

**Highways Department
Hong Kong Government**

**Agreement No. CE 22/97
Route 9 between Tsing Yi
and Cheung Sha Wan
Detailed Feasibility Study**

Environmental Impact Assessment Executive Summary

August 1999

Atkins China Ltd

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1. INTRODUCTION

1.1 Background and Objectives

Background

- 1.1.1 Atkins China Limited was appointed by Highways Department of the Government of the Hong Kong Special Administrative Region (SAR), to carry out a detailed feasibility study of Route 9 (R9) between Tsing Yi and Cheung Sha Wan (The Project). An Environmental Impact Assessment (EIA) was carried out as part of the detailed feasibility study. Potential environmental impacts are assessed in detail in the EIA. This EIA was conducted under the statutory provisions of the EIA Ordinance.
- 1.1.2 Key issues include the potential impacts from traffic noise and vehicle emissions on sensitive landuses. Mitigation measures to control impacts are a fundamental concern of this EIA.
- 1.1.3 In addition to impacts from traffic noise and vehicle emissions, the EIA considers ecological impacts resulting from removal of vegetation during construction of the tunnel portals, water quality impacts and landscape and visual impacts. A Landscape and Visual Assessment report, (L&VA) based on the structural designs for R9 viaducts, tunnel portals and Stonecutters Bridge was produced.
- 1.1.4 Certain sections of the R9 alignment are within 1000m of four oil terminals at Tsing Yi, so a Quantitative Risk Assessment (QRA) was required. A summary of the findings of the L&VA and QRA are also included in the EIA.

1.2 Study Area

- 1.2.1 The EIA considered noise sensitive uses within 300m of the alignment. Landscape impact and air pollution assessments were assessed up to 500m from the proposed road alignment and all potential visual sensitive receivers were included in the visual assessment. The risk assessment was carried out on the sections of the R9 alignment which fall within the 1,000m radius consultation zones of the Tsing Yi Oil Terminals.

1.3 Project Description

- 1.3.1 Viaducts will run from Lai Wan Interchange in the east, connecting Route 16 (R16) and the West Kowloon Highway (WKH) near Cheung Sha Wan. Moving westward R9 is aligned across the northern section of the West Kowloon Reclamation (WKR), between Container Terminal 8 (CT8) and Stonecutters Base. Stonecutters Bridge will carry R9 across the Rambler Channel between CT8 and CT9. Viaducts will link the Stonecutters Bridge to CT9 and the main carriageway will continue through Tsing Yi Island via the dual three lane Nam Wan Tunnel (NWT). Near the western portal of the NWT, viaducts will link R9 to the North West Tsing Yi Interchange.
- 1.3.2 The alignment affects few sensitive receivers as it passes through areas of established transport corridors and existing or planned non-sensitive land-uses.
- 1.3.3 The Study Area was subdivided into convenient geographical areas for assessment:

- Western Portal of Nam Wan Tunnel and Link Roads to North West Tsing Yi Interchange.
- Nam Wan Tunnel and ventilation facilities,
- Eastern Portal to Nam Wan Tunnel and viaducts,
- CT9 Slip roads,
- Stonecutters Bridge and viaducts at the boundary of Stonecutters Base,
- Lai Wan Interchange, Mei Foo and Northern WKR Developments,

2. ROAD TRAFFIC NOISE IMPACT STUDY

2.1 Introduction

2.1.1 The study assessed noise impacts and identified mitigation measures where noise levels exceeded the guidelines levels (70 dB(A) for residential, 65 dB(A) for educational facilities). Residual impacts, which remain after implementation of the mitigation measures, will be within accepted standards and guidelines.

2.2 Impacts on Receivers

2.2.1 Background noise in the Study Area is currently dominated by industrial, traffic and construction sources. However, many of the Noise Sensitive Receivers (NSRs) facing major roads are already protected by noise barriers (e.g. Cheung Ching Estate, Mei Foo Sun Chuen).

2.2.2 The nearest NSRs to R9 link roads to North West Tsing Yi Interchange and the Western Portal of the Nam Wan Tunnel are the residences of Ching Wah Court and the school at Ching Hong Rd/Tsing Yi Rd. These are outside the area of influence, being situated 800m from the main alignment, and Study Area boundary for noise assessment.

2.2.3 NSRs in the vicinity of the Eastern Portal and CT9 Slip Roads include the residences at Mayfair Gardens, Cheung Ching Estate, the Vocational Training College at Tsing Yi Rd/Sai Shan Road and the staff quarters.

2.2.4 Modelling showed the Mayfair Gardens would not be significantly affected by the new R9/CT9 slip road. The contribution of additional traffic noise from the R9/CT9 slip road to Cheung Ching Estate is less than 1dB(A). Noise generated from existing roads and the new R9/CT9 slip road will affect the Tsing Yi Technical College staff quarters.

2.2.5 Without mitigation, the teaching rooms nearest the R9 slip roads are predicted to exceed the Technical Memorandum on the Environmental Impact Assessment Process (TM on EIAO) recommended limits. The staff quarters are predicted to exceed the criterion by up to 3dB(A) at the upper (third) floor. Direct mitigation is required in the form of a 5.1m high cantilever barrier with 2.8m extension along a 300m section at the western edge of the R9 slip road (Figure 2). This reduces noise levels to less than 70 dB(A) at the staff quarters.

2.2.6 Noise levels at Stonecutters Base comply with the 70 dB(A) guideline.

2.2.7 NSRs in the Lai Wan Interchange Zone are the residential blocks at Mei Foo Sun Chuen. These face a complex road network consisting of major trunk roads (Route 3 and WKH) and the Lai Wan Interchange. Route 16 will also affect the eastern side of Mei Foo. Calculations indicate that road traffic noise would exceed the noise planning standard of 70 dB(A) for some NSRs facing Lai Wan Interchange or R16. Contribution from the new roads to total noise levels is only significant (>1dB(A)) at some of the upper floors in the central to eastern blocks at Mei Foo, due to the inclusion of the R9 and R16 link roads.

2.2.8 Future NSRs in the Lai Wan Interchange area are the planned residential blocks at the bus depot CDA site to the east of Mei Foo. Current proposals indicate a podium with

residential tower blocks, forming a virtual noise barrier for the NSRs at the east of Mei Foo. Calculations indicate that road traffic noise in this new development would exceed 70 dB(A) for the NSRs facing Lai Wan Interchange or R16. The existing road network is the major component of the traffic noise.

- 2.2.9 Direct mitigation is proposed at Mei Foo and the CDA site in the form of noise barriers running along the western and northern edge of the R9 slip road (Figure 2).
- 2.2.10 Developments at Sites 6 and 10 will be subject to road traffic noise levels over 70 dB(A). However, the contribution from Route 9 to the total noise exposure is insignificant (<1dB(A)). However, direct mitigation in the form of noise barriers along the western and northern edges of the R9 slip road is recommended to minimise the constraints from R9 (Figure 2).

2.3 Summary

- 2.3.1 Maximum mitigation against noise generation from R9 is recommended and this is summarised as follows:
- provision of Low Noise Surfacing on all the new roads except the R9 slip road to CT9
 - provision of a 3m barrier along the main carriageways of Route 9 near the Lai Wan Interchange
 - provision of a 3m on the R9/WKH link road east bound
 - provision of a 5.1m high noise barrier with 2.8m cantilever on the CT9 slip road at Tsing Yi.
- 2.3.2 These measures will result in compliance with the TM on EIAO criteria at Tsing Yi Technical College Staff Quarters. Despite maximum mitigation, NSRs (existing and future) at West Kowloon may be exposed to noise levels greater than 70 dB(A) due to the contribution from the existing roads. No receivers will be eligible for indirect mitigation measures under the ExCo criteria.

3. Air Quality Impact Study

3.1 Introduction

The purpose of this section is to investigate the extent of operational air quality impacts from existing and future pollution sources associated with the Project. The main concern is the impact of traffic emissions.

3.2 Methodology

3.2.1 Air quality impacts and predicted future pollutant concentrations at the air sensitive receivers (ASRs) were assessed based on traffic emission sources associated with R9. Background air pollution levels in the Study Area were established, and in each sensitive zone, existing and future ASRs were identified.

3.2.2 Likely impacts were assessed using the air dispersion model, CALINE4. Experience shows that nitrogen dioxide (NO₂) is the pollutant of major concern and detailed modelling of NO₂ was undertaken.

3.3 Impacts on Receivers

3.3.1 Background air quality is currently influenced by industrial chimneys in Tsing Yi and vehicular emissions on the roads of the Study Area.

3.3.2 Air quality associated with both traffic and portal emissions shows a potential exceedance of 25% of the Air Quality Objective (AQO) for an area of about 2ha under the viaduct near the Western Nam Wan Tunnel portal. There are currently no plans for the use of this area and is not considered a sensitive use under the TM on EIAO.

3.3.3 Air quality associated with both traffic emission and emissions from the eastern portal shows a minor exceedance for the area beneath the viaduct. A CLP substation is located here, with the remainder of land used for storage. With no resident staff present, this is not considered to be a sensitive land use under the TM on EIAO.

3.3.4 The CT9 Zone includes existing ASRs at Tsing Yi Technical College (TYTC) and Mayfair Gardens, plus planned landuses (e.g. hotel development, commercial accommodation and container-related facilities). Modelling demonstrated that AQOs would be met at all ASRs.

3.3.5 Compliance with the AQOs is predicted at Stonecutters Island.

3.3.6 Mei Foo Sun Chuen and future sites in the Northern WKR were identified as existing ASRs in the Lai Wan Interchange Zone. The predicted NO₂ levels are 50% of the AQO. Setback distance and the vertical separation of the viaducts from the ASRs are sufficient to allow significant dispersion of traffic emissions.

3.3.7 At Sites 6 and 10 on the West Kowloon Reclamation, residential uses schools are planned. There is no constraint on Site 10 where the Air Quality Objective is achieved over the whole site. Site 6 will require a buffer of 25m from the southern site boundary where ground level sensitive uses should be avoided (active recreational uses such as ball courts and children's playgrounds). At a building height of 15m, there are no constraints on the site.

3.4 Summary

- 3.4.1 Traffic emissions produced during the operational phase of the Project are not likely to present any significant air quality impacts along the majority of the alignment.
- 3.4.2 Development at Site 6 will require careful attention at the design stage to ensure that developments are located in areas where the AQOs are met. Particular attention should be paid to the location of planned schools and ASRs to ensure that air quality impacts are minimised. The layout for Site 10 will comply with AQOs.

4. WATER QUALITY

4.1 Background Water Quality

The main influence on water quality inshore near R9 is the poor flushing capacity of the Rambler Channel and high pollution loading from sewage and industry in the hinterland. Suspended solids, bacteria levels and nutrient content are high.

4.2 Potential Impacts on Water Quality

4.2.1 Water quality impacts are expected to be minimal during the operational phase

4.2.2 There will be possible pollutant runoff, however this is not quantifiable. There will be considerable dilution of road runoff because of the large catchment area of Rambler Channel in comparison with R9. Spillage may result in environmental impact, however these are not quantifiable.

5. LANDSCAPE AND VISUAL IMPACTS

5.1 Introduction

The landscape assessment was carried out within a band of 500m surrounding the proposed alignment (Figure 1). All sensitive receivers were considered in the visual impact assessment, regardless of the distance from the proposed R9 alignment. In practice, the mountainous topography, the dense urban development areas, and Hong Kong's frequently hazy visibility will limit views of R9.

5.2 Methodology

5.2.1 The purpose of the Landscape and Visual Assessment is to determine the impact of R9 on key elements of the landscape and on visually Sensitive Receivers (VSRs). Mitigation measures are proposed and their effectiveness assessed. The assessment analyses the existing landscape character of the study area and identifies the degree of compatibility of the Project with its environs.

5.2.2 For the purposes of the assessment process, a distinction is drawn between *landscape* and *visual* impacts:

- *landscape impacts* relate to the effects of development upon the physical fabric or components of the landscape; and
- *visual impacts* relate to the changes resulting from the Project to individual receiver groups' views of the landscape.

5.3 Summary of Landscape and Visual Assessment

5.3.1 The R9 corridor is located within the existing urban/industrial/container terminal areas of Tsing Yi and West Kowloon. The majority of the VSRs for the R9 project are of low sensitivity given their distance from the alignment and the quality of their existing views. The only significant adverse landscape impact will be the local landform and vegetation disturbance at the eastern Nam Wan Tunnel portal.

5.3.2 Stonecutter's Bridge will be the most visible section of R9 and will form a feature of the overall landscape. With suitable attention to design and lighting details, R9 will blend with the existing land use.

5.3.3 Residents of the proposed development on eastern Ma Wan are a medium sensitivity receptor due to the viewing distance and visual context for R9.

5.4 Landscape and Visual Impact Mitigation

A range of construction and operational phase landscape and visual impact mitigation measures are recommended to blend the highway with the adjacent development areas. Measures include: retention of vegetation, protection of the stream below the eastern Nam Wan Tunnel portal, minimisation of land requirements and stream disturbance, prompt hydroseeding of disturbed areas, reinstatement of construction access road corridors and works areas, highway lighting design to minimise glare disturbance, visually unobtrusive design of portal buildings, and avoidance of shotcreting slope treatments.

5.5 Summary

The analysis has demonstrated that impacts will be acceptable with mitigation measures in most areas given the extent of other major highway infrastructure in the area.

6. ECOLOGY

6.1 Introduction

The R9 alignment is directed mainly through industrial and urban areas, consequently there is limited ecological disturbance. Key ecological issues have been identified for the areas adjacent to the Nam Wan Tunnel portal sites on Tsing Yi.

6.2 Western Portal Site

The area is considered to be of low ecological significance and is of low importance for local wildlife. No major ecological constraints were identified on the western portal site. Construction activities should ensure that disturbance to areas of cut are minimised by restricting the extent of access clearance wherever possible and restoring cut areas by reshaping and planting with native species.

6.3 Eastern Portal Site

Some of the habitats found on the site are man made including managed orchards and fruit trees. There have been agricultural holdings in this area for at least 30 years. Natural habitat identified include natural tall scrub which is of low ecological significance in itself, but is a source of food for birds and should be preserved where possible. The small natural rocky stream contains water seasonally and only common flora and fauna were identified.

6.4 Summary of Key Ecological Resources

- 6.4.1 The ecological impacts during operational phase in the area surrounding the western portal were insignificant. The areas surrounding the proposed eastern portal site are of local ecological interest. The natural tall scrub and stream course habitats are typical of Hong Kong but since they are of local wildlife interest they should be left undisturbed if possible.
- 6.4.2 Surveys have not revealed any key habitats or species of particular ecological interest and the extent of damage to existing habitats will be minimal.
- 6.4.3 Ecological impacts during the operational phase are insignificant.
- 6.4.4 Based on the findings of the assessment, it is recommended that works should concentrate on avoiding any damage or disturbance to natural habitats. Works sites should be sensitively located and any cut/fill requirements balanced. Disturbed areas should be reinstated and replanted with native species wherever possible. It appears that the Project as currently conceived will have insignificant ecological impact.

7. CONSTRUCTION IMPACTS

7.1 Introduction

The construction phase of the development has the potential to generate noise, dust, and atmospheric emissions. Although transient in nature, these can cause disturbance to work, leisure and sleep. However, because of the nature of the sources there is usually considerable scope for mitigation.

7.2 Noise

The majority of the alignment is sufficiently far from receivers that guideline noise levels will be met. The CDA sites in the WKR and Tsing Yi Technical College may experience some exceedances depending on the intensity of construction works. Mitigation through the use of silenced equipment and screening is required in these locations, with mitigation compliance with the guidelines. Statutory provisions of the Noise Control Ordinance will apply during restricted working periods.

7.3 Air Quality

7.3.1 Assessment indicates that receivers are sufficiently distant from the R9 construction sites that dust impact will not occur.

7.3.2 Dust reduction measures are still recommended as good practice. Measures include the provision of adequate wheel/vehicle washing facilities; covering of vehicle loads; speed restriction, limits on movement of vehicles, use of upward exhausts; and use of water bowsers, sprays or vapour mists.

7.4 Water Quality

7.4.1 The major sources of potential water quality impacts include construction runoff and drainage (including ground water from the Nam Wan Tunnel works) and sewage from on-site construction workforce.

7.4.2 Discharge is controlled under the Water Pollution Control Ordinance (WPCO) and the relevant Technical Memorandum for the Water Control Zone. Sewage should be directed to the nearest sewer and compliance with the Standards for Effluents Discharged to Drainage and Sewerage Systems, Inland and Coastal Waters should be ensured.

7.5 Construction Waste

7.5.1 Waste arising from construction work will typically comprise excavated material (including over 300,000m³ of tunnel spoil), construction waste, chemical waste and general refuse.

7.5.2 The waste may cause nuisance in the form of dust and odour, but providing it is handled in line with the Waste Disposal Ordinance (WDO), Waste Disposal (Chemical Waste)(General) Regulations and other recommended guidelines, no significant adverse impacts are anticipated.

7.6 Summary

In view of the distance of construction activities from sensitive receivers and with the implementation of correct site practice, adverse impacts are not expected.

8. ENVIRONMENTAL MONITORING & AUDIT

The environmental monitoring and audit (EM&A) process ensures that proactive monitoring, audit, and mitigation measures are adopted to avoid adverse potential dust, water quality and noise impacts. The EM&A Manual is a stand-alone document which forms part of contractual requirements and has statutory enforcement under the Environmental Impact Assessment ordinance.

9. RISK ASSESSMENT

9.1 Introduction

The Potentially Hazardous Installation sites relevant to R9 are the oil and fuel depots of China Resources Co., Esso, Shell and Caltex. These petroleum depots store LPG in large quantities. These sites are located within 1000m of the R9 alignment. The purpose of the Risk Assessment Study is to provide information on the nature and extent of risk impacts arising from the construction and operation of R9.

9.2 Potential Impacts

- 9.2.1 Analysis of the assessment provided results generally consistent with those of more detailed studies carried out previously. No cases of hazardous concentrations of released LPG were discovered which could present concern for ignition at the R9 alignment. It was found that flash fire effects would not reach R9.
- 9.2.2 Major fireball effects from above ground storage tanks involved in intense heating or from a ship tank explosion could have limited effect on R9, but would be below the 50% fatality levels. The proximity of the tunnel to the loading facility means that even an overfilled tanker would not constitute a threat.
- 9.2.3 Fireball or flash fire from a catastrophic incident may result in incidents on the Expressway. The design of the Expressway in the vicinity of the terminals should avoid factors likely to contribute to collisions.

10. Landuse impact

10.1 Introduction

10.1.1 Land use implications were reviewed in detail in the Report on Land Requirements. Also provided is an overview of the existing and planned development context of the areas along and adjacent to the proposed alignment.

10.1.2 A highway reserve was identified on the relevant statutory plans on Tsing Yi Island, Stonecutters Island and the West Kowloon Reclamation allowing for simple alignment.

10.1.3 R9 carriageways will be well away from the main concentrations of sensitive receivers but the R9/CT9 slip roads will pass sufficiently close to existing and proposed land uses to require mitigation with respect to noise or air quality impacts.

10.2 Summary of Key Planning and Land Use Interface Issues

10.2.1 Other land use interface issues may arise if there are further changes to land use planning in Tsing Yi, Stonecutters Island or the West Kowloon Reclamation. The overall environmental impact of R9 was shown to be acceptable after the inclusion of mitigation measures to control noise, air quality, water quality, ecological landscape and visual impacts.

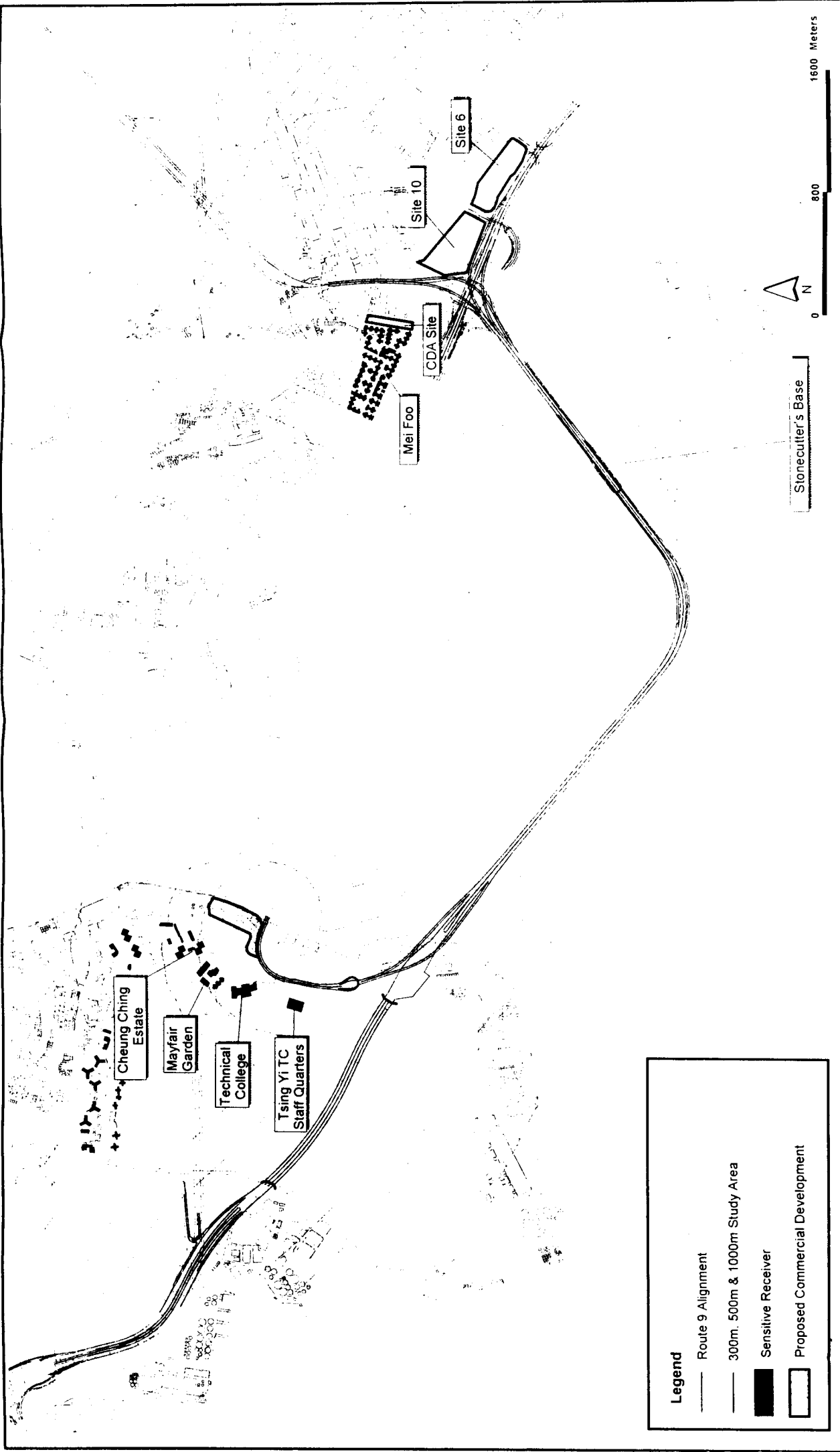
10.2.2 The long-term operational impacts on landuse are acceptable but the vertical component of the alignment is yet to be finalised and, as far as practicable, options are being adopted which will further reduce the environmental impacts.

10.2.3 The cumulative air quality impacts of WKH, P1, R9 ramps and the Lai Wan Interchange may pose slight constraints on the land parcels which have recently been proposed for residential use.

APPENDIX
Responses to Comment

Concerned Party	Comment	Response/ Actions have been taken
Environmental Protection Department	Section 2.1.1.1 Delete the 2 nd sentence "The alignment and traffic flows..."	Deleted.
ref. (29) in An (1) in EP2/N3/A/28 Pt.2 dated 7 May 1999	Section 2.2.4, 2.2.5 & 2.3.2 Include the summary of the noise assessment results for the Tsing Yi Technical College.	Sections 2.2.4, 2.2.5 & 2.3.2 amended.
ES (E)	Section 2.2.7 (3 rd sentence) Replace "breach the noise planning standard" with "exceed the noise planning standard".	Section 2.2.7 amended.
	Section 2.2.9 Delete the last sentence and include the final finding regarding the residual impacts from new roads.	Section 2.2.9 amended.
	Section 2.2.10 The final finding regarding the residual impacts from new roads should be included.	Section 2.2.10 amended.
	Section 7.2 Amend the 2 nd sentence "..... in the WKR and the Tsing Yi Technical College add may....." and include summary results of the cumulative construction impacts.	Section 7.2 amended.
ES (both (E) and (C))	All Sections All criteria of and references to HKPSG in the report shall be revised to criteria stipulated in the Technical Memorandum on the Environmental Impact Assessment Process.	All sections amended and reference to TM made.
	Section 6.3 Indicate the ecological significance of the "natural tall scrub" and "stream" to tally with the presentation for the Western portal at Section 6.2 of the EIA.	Section 6.3 amended.
	Section 6.4.1 Amend in accordance with section 6.5.6 to section 6.5.8 of the EIA report, that "the ecological impacts during operational phase were insignificant."	Section 6.4.1 amended.

FIGURES

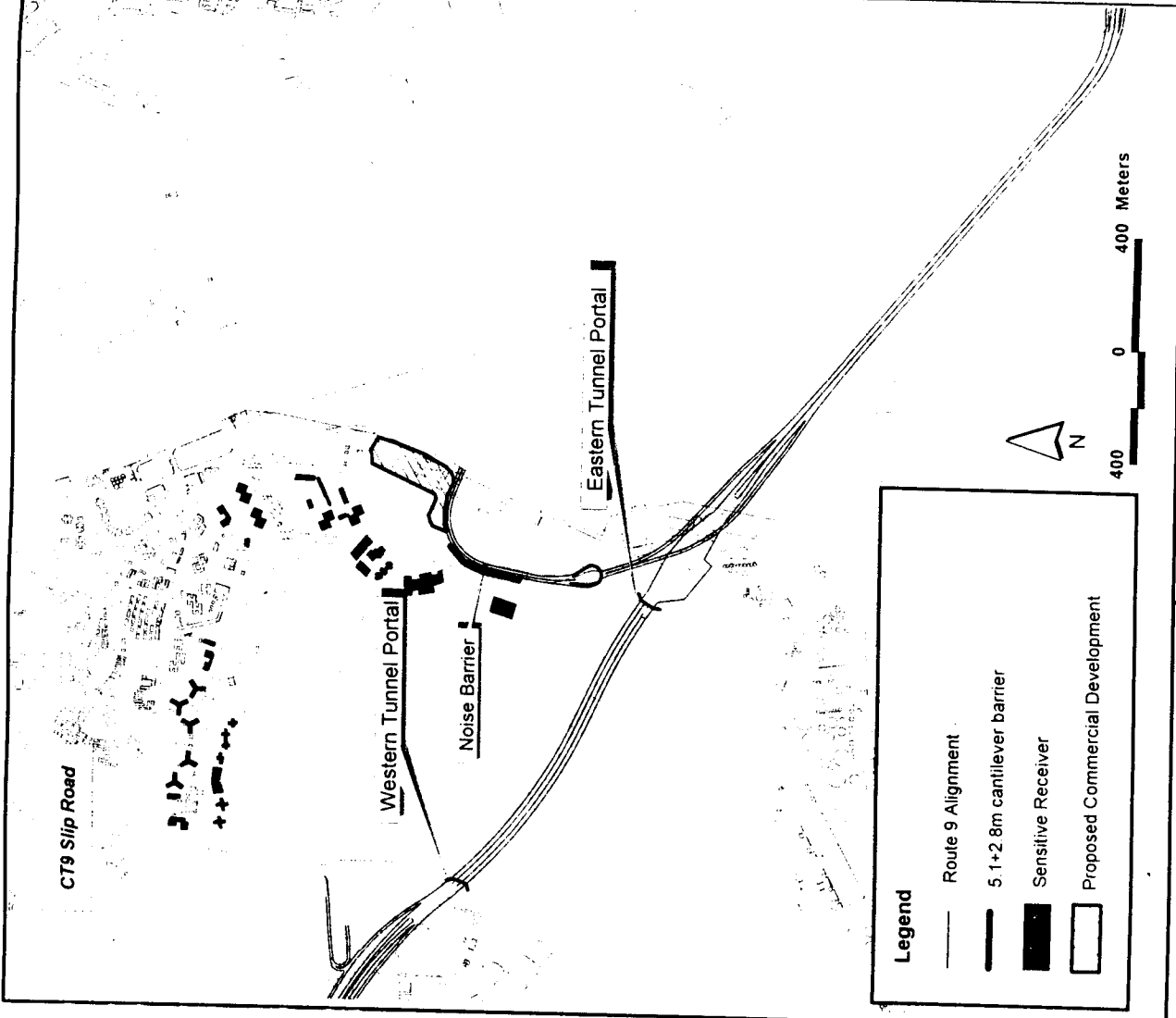
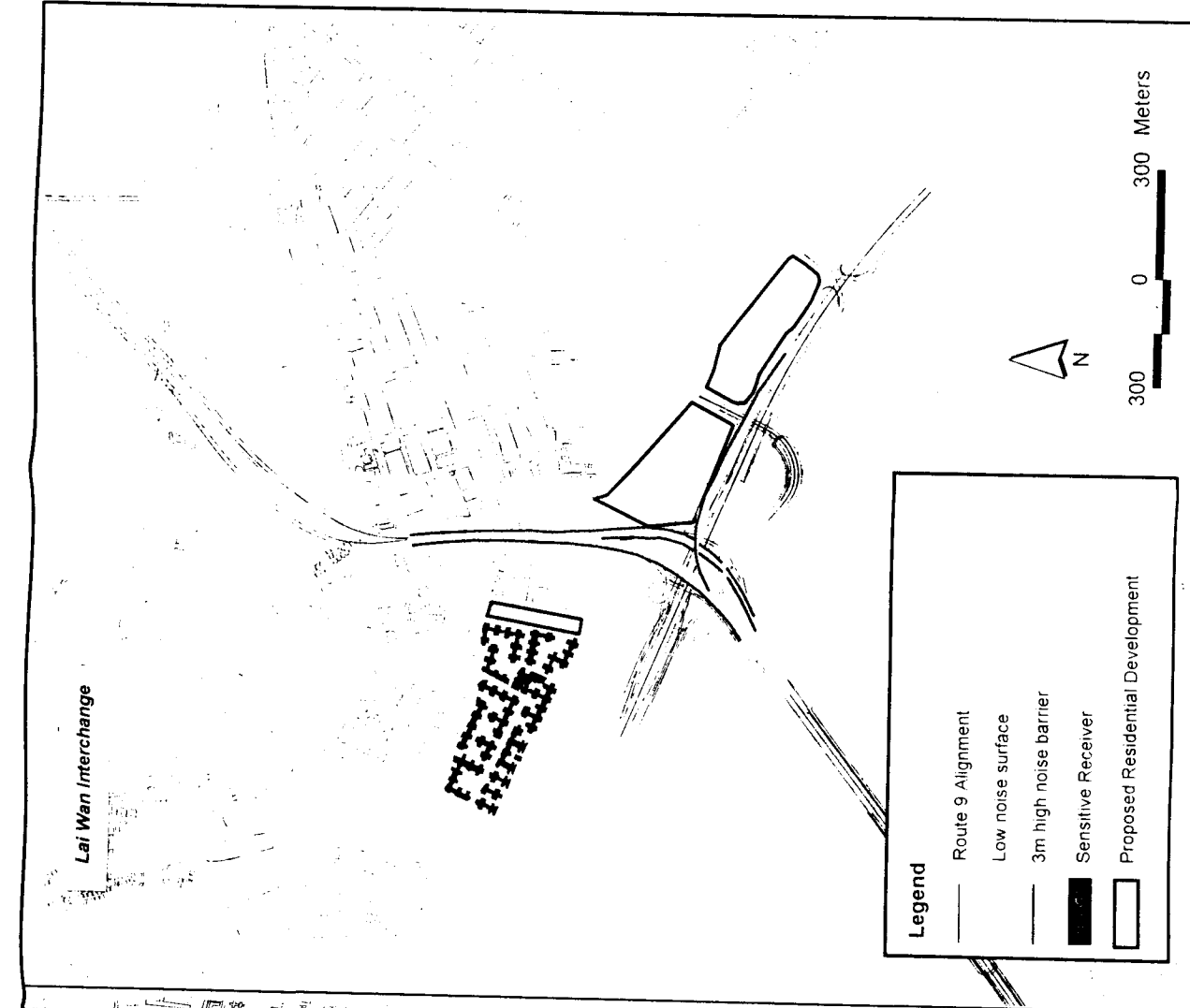


Legend

- Route 9 Alignment
- 300m. 500m & 1000m Study Area
- Sensitive Receiver
- Proposed Commercial Development

	Route 9 Between Tsing Yi and Cheung Sha Wan Detailed Feasibility Study	Title Study Area and Sensitive Receivers
		Scale Date Aug 1998
Highways Department	Figure No. 1	

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Legend

- Route 9 Alignment
- Low noise surface
- 3m high noise barrier
- Sensitive Receiver
- Proposed Residential Development

Legend

- Route 9 Alignment
- 5.1+2.8m cantilever barrier
- Sensitive Receiver
- Proposed Commercial Development

 Highways Department	Route 9 Between Tsing Yi and Cheung Sha Wan Detailed Feasibility Study		Title Mitigation Measures
	 <i>a member of the WS Atkins group of companies</i>	Scale Date Aug 1998	Figure No. 2