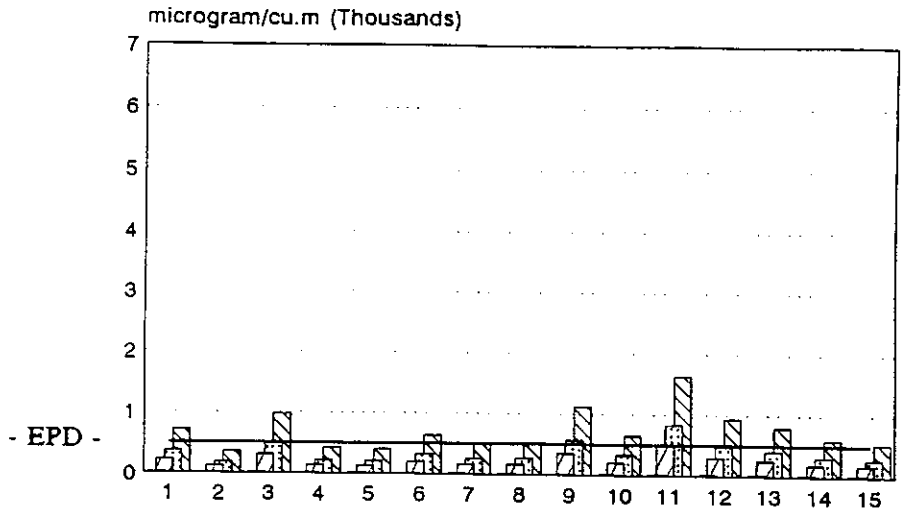

Figure A10
Phase 5
Maximum Predicted 1 Hour TSP

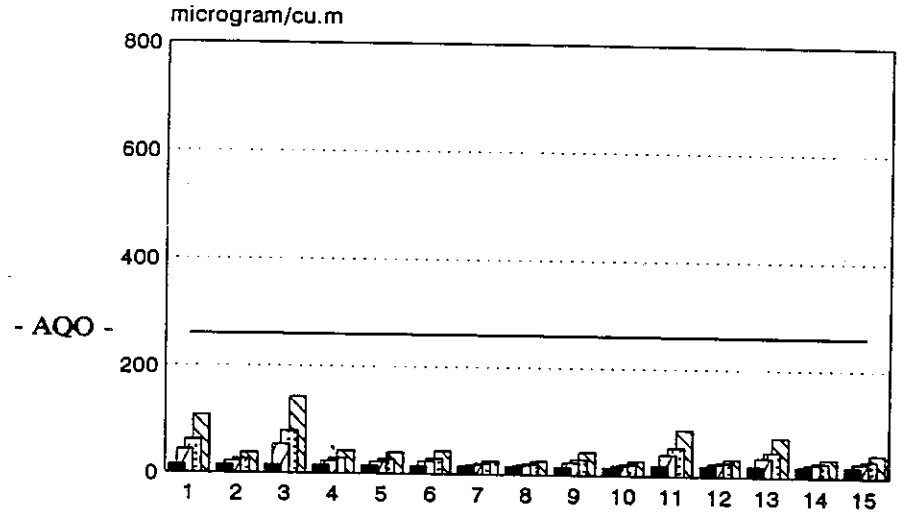

Figure A11
Phase 5
Maximum Predicted 24 Hour TSP

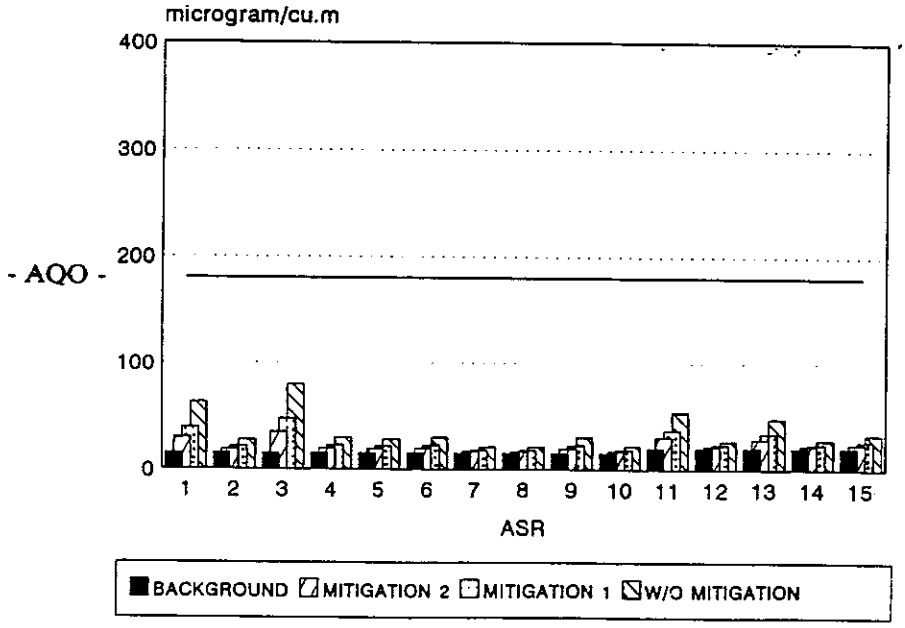

Figure A12
Phase 5
Maximum Predicted 24 Hour RSP

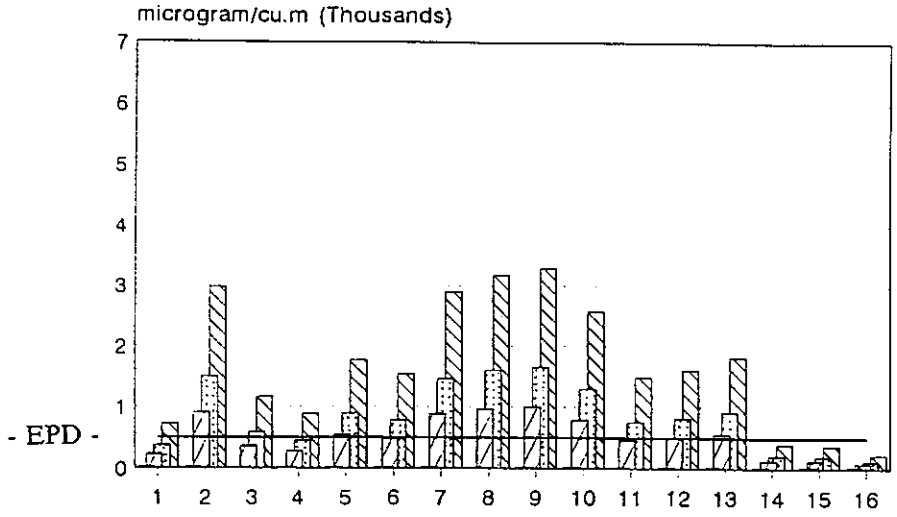

Figure A1
Phase 2
Maximum Predicted 1 Hour TSP

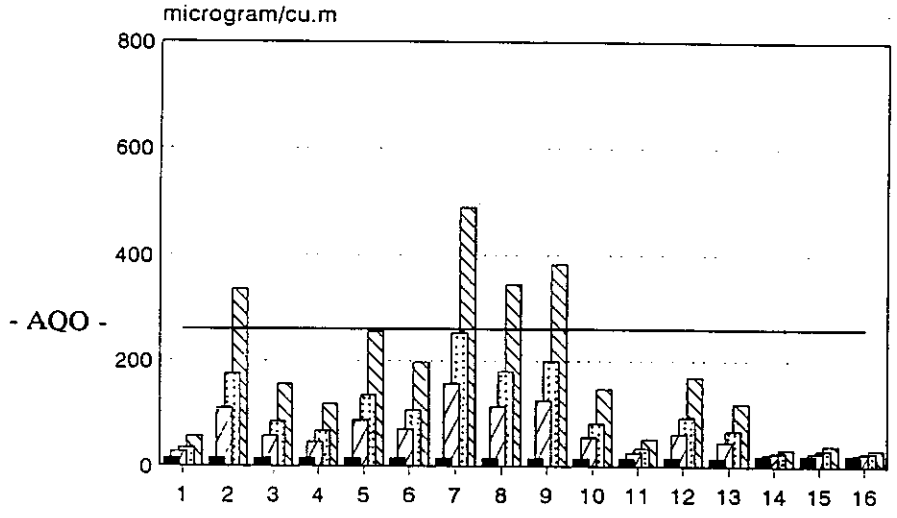

Figure A2
Phase 2
Maximum Predicted 24 Hour TSP

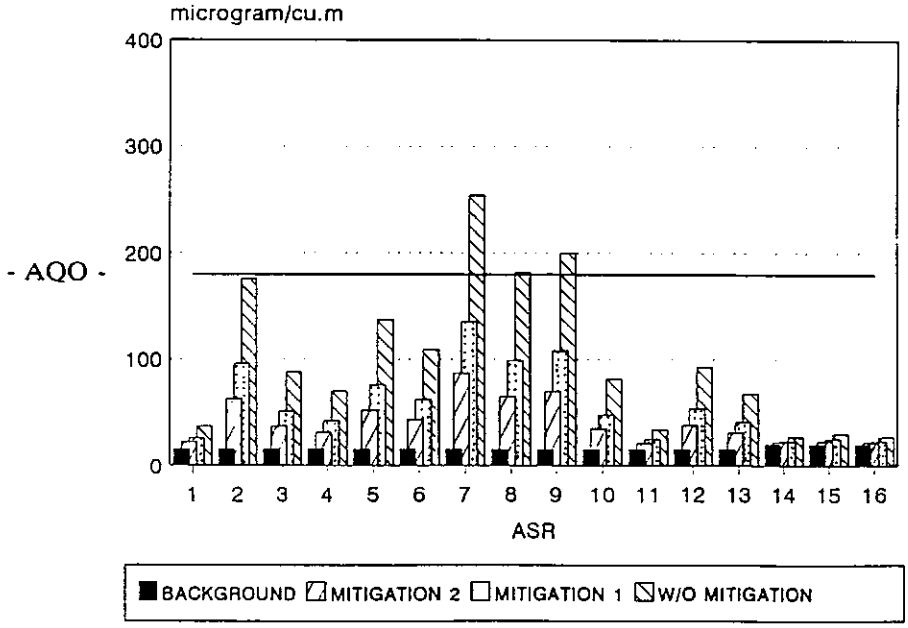

Figure A3
Phase 2
Maximum Predicted 24 Hour RSP

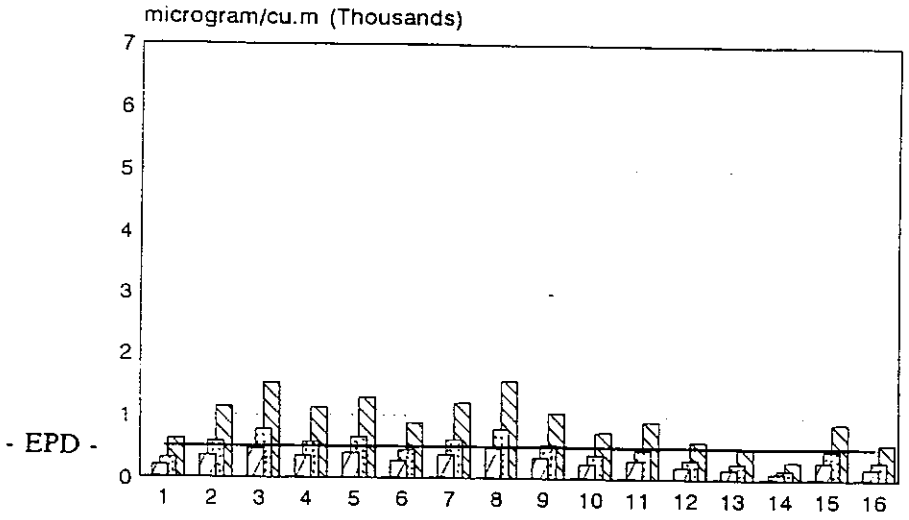

Figure A4
Phase 3
Maximum Predicted 1 Hour TSP

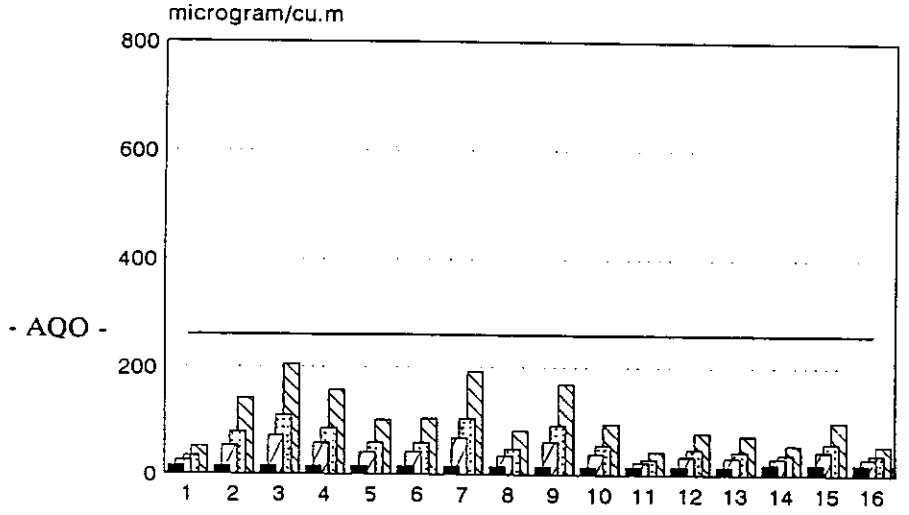

Figure A5
Phase 3
Maximum Predicted 24 Hour TSP

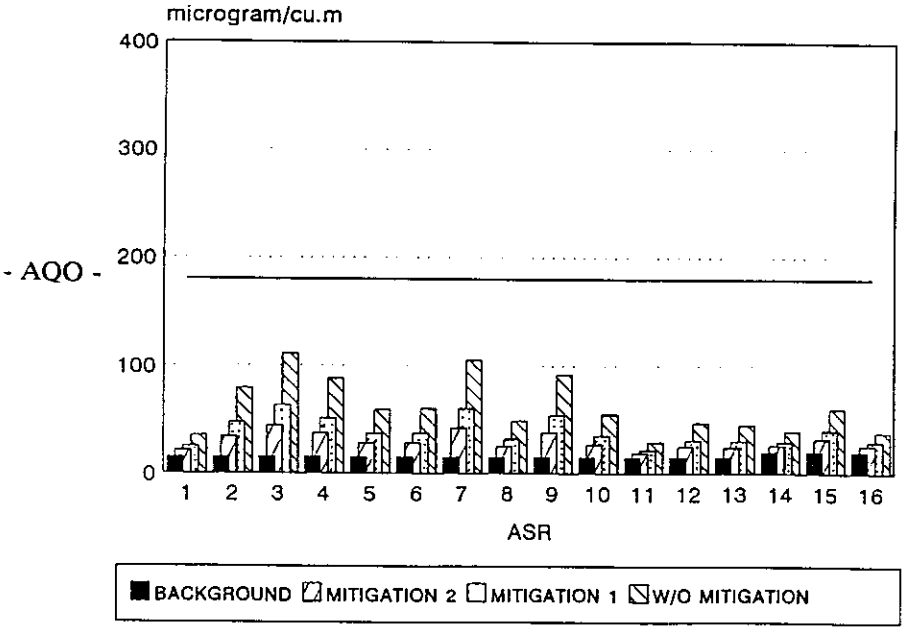

Figure A6
Phase 3
Maximum Predicted 24 Hour RSP

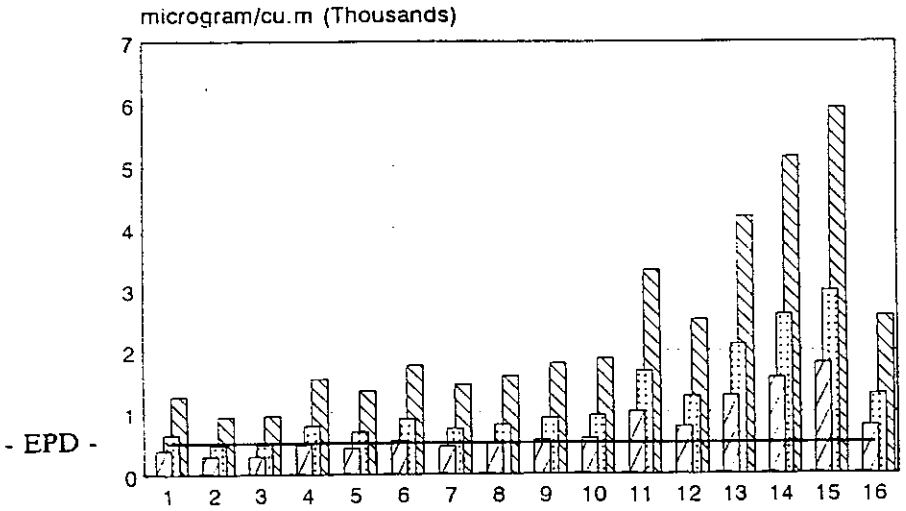

Figure A7
Phase 4
Maximum Predicted 1 Hour TSP

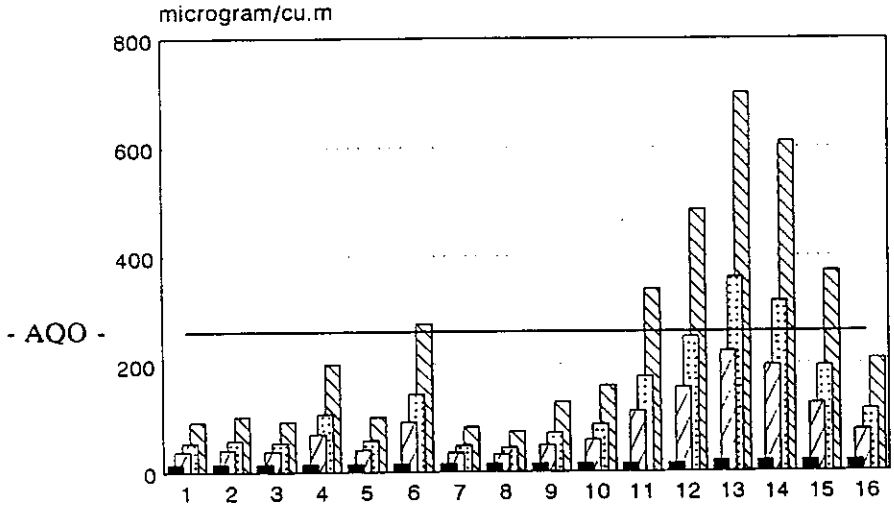

Figure A8
Phase 4
Maximum Predicted 24 Hour TSP

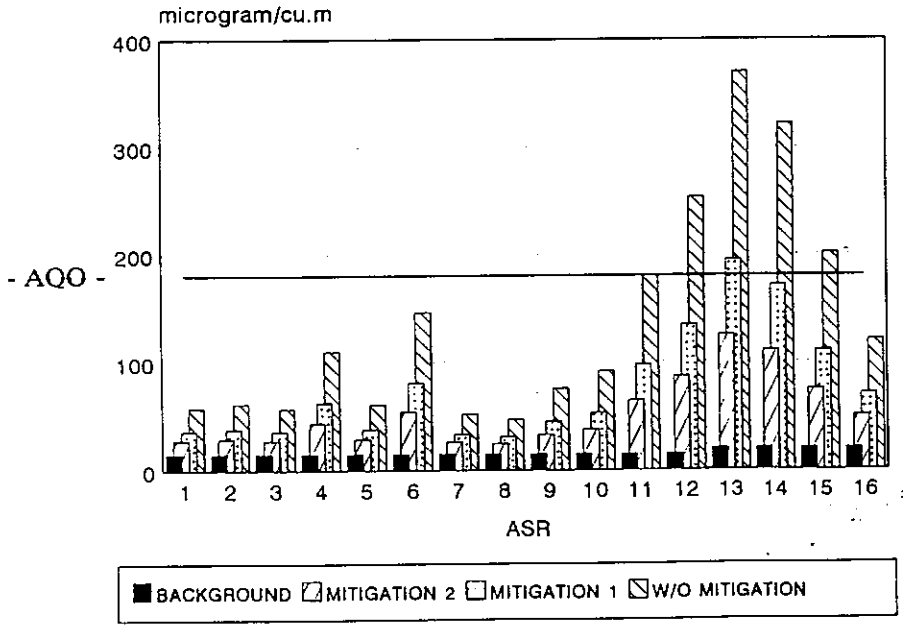

Figure A9
Phase 4
Maximum Predicted 24 Hour RSP

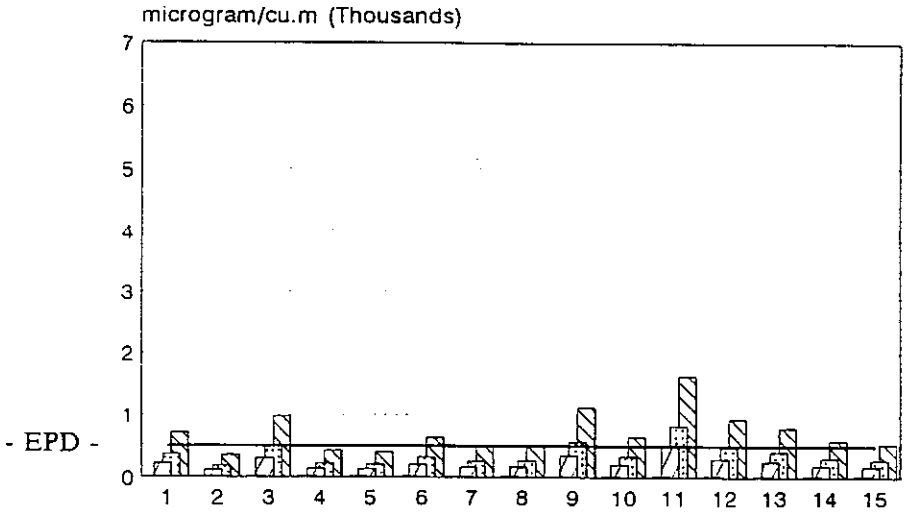

Figure A10
Phase 5
Maximum Predicted 1 Hour TSP

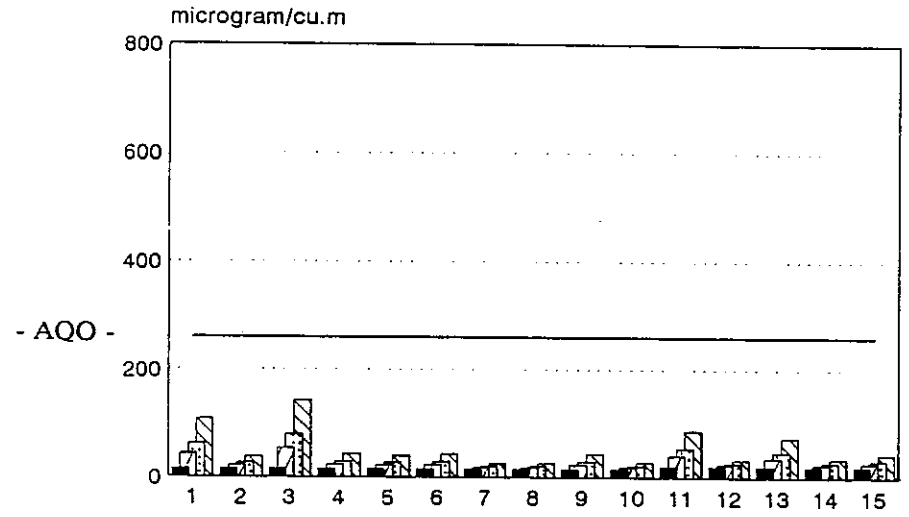

Figure A11
Phase 5
Maximum Predicted 24 Hour TSP

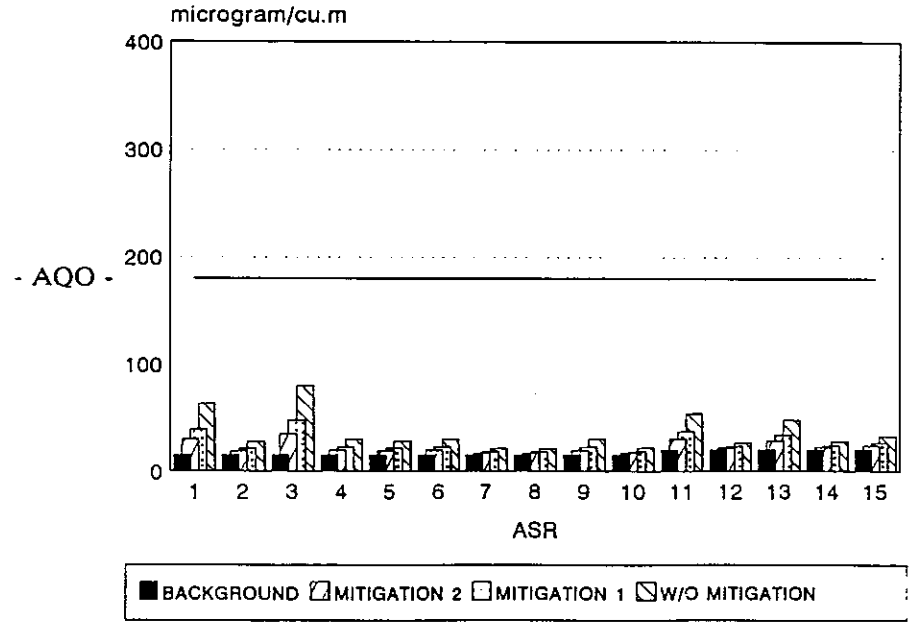

Figure A12
Phase 5
Maximum Predicted 24 Hour RSP

Appendix B

Operational Noise

Figure B1
Tung Chung - 2001

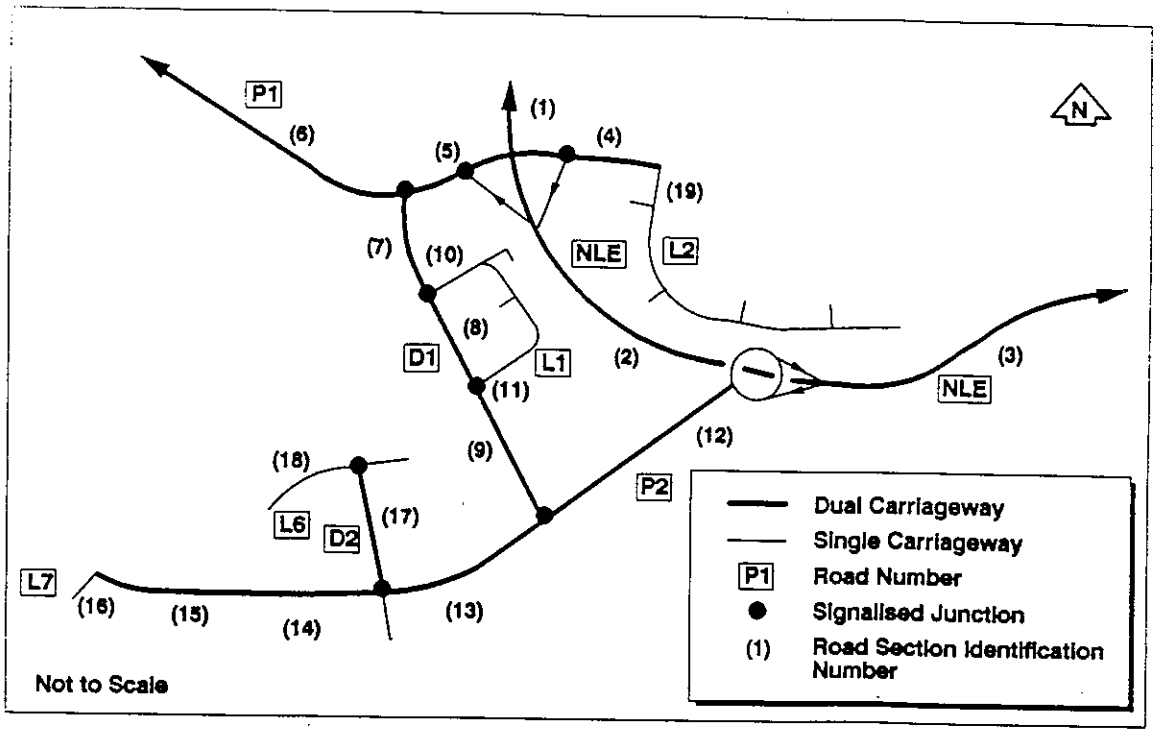

Figure B2
Tai Ho Wan - 2001

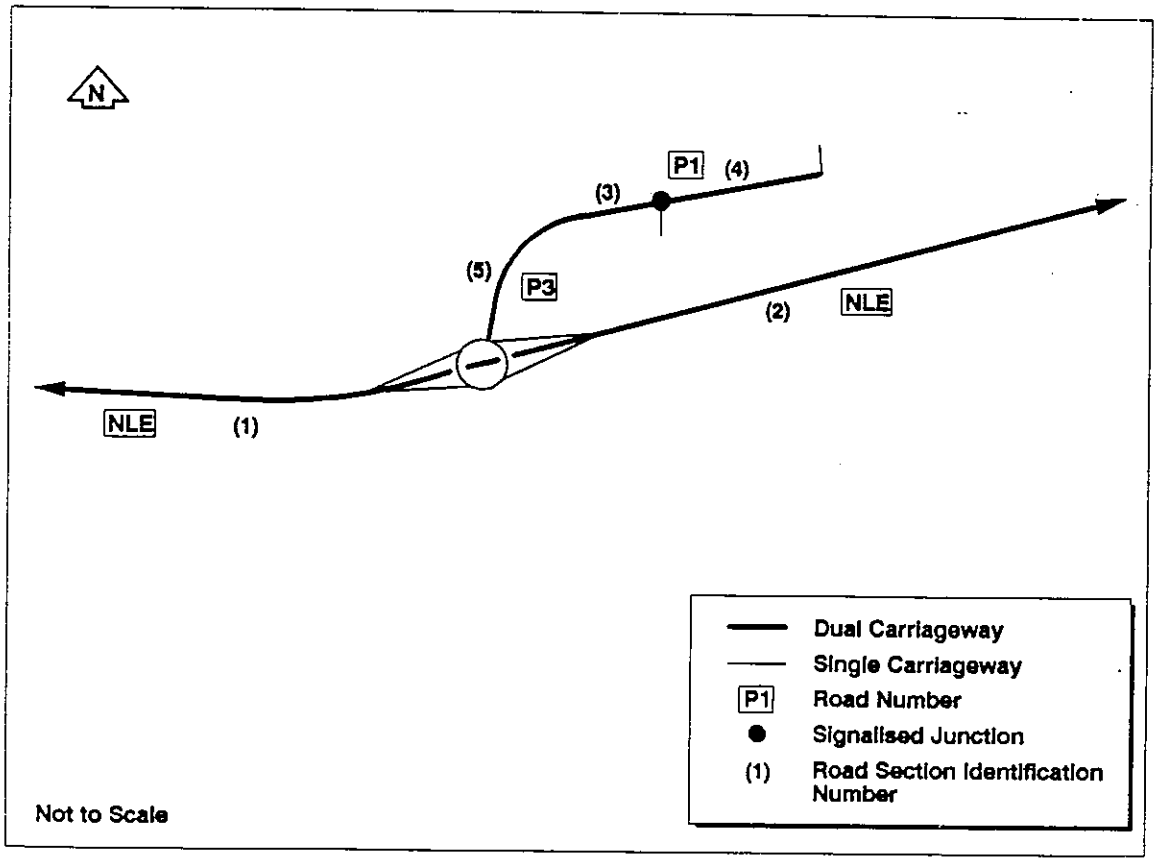

Figure B3
Tung Chung - 2011

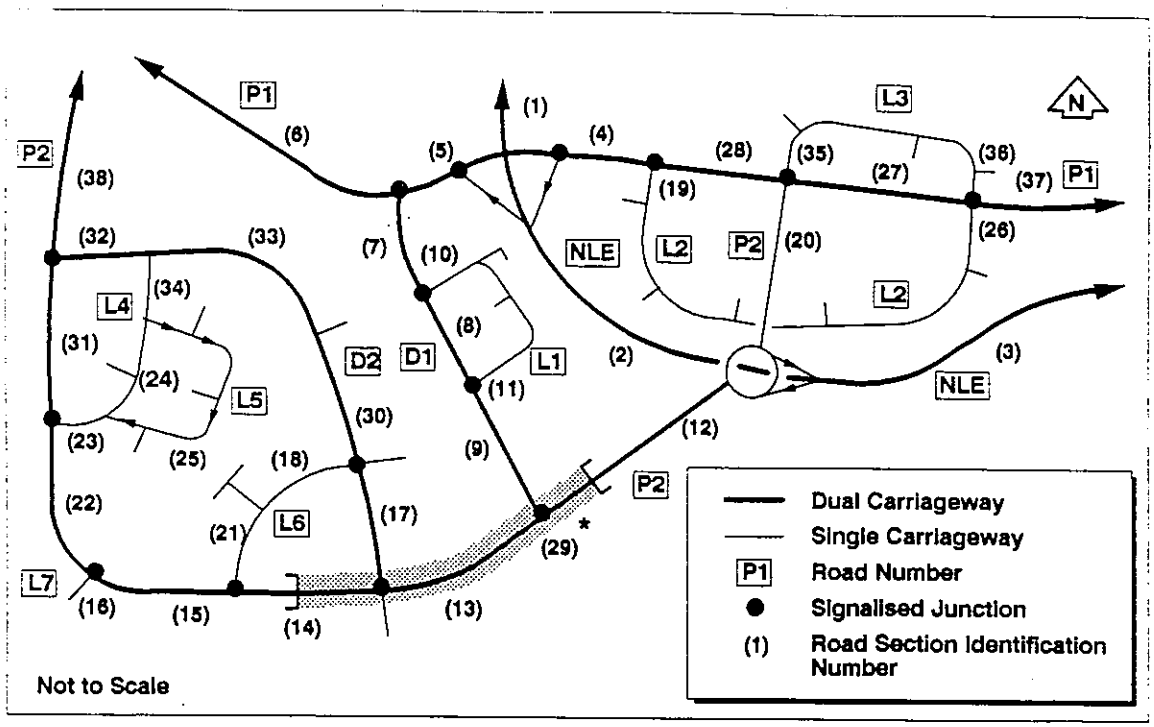

Figure B4
Tai Ho Wan - 2011

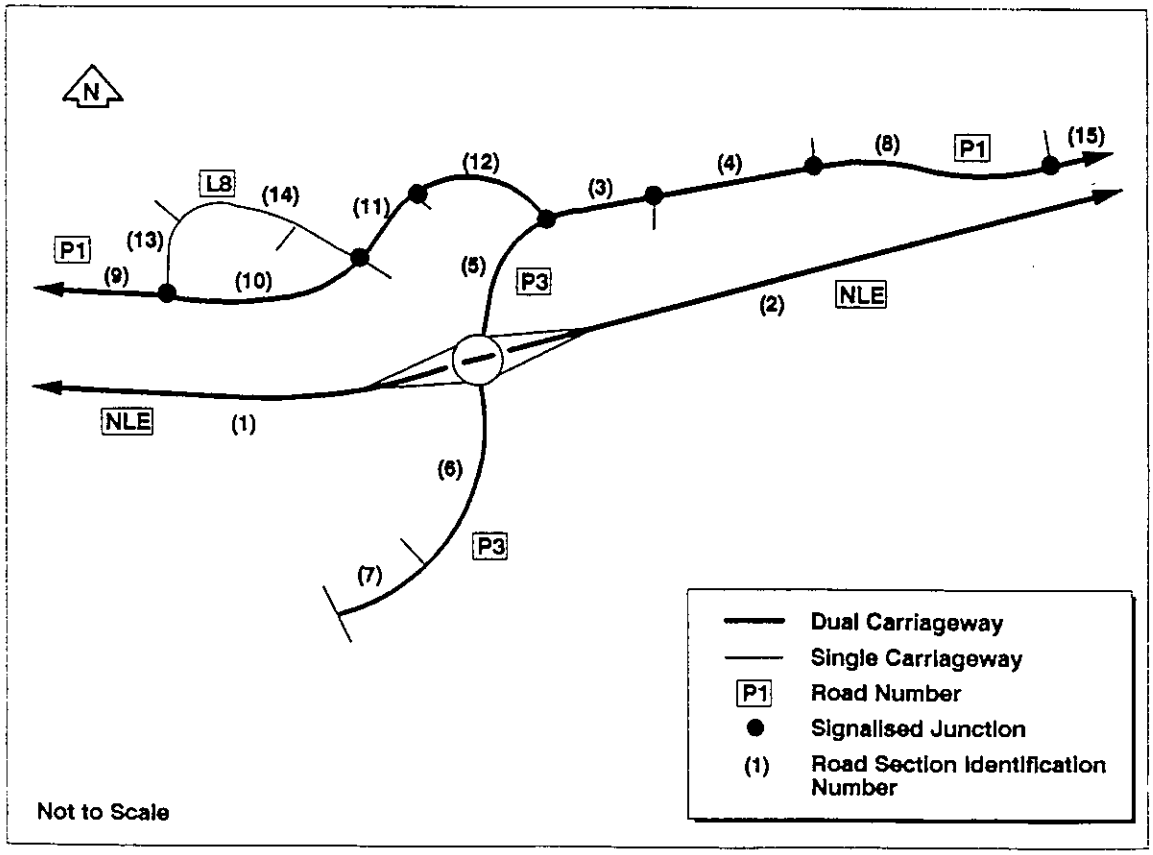

Table B1 Traffic Flows and Speeds for Different Road Sections in Tung Chung (2001)

Section	Predicted Speed (km/hr)	AM (veh/hr)		PM (veh/hr)		OP (veh/hr)		24 Hour	
		Light	Heavy	Light	Heavy	Light	Heavy	Total	Heavy
1 N	69	1243	412	1084	542	1134	552	28436	9144
S	72	528	426	1542	532	1530	565	33841	9298
2 N	67	1348	770	1132	846	1176	889	34924	14806
S	70	721	846	1654	866	1580	919	41148	15355
3 W	62	1451	984	1281	1022	1300	1147	41149	18880
E	67	932	1054	1768	1029	1685	1154	46858	19093
4 W	45	195	327	169	202	92	265	6359	4409
E	48	206	302	157	254	93	264	6458	4515
5 W	47	187	217	125	176	79	177	4709	3066
E	47	180	253	175	218	85	192	5291	3434
7 N	26	742	248	259	218	197	202	7904	3551
S	33	218	203	486	177	223	187	7746	3173
8 N	29	608	88	191	74	148	73	4602	1267
S	38	154	75	424	51	199	76	5206	1216
9 N	27	537	167	223	138	192	197	7002	3127
S	34	134	146	346	108	201	176	6495	2743
12 W	47	104	213	148	176	123	258	6210	4073
E	45	214	213	116	163	104	235	5715	3746

Section Numbers correspond to Figures Presented B1 - B4 of this Appendix

Table B2 Traffic Flows and Speeds for Different Road Sections in Tai Ho Wan (2001)

Section	Predicted Speed (km/hr)	AM (veh/hr)		PM (veh/hr)		OP (veh/hr)		24 Hour	
		Light	Heay	Light	Heavy	Light	Heavy	Total	Heavy
1 W	63	1451	984	1281	1022	1300	1147	41149	18880
E	66	932	1054	1768	1029	1685	1154	46858	19093
2 W	59	1480	1262	1210	1235	1272	1425	45161	23411
E	63	810	1310	1734	1252	1661	1434	50826	23646
3 W	49	24	322	112	289	57	345	6747	5663
E	49	170	347	76	278	52	342	6763	5630
4 W	51	17	277	93	241	49	290	5681	4764
E	48	154	296	71	229	42	87	3188	2219
5 N	48	170	347	76	278	52	342	6763	5630
S	45	24	322	112	289	57	345	6747	5663

Section Numbers correspond to Figures B1 - B4 of this Appendix

Table B3 Traffic Flows and Speeds for Different Road Sections in Tung Chung (2011)

Section	Predicted Speed (km/hr)	AM (veh/hr)		PM (veh/hr)		OP (veh/hr)		24 Hour	
		Light	Heay	Light	Heavy	Light	Heavy	Total	Heavy
2 N	67	1670	620	1910	740	1830	760	43760	12650
S	67	1300	750	2320	740	2410	790	52255	13220
3 E	56	2040	1240	2660	1170	2690	1290	66160	21495
W	58	1930	1100	2507	1160	2110	1260	57671	20880
4 E	48	260	250	410	100	150	210	6795	3300
W	47	310	250	250	180	170	200	6755	3415
5 E	45	340	280	330	200	160	200	7020	3520
W	45	310	220	260	190	180	210	7020	3525
7 N	29	460	260	160	170	130	190	6070	3275
S	38	160	210	335	170	170	200	6695	3325
8 N	38	400	110	100	70	90	70	3275	1250
S	39	110	90	240	70	140	80	3980	1345
9 N	37	340	200	290	140	200	170	6725	2845
S	39	230	140	290	160	230	180	7030	2940
12 E	41	910	480	560	470	440	550	17550	9005
W	50	510	530	820	460	400	540	17150	8925

Section Numbers correspond to Figures B1 - B4 of this Appendix

Table B4 Traffic Flows and Speeds for Different Road Sections in Tai Ho Wan (2011)

Section	Predicted Speed (km/hr)	AM (veh/hr)		PM (veh/hr)		OP (veh/hr)		24 Hour	
		Light	Heay	Light	Heavy	Light	Heavy	Total	Heavy
1 W	58	1924	1103	2509	1158	2109	1260	57654	20879
E	55	2042	1236	2655	1173	2683	1162	64464	19898
2 W	53	1780	1529	2364	1473	1984	1653	61937	27375
E	52	1826	1624	2332	1505	2502	1656	68661	27651
3 W	42	163	615	581	551	276	594	15438	10001
E	40	711	657	408	505	339	629	16891	10363
4 W	45	153	605	556	534	269	574	14945	9685
E	33	703	627	402	492	340	612	16577	10067
5 N	42	459	597	489	519	332	625	16571	10265
S	31	299	560	399	543	278	596	15040	9919

Section Numbers correspond to Figures B1 - B4 of this Appendix

Appendix C

Construction Noise

Table C1 Phase 2 - Noise Levels from Work Site 3(a)

Activity	Sub-Activity	Facade NoiseLevel in dB(A)													
		YC	MWC	SH	LPG	ORCG	SLP	STG	R1 (4)	RS (10)	HOS (11)	GIC (12)			
Reclamation / Dredging	Dredging	63	42	39	38	37	34	45	58	58	61	64			
	Seawall	66	45	42	41	40	37	48	61	61	64	67			
	Reclamation	79	58	55	54	53	50	61	74	74	77	80			
	Concrete	63	42	39	38	37	34	45	58	58	61	64			
	Road Paving	54	33	30	29	28	25	36	49	49	52	55			
	Infrastructure	74	53	50	49	48	45	56	69	69	72	75			
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
YC : Youth Camp
MWC : Ma Wan Chung
SH : Shan Ha
LPG : Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai, Lung Tseng Tau
ORCG : Outdoor Recreation Camp, Sha Tsui Tau
SLP : Shek Lau Po
STG : San Tau, Tin Sam, Kau Liu

Table C2 Phase 2 - Noise Levels from Work Site 3(b)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		YC	MWC	SH	LPG	ORCG	SLP	SMKG	MKG	STG	R1 (4)	RS (10)	HOS (11)	GIC (12)	
Reclamation / Dredging	Dredging														
	Seawall														
	Reclamation														
	Concrete														
	Road Paving														
	Infrastructure														
Cutting / Excavation	Rock Excavation	77	96	85	94	87	86	96	100	70	74	87	73	79	
	Soil Excavation	66	85	74	83	76	75	85	89	59	63	76	62	68	
	Road Paving	46	65	54	63	56	55	65	69	39	43	56	42	48	
	Infrastructure	66	85	74	83	76	75	85	89	59	63	76	62	68	

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
YC : Youth Camp
MWC : Ma Wan Chung
SH : Shan Ha
LPG : Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai, Lung Tseng Tau
ORCG : Outdoor Recreation Camp, Sha Tsui Tau
SLP : Shek Lau Po
SMKG : Shek Mun Kap, San Keng
MKG : Mok Ka, Nim Yuen, Tung Hing
STG : San Tau, Tin Sam, Kau Liu

Table C3 Phase 2 - Facade Noise Levels from Work Site 4(a)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	TLG												
Reclamation / Dredging	Dredging	51	50												
	Seawall	54	53												
	Reclamation	67	66												
	Concrete	51	50												
	Road Paving	42	41												
	Infrastructure	62	61												
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C4 Phase 2 - Facade Noise Levels from Work Site 4(b)

Activity	Sub-Activity	Facade Noise Levels in dB(A)													
		PM	TLG												
Reclamation / Dredging	Dredging	33	34												
	Seawall	36	37												
	Reclamation	49	<u>50</u>												
	Concrete	33	34												
	Road Paving	24	25												
	Infrastructure	44	45												
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C5 Phase 3 - Facade Noise Levels from Work Site 5(a)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		YC	SH	LPG	SLP	STG	R1 (4)	RS (10)	HOS (11)	R1 (15)	GIC (17)	RS (24)	HOS (23)	R2 (22)	R3 (38)
Reclamation / Dredging	Dredging	42	40	42	38	50	64	47	46	54	44	58	60	46	50
	Seawall	45	43	45	41	53	67	50	49	57	47	61	63	49	53
	Reclamation	58	56	58	54	66	80	63	62	70	60	74	76	62	66
	Concrete	42	40	42	38	50	64	47	46	54	44	58	60	46	50
	Road Paving	33	31	33	29	41	55	38	37	45	35	49	51	37	41
	Infrastructure	53	51	53	49	61	75	58	57	65	55	69	71	57	61
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
YC : Youth Camp
SH : Shan Ha
LPG : Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai, Lung Tseng Tau
ORCG : Outdoor Recreation Camp, Sha Tsui Tau
SLP : Shek Lau Po
STG : San Tau, Tin Sam, Kau Liu

Table C6 Phase 3 - Facade Noise Levels from Work Site 5(b)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		STG	R1 (4)	RS (24)	HOS (23)	R3 (38)	R4 (43)								
Reclamation / Dredging	Dredging	52	47	68	66	62	52								
	Seawall	55	50	71	69	65	55								
	Reclamation	68	63	84	82	78	68								
	Concrete	52	47	68	66	62	52								
	Road Paving	43	38	59	57	53	43								
	Infrastructure	63	58	79	77	73	63								
Cutting / Excavation	Rock Excavation	72	69	100	94	94	75								
	Soil Excavation	61	58	89	83	83	64								
	Road Paving	41	38	69	63	63	44								
	Infrastructure	61	58	89	83	83	64								

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
STG : San Tau, Tin Sam, Kau Liu

Table C7 Phase 3 - Facade Noise Levels from Work Site 5(c)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		SH	LPG	RS (24)	HOS (23)	R2 (22)	R3 (25)	GIC (27)							
Reclamation / Dredging	Dredging														
	Seawall														
	Reclamation														
	Concrete														
	Road Paving														
	Infrastructure														
Cutting / Excavation	Rock Excavation	100	89	80	75	86	89	100							
	Soil Excavation	89	78	69	64	75	78	89							
	Road Paving	69	58	49	44	55	58	69							
	Infrastructure	89	78	69	64	75	78	89							

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
SH : Shan Ha
LPG : Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai, Lung Tseng Tau

Table C8 Phase 3 - Facade Noise Levels from Work Site 5(d)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		LPG	SMKG	MKG	RS (24)	HOS (23)	R3 (25)	R3 (38)	R4 (43)						
Reclamation / Dredging	Dredging														
	Seawall														
	Reclamation														
	Concrete														
	Road Paving														
	Infrastructure														
Cutting / Excavation	Rock Excavation	92	94	94	76	74	74	100	94						
	Soil Excavation	81	83	83	65	63	63	89	83						
	Road Paving	61	63	63	45	43	43	69	63						
	Infrastructure	81	83	83	65	63	63	89	83						

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
LPG : Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai, Lung Tseng Tau
SMKG : Shek Mun Kap, San Keng, Shek Pik Au
MKG : Mok Ka, Nim Yuen, Tung Hing, Ngau Au

Table C9 Phase 3 - Facade Noise Levels from Work Site 6(a)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	TLG												
Reclamation / Dredging	Dredging	40	40												
	Seawall	43	43												
	Reclamation	<u>56</u>	<u>56</u>												
	Concrete	40	40												
	Road Paving	31	31												
	Infrastructure	51	51												
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C10 Phase 3 - Facade Noise Levels from Work Site 6(b)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	TLG												
Reclamation / Dredging	Dredging	33	35												
	Seawall	36	38												
	Reclamation	<u>49</u>	<u>51</u>												
	Concrete	33	35												
	Road Paving	24	26												
	Infrastructure	44	46												
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C11 Phase 3 - Facade Noise Levels from Work Site 6(c)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	TLG												
Reclamation / Dredging	Dredging	46	70												
	Seawall	49	73												
	Reclamation	62	86												
	Concrete	46	70												
	Road Paving	37	61												
	Infrastructure	57	81												
Cutting / Excavation	Rock Excavation	67	88												
	Soil Excavation	56	77												
	Road Paving	36	57												
	Infrastructure	56	77												

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C12 Phase 4 - Facade Noise Levels from Work Site 7(a)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		GIC (58)	GIC (20)	R1 (19)	R1 (15)	GIC (17)									
Reclamation / Dredging	Dredging	72	70	70	68	60									
	Seawall	75	73	73	71	63									
	Reclamation	88	86	86	84	76									
	Concrete	72	70	70	68	60									
	Road Paving	63	61	61	59	51									
	Infrastructure	83	81	81	79	71									
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.

Table C13 Phase 4 - Facade Noise Levels from Work Site 7(b)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		STG	TH	RS (35)	CR (36)	RS (24)	R1 (4)	HOS (23)							
Reclamation / Dredging	Dredging	59	55	72	72	78	52	78							
	Seawall	62	58	75	75	81	55	81							
	Reclamation	75	71	88	88	94	68	94							
	Concrete	59	55	72	72	78	52	78							
	Road Paving	50	46	63	63	69	43	69							
	Infrastructure	70	66	83	83	89	63	89							
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
STG : San Tau, Tin Sam, Kau Liu
TH : Tung Hing

Table C14 Phase 4 - Facade Noise Levels from Work Site 8(a)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	TLG	OU (11)											
Reclamation / Dredging	Dredging	30	31	32											
	Seawall	33	34	35											
	Reclamation	46	47	48											
	Concrete	30	31	32											
	Road Paving	21	22	23											
	Infrastructure	41	42	43											
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C15 Phase 4 - Facade Noise Levels from Work Site 8(b)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	TLG	OU (11)											
Reclamation / Dredging	Dredging	33	34	41											
	Seawall	36	37	44											
	Reclamation	49	50	57											
	Concrete	33	34	41											
	Road Paving	24	25	32											
	Infrastructure	44	45	52											
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C16 Phase 4 - Facade Noise Levels from Work Site 8(c)

Activity	Sub-Activity	Facade Noise Levels in dB(A)													
		PM	TLG	OU (11)											
Reclamation / Dredging	Dredging	35	36	39											
	Seawall	38	39	42											
	Reclamation	51	52	55											
	Concrete	35	36	39											
	Road Paving	26	27	30											
	Infrastructure	46	47	50											
Cutting / Excavation	Rock Excavation	57	57	61											
	Soil Excavation	46	46	50											
	Road Paving	26	26	30											
	Infrastructure	46	46	50											

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C17 Phase 4 - Facade Noise Levels from Work Site 8(d)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	TLG	OU (11)											
Reclamation / Dredging	Dredging	58	47	56											
	Seawall	61	50	59											
	Reclamation	74	63	72											
	Concrete	58	47	56											
	Road Paving	49	38	47											
	Infrastructure	69	58	67											
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C18 Phase 4 - Facade Noise Levels from Work Site 8(e)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	TLG	OU (11)											
Reclamation / Dredging	Dredging	63	44	60											
	Seawall	66	47	63											
	Reclamation														
	Concrete														
	Road Paving														
	Infrastructure														
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C19 Phase 4 - Facade Noise Levels from Work Site 8(f)

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	TLG	OU (11)											
Reclamation / Dredging	Dredging	48	56	72											
	Seawall	51	59	75											
	Reclamation	64	72	88											
	Concrete	48	56	72											
	Road Paving	39	47	63											
	Infrastructure	59	67	83											
Cutting / Excavation	Rock Excavation	70	78	94											
	Soil Excavation	59	67	83											
	Road Paving	39	47	63											
	Infrastructure	59	67	83											

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
PM : Pak Mong
TLG : Tin Liu, Ngau Kwu Long, Tai Ho San Tsuen

Table C20 Phase 5 - Facade Noise Levels from Work Site 9

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		STG	HOS (46)	R1 (47)	R2 (48)	R1 (4)	R1 (15)	R1 (54)	R2 (53)						
Reclamation / Dredging	Dredging	57	67	67	58	55	50	47	47						
	Seawall	60	70	70	61	58	53	50	50						
	Reclamation	73	83	83	74	71	66	63	63						
	Concrete	57	67	67	58	55	50	47	47						
	Road Paving	48	58	58	49	46	41	38	38						
	Infrastructure	68	78	78	69	66	61	58	58						
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria.
STG : San Tau, Tin Sam, Kau Liu

Table C21 Phase 5 - Facade Noise Levels from Work Site 10

Activity	Sub-Activity	Facade Noise Level in dB(A)													
		PM	R2 (18)	HOS (19)	R1 (21)	HOS (22)	HOS (15)	R3 (T56)	R2 (T55)	R1 (T54)	GIC (T58)	GIC (T20)	R1 (T19)		
Reclamation / Dredging	Dredging	56	74	74	63	55	49	59	50	51	57	54	54		
	Seawall	59	77	77	66	58	52	62	53	54	60	57	57		
	Reclamation	72	90	90	79	71	65	75	66	67	73	70	70		
	Concrete	56	74	74	63	55	49	59	50	51	57	54	54		
	Road Paving	47	65	65	54	46	40	50	41	42	48	45	45		
	Infrastructure	67	85	85	74	66	60	70	61	62	68	65	65		
Cutting / Excavation	Rock Excavation														
	Soil Excavation														
	Road Paving														
	Infrastructure														

Note : Underlined figures show where the predicted noise levels would exceed the noise criteria, and R1(T19),GIC(T20),R1(T54),R2(T55),R3(T56),GIC(T58) are located in Tung Chung.

PM : Pak Mong

Table C22 Existing Village Groups Assessed for Noise Impacts in the Study Area

VILLAGE GROUPS IN THE STUDY AREA	
VILLAGE GROUP	VILLAGES
YC	Youth Camp
MWC	Ma Wan Chung
SH	Shan Ha
LPG	Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai, Lung Tseng Tau
ORCG	Sha Tsui Tau, Outdoor Recreation Camp
SLP	Shek Lau Po
SMKG	Shek Mun Kap, San Keng
MKG	Mok Ka, Nim Yuen, Ngau Au
STG	Kau Liu, San Tau, Tin Sam
PM	Pak Mong
TLG	Ngau Kwu Long Tin Liu Tai Ho San Tsuen
TH	Tung Hing